NUMBERS & NEEDS

IN LOCAL GOVERNMENT

Addressing civil engineering – the critical profession for service delivery

Allyson Lawless

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saice

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Foreword

The report, *Numbers and Needs in Local Government*, which addresses the role of the civil engineering profession in service delivery, is a valuable contribution to our national understanding of the skills required in the sector.

The Constitution requires local government to provide services to communities in a sustainable manner. Since services are largely the domain of civil and electrical engineers their provision, operation and maintenance demands that adequate engineering skills, structures and systems are in place. The South African Institution of Civil Engineering (SAICE) and the South African Black and Allied Technical Careers Organisation (SABTACO) should be commended for their extensive work in researching and compiling the 'numbers and needs' whilst implementing in partnership with the **dplg** and Gauteng Department of Local Government, the innovative support and mentorship programme ENERGYS (Engineers Now Ensuring Rollout by Growing Young Skills).

Whilst South Africa has made major strides in service delivery, the challenge remains to meet the Millennium Development Goals to address poverty, health, education, equality, service delivery and ensure that all live in dignity. Many of South Africa's national targets relate to engineering services, as follows:

- Bucket eradication by 2007
- Access to potable water for all by 2008
- Access to sanitation by 2010
- Access to electricity by 2012
- Access to basic roads, sport, recreation, waste disposal, public and community facilities by 2013
- Upgrade of all informal settlements by 2014
- Accelerated housing delivery by 2014

Delivery of this infrastructure and the long-term support and sustainability of these services require that sound structures, skills, systems and processes are in place. With this in mind, government is embarking on a process to review the current White Paper on Local Government in order to refine the system, including policy, fiscal and institutional matters, to enable local government to accelerate the pace and quality of development. A comprehensive cycle of debate has been initiated, calling on input from all sectors of society to share their views and experiences in order to enrich the final policy.

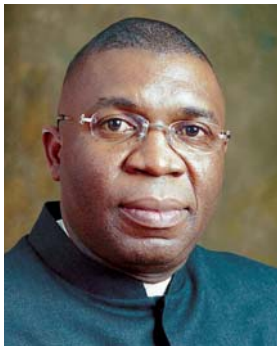
This report represents an important contribution to our understanding of the bottlenecks and solutions necessary to develop and sustain service delivery. The level of detail will be invaluable for those tasked with charting new approaches. Of particular importance is the fact that many suggestions made have already been tried and tested through the rollout of the ENERGYS programme in municipalities.

The recommendations and interventions proposed in the report lay a sound foundation for developing future strategies to develop skills, accelerate service delivery and build sustainable local government. I congratulate the civil engineering profession on publishing this book.

I thank you

Fholisani Sydney Mufamadi
Minister of Provincial and Local Government

Sydney Mufamadi
(Minister, Provincial and Local Government)



Dedication

This book is dedicated to my dear friends in local government, the municipal engineers of South Africa, whose dedication and foresight have provided the backbone of local government infrastructure and whose continued commitment and perseverance is critical to achieve our country's growth and the Millennium Development Goals.

Acknowledgements

A document covering this amount of detail cannot be prepared in isolation. Ideas from the teams of experienced engineering professionals deployed in local government through various initiatives, input from officials and politicians in local government and help from the civil engineering industry have all contributed to understanding the breadth of challenges and the solutions required.

Many have made significant contributions in terms of data collection, not least of which the municipal engineering community as a whole, both in South Africa and further afield, without whose cooperation this could never have been achieved.

