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# Delivering infrastructure at scale: eThekwini Water and Sanitation experience in a pilot project

## BACKGROUND

The Construction Industry Development Board (CIDB) and the Business Trust, through its support programme to the EPWP, identified several shortcomings in the current delivery system relating to the under-expenditure of government departments and municipalities, and capacity constraints in the public sector. These bodies have partly attributed the capacity problems to the predominance of small contracts which results from:

- the **project approach** whereby, for each and every project, consultants are appointed, briefed, directed and overseen by a gradually disappearing cadre of skilled staff
- **unbundling strategies** aimed at reducing the size of contracts in order to target small or local enterprises

The Business Trust developed a delivery model against this background to address these capacity constraints. The eThekwini Water and Sanitation Unit, with the support of the CIDB, piloted its implementation in the replacement of the city's asbestos cement water mains.

## THE DELIVERY MODEL

### The approach

The spending of capital budgets, where capacity and capability constraints exist, can best be achieved where:

- projects of a similar nature are grouped together within a geographic region into a single programme
- key contracts associated with a programme are placed with a limited number of service providers and/or contractors for a period of not less than three years
- single point accountability is assigned to those who are contracted for developing and overseeing the implementation of the programme
- efficient and integrated risk management and project management practices are pursued

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.

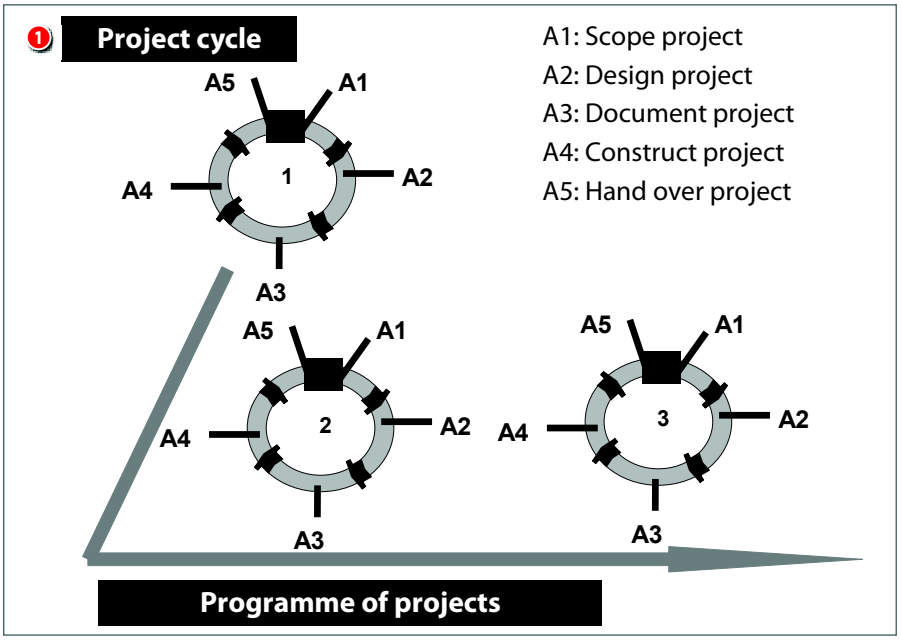
### The challenge

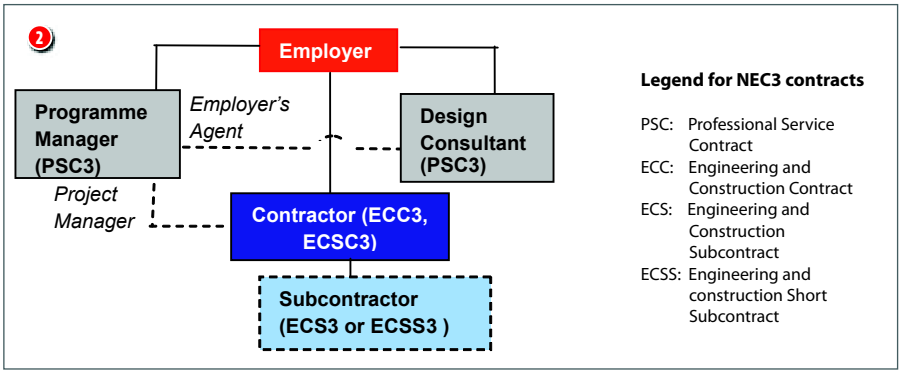
The challenge in developing and implementing a delivery model that enables allocated budgets to be spent, is to do so in a manner that results not only in construction works of an acceptable quality being delivered in response to prioritised needs, but also in contributing to the regional social and economic agenda, including employment and skills development.