ORGANISATIONS WHICH PROVIDED DATA

Special thanks must go to:

- **Buffalo City:** A particular word of thanks for making job specifications available for use as a guideline
- **ECSA:** For making data available as required
- **IMESA:** For access to their member database
- **LGSETA:** For making data available
- **Municipalities:** Who made engineering, artisan, town planning and organogram data available as requested. Special thanks must go to the metros which provided much additional benchmarking material
- **SABTACO:** For their assistance and access to engineering student and graduate databases
- **SAICE:** For their assistance and access to datasets of engineering seniors, students and graduates
- **Universities:** All universities of technology, and the universities of Limpopo and Venda for access to students and graduates

INDIVIDUALS WHO OFFERED INPUT

Many with experience in the field offered discipline-specific input, innovative ideas or historical background. These include former city engineers Don Macleod and George Grant, current municipal engineers, Mehboob Babamia and Neil Macleod (SAICE President 2007), former municipal engineers Dr Kevin Wall (SAICE President 2001), Dawie Botha (SAICE Executive Director), Leonard Le Roux and Johan Malherbe. Specialist input was received from Dr John Sampson, Oliver Ive, James Ngobeni (past president SABTACO), Paul Kgole (past president SABTACO) and many others.

THE ENERGYS TEAM

The South African Institution of Civil Engineering (SAICE) and the South African Black & Allied Careers Organization (SABTACO) teamed up to manage a project to deploy senior engineers paired with students and graduates in local authorities to unblock bottlenecks and in so doing, offer comprehensive training to both students and graduates. The project, ENERGYS (Engineers Now Ensuring Rollout by Growing Young Skills) consisted of some

Table 1 ENERGYS graduates and students deployed in local government in 2006

Graduates	Students		
Andrew Modjela	Aaron Mahapa	Marcus Tshule	Richard Lebese
Ashley America	Andile Makhanya	Maropng Mashaba	Samuel Mopeli
Bafana Mazibuko	Andrew Mabuza	Masibonge Mkabile	Sanele Manaba
Bernard Jase	Bafana Mazibuko	Matole Matome	Selaelo Mogano
Caroline Bopape	Bongeka Nxele	Maxwell Khumalo	Senzela Thubelihe
Ernest Manyatsa	Buthelezi Ayanda	Mcabango Dumakude	Sibonelo Nduli
Given Moabelo	Cameron Mametsa	Melusi Malinga	Sibusiso Mazibuko
Gosiame Montle	Caroline Maphanda	Michael Xelani	Simphiwe Sunduza
Johannes Pilusa	Collette Baloyi	Moalusi Pitso	Siyanda Mbangxa
Josias Mabusela	Cosmas Mnguni	Monwabisi Kutwana	Sonaba Thabo
Kate Mabotja	Cyprian Nomavilla	Movie Mphahlele	Sontsele Mzingisi
Linah Moshiga	Cyril Ndlovu	Mtshali Ndumiso	Teboho Lebeko
Luzuko Govu	Derby Kgosiemang	Mtshiza Siyanda	Tembakazi Moya
Mahlatse Maebana	Dimakatso Mmatli	Mzwandile Jeza	Terri Malatji
Matthews Radebe	Ditebogo Senyatsi	Nabe Masalela	Thabiso Chebase
Mlungisi Mnganga	Elvis Debeila	Napo Mphula	Thapelo Ndlovu
Moloko Mojapelo	Gloria Phohu	Nathi Manamela	Thembisile Njiyela
Nelson Pose	Gxaba Onke	Ndumiso Mtshali	Thobejane Lesley
Njabulo Kheswa	Hlamalani Baloyi	Nicholas Kubu	Thulani Bonkolo
Nomgqibelo Nkutha	Innocent Mashinyane	Njabulo Ngema	Tsatsi Ngumenkomo
Ntombi Mayinga	Itumeleng Rametse	Nontobeko Ngidi	Tshepiso Marokane
Obed Kgolane	Joseph Tsotetsi	Nqotola Luzuko	Tshilidzi Godzwana
Phillip Makgahlela	Josias Mabusela	Ntombizodwa Majola	Tumelo Matokonyane
Richard Sengani	Justice Nkosi	Patrick Kiviet	Unenceba Magodla
Sabelo Nxumalo	Khethiwe Mvelase	Paulen Matia	Violet Beetha
Tabisha Buda	Lebabo Matoko	Peter Kekana	Wandile Dlamini
Thabisho Chebase	Lebabo Matoko	Peter Mahlelala	Xolani Mnqayi
Thabo Matshabe	Lebea Rakobo	Petros Khomo	Zinhle Ntanzi
Thembsile Njiyela	Leftwin Khosa	Philani Ndlovu	Ziqu Gcobani
Thulani Sikhosana	Leslie Budeli	Philly Matlapeng	Zotha Cele
Tsepang Mashale	Lindiwe Magagula	Phindile Masemola	
Vincent Mabundla	Lorraine Xabangela	Pretty Sogiba Nontle	
Werner Badenhorst	Lufuno Mudzunga	Rabelani Thinadzanga	
Zama Shawuka	Malogadi Masemola	Rendani Hadzhi	

Table 2 ENERGYS engineers deployed in local government in 2006

Senior engineers			
Awie van Zyl	Deon van Tonder	Jaap van den Bergh	Peter Skotnicky
Barry van Niekerk	Eddie van der Heiden	Jacob Rheeder	Philip Pybus
Brian Hollingworth	Francois Olivier	Jan Viljoen	Peter de Villiers
Bo Barta	Frans Laubscher	Johan de Wet	Pieter Steenkamp
Bossie Badenhorst	Frik Pretorius	Johan Rossouw	Reynold Steenkamp
Braam de Wet	Gerhard Koekemoer	Johan Koekemoer	Riaan Perold
Brad Rutherford	Gerhard du Toit	John Lavery	Robin Husband
Carel Combrinck	Gerhard Uys	John Mcglashan	Soekie Schoeman
Cas Kempff	Gerrit Venter	Koos Loots	Steve Mills
Chris Burns	Gert Aggenbach	Leslie Whiteman	Stewart Gibson
Chris Schutte	Gordon Lloyd Page	Martin Redford	Theo van Niekerk
Christian Schumann	Gunther Erhardt	Martin Drake	Theunis Volschenk
Christo van der Merwe	Hannes Schutte	Mike Church	Thys Human
Dave Lyddell	Howard Richardson	Nicho Rabie	Tom de Kock
Dawid Vermeulen	Ilette Swanevelder	Paul Woodard	Vince Knott
Deon Slabbert	Ilse Rian	Peet Potgieter	William Garnett

50 senior engineers and 150 students and graduates across cultural, political and demographic divides. But divided they were not. United they teamed up to tackle a range of challenges and made a huge difference in the more than seventy municipalities in which they were deployed! Their experiences and input have been invaluable. The names of the team are published in Tables 1 and 2. A big thank you to all of you!

DEPARTMENTS WHICH OFFERED SUPPORT

Over the years, partnerships between many departments, SAICE and SABTACO in capacity building initiatives have contributed towards understanding the skills challenges and developing solutions. All should be delighted to see the results of their support in the many success stories highlighted throughout the book. Thank you to:

- The Department of Provincial and Local Government
- The Gauteng Department of Local Government
- The Department of Water Affairs and Forestry
- The North West Department of Local Government and Housing
- The Department of Education
- The Department of Science and Technology
- The Joint Initiative for Priority Skills Acquisition
- The Local Government Sector Education & Training Authority
- The Construction Education & Training Authority

THE PRODUCTION TEAM

Many, many hours were spent researching, capturing data and preparing tables and graphs. Thank you to the research, capture and proofreading team, in particular to Elaine Orpen,

Natasha Niemandt and Marthelene Buckle, GIMS (Geographic Information Management Systems) for preparing the GIS maps and Tildie Williams, Linda Cloete, Frans Pieterson and Johann Seidel for editing, indexing, final design and production.

Glossary

Asset
A physical component of a facility that has value, is a component of service provision and has an economic life span greater than 12 months.