### The model

In terms of this model, the client identifies a programme comprising a number of projects and obtains the necessary funding

1 Project cycle within a programme of projects
2 Contractual relationships in the model
3 Structure of SANS 1914 performance-based resource standards




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 (see www.cidb.org.za).

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
- 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

**Table 1** Comparative schedule for tender evaluation purposes

| Summary of costs | | | |
|---|---|---|---|
| **No** | **Component** | **Basis of assumed cost** | **Assumed cost, Rand** |
| 1 | People | Employer estimated amount | |
| 2 | Equipment | Employer estimated amount plus tendererd amounts for identified items or percentage of specified hire lists | |
| 3 | Plant and Materials | Employer estimated amount | |
| 4 | Charges | Employer estimated amount plus tendered percentage on people for overhead costs in the working areas | |
| 5 | Manufacture and Fabrication | Tendered hourly rates multiplied by employer estimate of hours and overhead percentage for employer estimated hours | |
| 6 | Design | | |
| Subtotal | | | |
| Subcontracted Work | | Employer estimated amounts | |
| Total Defined Cost | | | |
| Compensation Events | | Employer estimated amounts plus tendered percentage for people overheads and percentage adjustment on listed prices for equipment | |
| | | | |
| (Defined cost plus compensation events) x tendered direct fee percentage | | …/100 = Rand …Fee 1 | |
| Subcontracted work x tendered subcontracted fee percentage | | …/100 = Rand …Fee 2 | |
| Total comparative figure = Defined cost plus compensation events plus Fee 1 plus Fee 2 | | | |

the tendered cost parameters (percentages and rates) (see Table 1).

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.

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. (See pages 26 to 33 of *Civil Engineering*, Jan/Feb 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).

## ACCOMMODATING THE SOCIAL AND ECONOMIC AGENDA

There are a number of techniques and mechanisms associated with targeted procurement procedures, all of which are designed to promote or attain the participation of targeted enterprises and targeted labour in contracts. These procedures (see SANS 10396, *Implementing preferential construction procurement policies using targeted procurement procedures*) relate to the:

- measurement and quantification of the participation of target groups
- definition and identification of target groups
- unbundling of contracts
- granting of preferences
- provision of incentives for the attainment of key performance indicators in the performance of the contract
- creation of contractual obligations to engage target groups in the performance of the contract
- provision of third party management support
- requirements for minimum prescribed levels of equity in the tendering entity
- acceleration of targeted enterprises in rotating electronic data bases
- evaluation of procurement outcomes

The most convenient way of measuring and quantifying the participation of targeted groups is by means of a contract participation goal, i.e. an amount equal to the sum of the wages and allowances for which the contractor contracts to engage targeted labour or the value of supplies, services and works for which the contractor contracts targeted enterprises to provide in the performance of the contract (or both), expressed as a percentage of the contract amount.

Contract participation goals measure the participation of targeted enterprises and targeted labour, i.e. the flows of money from the contract to the target group. They provide a measurable key performance indicator. Procedures as to how such goals can be quantified and verified in the performance of the contract need to be included in the contract.