BEng or BSc (Eng)
Bachelor of Engineering or Bachelor of Science in Engineering. These are designated engineering degrees awarded by South African universities. The duration of study is a minimum of four years full time.

Broad-based black economic empowerment (BBBEE)
Codes of practice for broad-based black economic empowerment have been developed to ensure that transformation takes place at all levels and promotes black economic empowerment countrywide.

BTech
Bachelor of Technology. Technical degree offered by universities of technology. This is a one-year post-graduate qualification that may only be embarked on after completion of a national diploma and gaining prescribed workplace experience.

Built environment
A term used to describe all professions within the construction sector, including architecture, building science, civil engineering, construction management and economics, quantity survey, land survey and town and regional planning.

Civil engineering professionals
- **Civil engineers** – those with a BSc or BEng degree or higher, and/or registered as PrEng
- **Civil engineering technicians** – those with a national diploma or equivalent from one of the universities of technology and/or registered as PrTechni
- **Civil engineering technologists** – those with a BTech, MDipTech or higher, and/or registered as PrTechEng

Coach
A guide who will develop specific skills that are used in the workplace. Skills transfer as a result of coaching translates directly to clearly defined performance outcomes that are achieved over a short period of time.

Division of revenue
The allocation of funds to all spheres of government, as required by the Constitution. See also *Equitable Share*.

Educator
Any person who teaches, educates or trains other people at an institution of education. The term is used in preference to the more traditional 'teacher' to broaden the scope of activities involving people engaged in some form of education of others.

Employment equity
Employment equity is governed by the Employment Equity Act 1998 (Act 55 of 1998), which seeks to ensure that employers put policies, procedures and practices into place that will ultimately result in equal employment opportunities and benefits in the workplace.

Equitable Share
The allocation of revenue to the national, provincial and local spheres of government, as required by the Constitution. See also *Division of revenue*.

Indigent
Person who is so poor as to lack even necessities. In the context of South African local government, an indigent household is one that has no regular source of income or access to food, clothing or energy sources and is therefore not in a position to pay for services.

Internship
Work experience that has a learning component built into it. An intern is a worker (usually a student or young graduate) who agrees to work for an employer who, in return, agrees to serve as the student's professional mentor.

Learner
Term now widely used in South Africa, in Education Department legislation and policy documents, in preference to 'student', to reflect more active, inclusive and life-long learning.

Learnership
Programme aimed at providing workplace learning in a structured and systematic form through providing both formalised learning and structured work experience. Learnership contracts are signed in a three-way agreement between the employer, education and training provider, and learner.

Life cycle costing
The total cost associated with an asset throughout its life, including the cost of planning, design, construction, acquisition, operation and maintenance.

Maintenance
All actions necessary for retaining an asset as near as practicable to its original condition, but excluding rehabilitation or renewal.

Mentor
Wise and trusted advisor or guide who will support a less experienced person to chart a comprehensive career path and offer advice as and when required.

Millennium Development Goals (MDG)

The Millennium Development Goals were adopted by the UN following the World Summit on Sustainable Development (Johannesburg, 2002). Each country was expected to determine its own set of goals to contribute towards the achievement of the international goals.

In response to the MDG and after research and consultation, South Africa set the following targets for local development:

- Bucket eradication by 2007
- Access to potable water for all by 2008
- Access to sanitation by 2010
- Access to electricity by 2012
- All schools to have adequate and safe water supply and sanitation by 2005
- All clinics to have adequate and safe water supply and sanitation services by 2007
- Access to basic roads, sport, recreation, waste disposal, public and community facilities by 2013
- Upgrade of all informal settlements by 2014
- Accelerated housing delivery by 2014

Medium-Term Expenditure Framework (MTEF)

The reintegration of the former independent states and self-governing territories, the extension of services to all South Africans and the commitment to transformation heightened pressures to expand public spending. As the post-1994 government also inherited a large and growing public debt, these pressures had to be balanced against the need to reduce debt to sustainable levels. This tension is managed by a medium-term approach to budgeting whereby priorities and longer-term policy options are explicitly brought into the budget process. Expenditure is driven by priorities but choices about these priorities are made from a set of affordable alternatives. This facilitates better planning, ongoing reprioritisation and clear political involvement in policy choices.