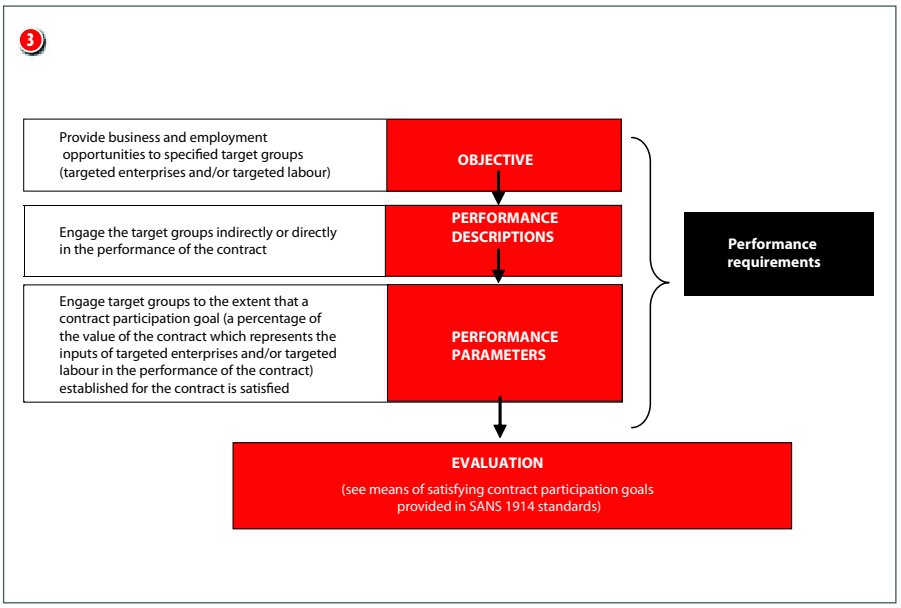
SANS 1914, *Targeted Construction Procurement*, provides a series of performance-based specifications to facilitate the establishment of a contract participation goal for a particular contract in respect of the participation of targeted enterprises, targeted partners in joint ventures, local resources and targeted labour, as relevant (see Figure 3). These specifications, upon award of the contract, form the basis for monitoring and verifying that the contractor achieves the contract participation goal in the performance of the contract.

Contract participation goals (CPG) may be used, in addition to measuring and reporting on a key performance indicator which reflects the quantum of business or employment generated in respect of targeted enterprises or targeted labour through the performance of the contract, to:

- reserve a portion of the contract work for specified target groups through the setting of minimum contract participation goals
- establish the basis for the awarding of preferences in proportion to the quantum of the CPG that is tendered
- establish performance targets for the payment of financial incentives relating to the attainment of key performance indicators

The CIDB's generic *Specification for Social and Economic Deliverables in Construction Works Contracts* (see www.cidb.org.za) should 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.

These deliverables 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 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 13 000 km of water mains in the Durban area of which about 2 500 km 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 article which allows the target price associated with each water district to be established once the scope of work and socio-economic deliverables have been finalised.

The concept of the model using the Option C (Target Cost) 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 were awarded during the last week of June 2007. Work commenced on 1 July 2007, i.e. the start of the new financial year.

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 CIDB's Specification for Social and Economic Deliverables in Construction Works Contracts. The contracts with both the contractors and consultants require that the project be delivered in terms of the generic project stages developed by the Construction Industry Council (UK) outlined in Table 3.

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 eThekwini 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 decommissioning the old pipes and commissioning the new ones, was a steep one.

Expenditure on this project up to 1 September 2008 was approximately R400 million. Currently up to 80 km of water mains are being replaced each month. Approximately 3 800 temporary workers (unemployed persons) are employed on the programme to excavate trenches (see Figure 4) and are rotated every four 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. Sixteen subcontractors or co-contractors have been offered work opportunities. These contractors, who have annual turnovers ranging from well below R750 000 to R5 500 000, are currently undertaking 10% of the construction work, but are being developed to undertake 20% of the construction work.

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 R1 000 000 and R10 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 eThekwini staff members to gain suitable experience to facilitate their registration as built environment professionals.

eThekwini has only assigned one of its senior project managers to interface with the project team through the appointed programme manager.

## OBSERVATIONS

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

- it is possible to procure a programme of works in the absence of a detailed scope of work within the current South African 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

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 focused contractor development programme to be implemented with clear and measurable outcomes. The scale of the project has allowed a focused 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

**Table 2** Social and economic deliverables

| Theme | Deliverable | | Overview of requirements |
|---|---|---|---|
| | No | Description | |
| Employment of local resources | A1 | Provide employment opportunities to targeted labour | The contractor is required to achieve a contract participation goal in accordance with the requirements of SANS 1914-5 relating to the participation of targeted labour:<br>a) as a contractual obligation; or<br>b) in order to receive a financial incentive.<br>Alternatively, the contractor is not set a contract participation goal, but is required to report on the contract participation goal that is achieved through the performance of the contract. |
| | A2 | Utilise local resources | The contractor is required to achieve a contract participation goal in accordance with the requirements of SANS 1914-4 relating to the participation of targeted labour and targeted enterprises:<br>a) as a contractual obligation; or<br>b) in order to receive a financial incentive.<br>Alternatively, the contractor is not set a contract participation goal, but is required to report on the contract participation goal that is achieved through the performance of the contract. |
| Employment opportunities in labour intensive works | B1 | Provide employment and skills development opportunities to targeted labour | The contractor is required to provide skills development and employment opportunities to unemployed persons along the lines of that advocated in the Guidelines for the Implementation of Labour Intensive Projects under the Expanded Public Works Programme (EPWP). Contractors may receive financial incentives should they exceed specified contract participation goals. |
| Business opportunities | C1 | Provide business opportunities to targeted enterprises | The contractor is required to achieve a contract participation goal in accordance with the requirements of SANS 1914-1 relating to the participation of targeted enterprises:<br>a) as a contractual obligation; or<br>b) in order to receive a financial incentive.<br>Alternatively, the contractor is not set a contract participation goal but is required to report on the contract participation goal that is achieved through the performance of the contract. |
| | C2 | Procure subcontractors for defined portions of the contract in terms of specified procedures | The contractor is required to procure targeted subcontractors for defined portions of the works in accordance with the requirements of the CIDB Standard for Uniformity in Construction Procurement. |
| Enterprise support and development programmes | D1 | Provide third party management support services to targeted contractors | The contractor is required to provide in terms of SANS 1921-4 construction management services, materials management services, or a combination of such services in order to minimise the risk of works not being constructed to stated requirements, within budget and on time. (The contracts with targeted enterprises are with the employer and not the contractor.) |
| | D2 | Procure or manage (or both) mentoring services for targeted contractors | The contractor is required to procure or manage (or both) mentoring services in order to assist targeted enterprises in the establishing of business systems within their businesses in order to improve the sustainability and growth of their business. |
| | D3 | Execute the contract in joint venture with a targeted partner | The contractor is required as an obligation of the contract to enter into a joint venture with a targeted enterprise after the award of the contract in accordance with the requirements of SANS 1914-2 and to achieve a prescribed contract participation goal. |
| Skills development | E1 | Provide experiential work opportunities towards a specified professional registration for designated persons | The contractor as an obligation of the contract is required to provide at least a specified quantum of work opportunities which enables designated persons to gain work place experience leading to a specified professional registration. |
| | E2 | Provide work learning opportunities towards a specified degree, diploma or certificate for designated persons | The contractor as an obligation of the contract is required to provide at least a specified quantum of work place opportunities which enables designated persons to gain work place experience leading to a specified degree, diploma or certificate from an accredited or registered formal institution of learning. |
| | E3 | Provide experiential work opportunities towards a SAQA-registered qualification or certificate for designated persons | The contractor as an obligation of the contract is required to provide at least a specified quantum of work place opportunities and training towards trade competencies for designated persons. |
| | E4 | Procure and manage a training provider to provide specific training for designated persons | The contractor as an obligation of the contract is required to procure and manage at least a specified quantum of specific training work opportunities for designated persons. |
| HIV/AIDS | F1 | Promote HIV/AIDS awareness | The contractor as an obligation of the contract is required to promote HIV/AIDS awareness in accordance with the requirements of SANS 1921-6. |

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 costs are high, compares very favourably with the achievements of 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% of the construction cost, excluding programme management and design and supervision costs, to be paid to small contractors.)