National diploma

Engineering diploma offered by universities of technology; a three-year undergraduate qualification consisting of four semesters of theory (S1, S2, S3 and S4) and one year's workplace experience, which should be undertaken after S2, but is often only undertaken after S3 or S4.

National skills development

The National Skills Development Plan was put in place to:

- Develop a culture of high quality life-long learning
- Foster skills development in the formal economy for productivity and employment growth
- Stimulate and support skills development in small business
- Promote skills development for employability and sustainable livelihood through social development initiatives
- Assist new entrants into employment

Non-governmental organisation (NGO)

A not-for-profit agency not affiliated with any government or private sector entity, devoted to managing resources and implementing projects with the goal of addressing social

problems or serving particular constituencies. NGO activities range from research, information distribution, training, local organisation and community service to legal advocacy and lobbying for legislative change. NGO access to strategic information can be used as a critical lobbying tool to mobilise and build power in endeavours to address particular shortcomings or inequalities. May receive some public funding.

Operations

The utilisation of an asset requiring the provision of manpower, chemicals, materials, equipment and energy.

Oversight

The term 'oversight' is used in its original context, that of overseeing or supervising work. It has been enshrined in the Constitution, and calls for oversight of many structures and functions to ensure that the ideal of a better quality of life for all the people of South Africa will be realised.

In the local government and construction context, oversight refers to supervising projects and service providers, rather than the modern usage which interprets oversight as a failure to identify a problem.

Privatisation

The full or partial sale of state-owned enterprises to private individuals or companies.

Professional registration

After obtaining the required qualifications and experience, the Engineering Council of South Africa registers engineering practitioners in the following categories:

- Professional Engineer (PrEng)
- Professional Engineering Technologis (PrTechEng)
- Professional Engineering Technician (PrTechni)

Public private partnerships (PPPs)

A contractual arrangement whereby a private party performs part of a government function and assumes the associated risks. In return, the private party receives a fee according to predefined performance criteria.

Public sector

National government, provincial government, local government, extra-budgetary governmental institutions, social security funds and non-financial public enterprises.

Race

The terms used to designate the racial categories that came to the fore in the apartheid era.

The racial classification of African, Coloured, Indian and White has now been widely adopted. The following require further definition:

- **African –** black African people
- **Indian –** Indian and other South-East Asian groups
- **Black** – African, Indian and Coloured
- **PDI –** Black males, all females and disabled persons

Rehabilitation
Work carried out to rebuild or replace parts or components of an asset to restore it to its function condition and extend its life. This may require modification.

Renewal
Work carried out to upgrade, refurbish or replace existing facilities with facilities of equivalent performance of capacity.

Replacement
Complete replacement of an asset that has reached the end of its useful life.

Section 21 company
Non-profit entities registered in terms of Section 21 of the Companies Act 1973 (Act 61 of 1973).

Sector Education and Training Authorities (SETAs)
The SETAs were put in place to address training and skills development per sector in a structured manner. Accredited training and learnerships required in each industry are developed through the SETAs and contributing companies are able claim for training of their staff.

Skills development levy
A payroll tax designed to finance training initiatives, in terms of the skills development strategy.

Small, micro- and medium enterprise (SMME)
Small, micro- and medium enterprises combine formal and informal sector activities. According to the Department of Trade and Industry (DTI), 95% of all enterprises in South Africa are SMMEs accounting for almost 75% of the employment in the country.

Southern African Development Community (SADC)
A regional governmental organisation that promotes collaboration, economic integration and technical cooperation throughout Southern Africa. Member nations are Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

Supervisor
A person who manages or supervises work. In the context of engineering work a good supervisor may double as a coach.