The clear and well-defined project stages have allowed the project team to document the delivery process and to allow the client to control the project using only one staff member.

The model has dramatically reduced the staffing requirements of the client and can offer a solution to overcoming capacity constraints in the public sector.

Figures 5 enables a rough comparison of the distribution of engineers and technologists in South Africa in 1967 and in 2005 to be made, based on an HSRC report and research undertaken by Lawless, respectively. What is clearly evident from this comparison is that the public sector has lost its staff to the consulting sector. What is also apparent is that the number of engineers and technologists in the industry and business sector has proportionally remained approximately the same during this period.

The current project approach that is employed in most government departments and municipalities works well where a knowledgeable client exists. With the loss of technical staff, many public sector clients have insufficient in-house capacity to get these projects up and running or to effectively oversee their implementation. According to Lawless (2005), 79 of the 231 local municipalities and 4 of the 47 district municipalities have no civil engineers, technologists or techni-


**Table 3** Key deliverables associated with each generic stage of a project within a programme (after Construction Industry Council, 2007)

| Stage | | |
|---|---|---|
| **No** | **Description** | **Description of stage** |
| 1 | Preparation | **Actions:** Defining the Project objectives, business need, acceptance criteria and Employer priorities and aspirations; describing the criteria, including the function, mix of uses, scale, location, quality, cost, value, time, safety, health, environment and sustainability<br>**Deliverable:** Employer approval of the Strategic Brief, setting out the basis for development of the concept definition for the Project |
| 2 | Concept | **Actions:** Establishing the detailed brief, scope, scale, form, and budget for the Project; including obtaining site studies and construction and specialist advice, determining the initial design criteria, design options, cost estimates, and the selection of the preferred design option<br>**Deliverable:** Employer approval of the Concept Report, setting out the integrated concept for the Project |
| 3 | Design development | **Actions:** Developing in detail the approved concept to finalise the design and definition criteria; establishing the detailed form, character, function and cost plan; defining all components in terms of overall size, typical detail, performance and outline specification<br>**Deliverable:** Employer approval of the Design Development Report, setting out the integrated developed design for the Project |
| 4 | Product information | **Actions:** Producing the final detailing, performance definition, specification, sizing and positioning of all systems and components<br>**Deliverable:** Completion of integrated production information enabling either construction, where the Contractor is able to build directly from the information prepared, or the production of manufacturing and installation information for construction |
| 5 | Manufacture, installation and construction information | **Actions:** Reviewing the manufacture, installation and construction information prepared by others based on the production information for general conformity with design intent.<br>**Deliverable:** Acceptance of manufacture, installation and construction information |
| 6 | Post Practical Completion | **Actions:** Dealing with issues arising after practical completion.<br>**Deliverable:** Completion of services |

cians in their employ, while the number of civil engineers, technologists and technicians in 2005 is as indicated in Figure 6. What is interesting to note is that there are more engineers and technologists working for contractors than government or local authorities.

There are two distinctly different strategies to address the current lack of service delivery and poor project outcomes:

1) Significantly improve and dramatically increase the skills base of built environment professionals within government to effectively and efficiently manage and oversee the current delivery processes.
2) Harness the capability and capacity of the private sector to deliver infrastructure using a radically different delivery process.

The model which eThekwini has implemented harnesses the capability and capacity of the private sector to deliver, and provides an alternative delivery process which enables allocated budgets to be spent in a manner that results not only in construction works of an acceptable quality being delivered in response to prioritised needs, but also contributes to the regional social and economic agenda including employment and skills development.

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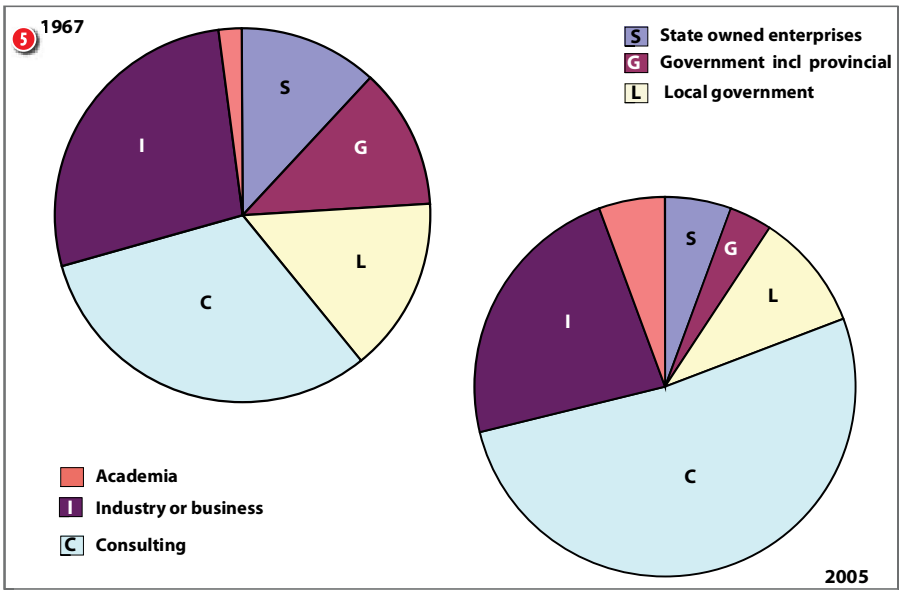


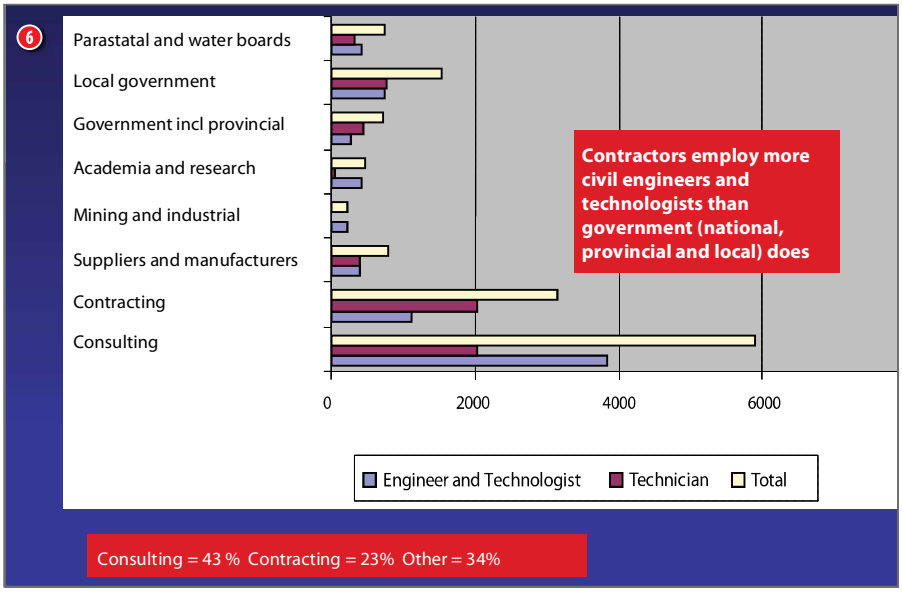


4 Trench excavation by hand in the replacement of secondary water mains in pilot project

5 Change in distribution of technologists and engineers in South Africa over a 40-year period (after Terblance (1971) and Lawless (2005))

6 Civil engineers, technologists and technicians in the work place (Lawless 2005)