Sustainable development
The ability to meet present needs for land and resources without compromising the needs of future generations.

Work-integrated (experiential) learning
As part of the national diploma the practical training for students in the workplace must be planned, structured and controlled so that they can derive maximum advantage from it and it enriches and amplifies their academic knowledge.

Workplace training (candidate phase)

In the candidate phase applicants for professional registration (who have already attained a recognised qualification in engineering) are trained in the application of engineering principles and methods and are given progressively more responsibility until they can accept professional responsibility and make engineering decisions at an appropriate level in their category.

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Acronyms

ABV	Australian Business Volunteering
ADKAR	Awareness, desire, knowledge, ability and reinforcement
AFL-CIO	American Federation of Labor and Congress of Industrial Organizations
AMEU	Association of Municipal Electricity Undertakings
ANC	African National Congress
ASCE	American Society of Civil Engineers
ASP	Activated sludge process
BBBEE	Broad-based black economic empowerment
BCEA	Basic Conditions of Employment Act
BEE	Black economic empowerment
C&CI	Cement and Concrete Institute
CAD	Computer-aided draughting
CBO	Community-based organisation
CE	Chief engineer
CEO	Chief executive officer
CEROI	Cities Environment Reports on the Internet
CETA	Construction Education and Training Authority
CFO	Chief financial officer
CIDB	Construction Industry Development Board
CODESA	Convention for a Democratic South Africa
CPD	Continuing professional development
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa Limited
DEAT	Department of Environmental Affairs and Tourism
DG	Director-General
DM	District municipality
DMA	District management area
DME	Department of Minerals and Energy
DOH	Department of Housing
DOL	Department of Labour
DORA	Division of Revenue Acts
DOT	Department of Transport
dplg	Department of Provincial and Local Government
DPW	Department of Public Works
DTI	Department of Trade and Industry
DWAF	Department of Water Affairs and Forestry
DWQM	Drinking water quality management
ECSA	Engineering Council of South Africa
EE	Employment equity
EIT	Engineer-in-training
EMF	Engineer's Mobility Forum
ENERGYS	Engineers Now Ensuring Rollout by Growing Young Skills
EPA	Environment Protection Agency (USA)
EPWP	Expanded Public Works Programme
ERB	Engineers Registration Board (Tanzania)
ESKOM	Electricity Supply Commission
EU	European Union
FET	Further education and training
GAAP	Generally Accepted Accounting Practice
GAMAP	Generally Accepted Municipal Accounting Practice
GCC	Government Certificate of Competence
GIAMA	Government-wide Immovable Asset Management Act
GIMS	Geographic Information Management Systems
GIS	Geographic information system
GSM	Groupe Special Mobile
HBE	Home-based enterprises
HOD	Head of department
HR	Human resources
HRD	Human resources development
HSRC	Human Sciences Research Council
IAM	Infrastructure asset management
ICT	Information and communication technology
IDoEW	Identification of engineering work
IDP	Integrated development plan
ILO	International Labour Organisation
IMESA	Institute of Municipal Engineering of Southern Africa
IPET	Institute of Professional Engineering Technologists
IPWEA	Institute of Public Works Engineering Australia
IT	Information technology
ITC	Institute of Town Clerks
ITP	Integrated transport plan

ITS	Intelligent transport system
ITT	Institute of Town Treasurers
IWMSA	Institute of Waste Management of South Africa
JIPSA	Joint Initiative for Priority Skills Acquisition
JRA	Johannesburg Roads Agency
JSE	Johannesburg Stock Exchange
KPA	Key performance area
KPI	Key performance indicator
KZN	KwaZulu-Natal
LED	Local economic development
LGSETA	Local Government Sector Education and Training Authority
LM	Local municipality
MBA	Master of Business Administration
MBTI	Meyers Briggs type indicator
MC	Management committee
MDB	Municipal Demarcation Board
MDG	Millennium Development Goals
MEC	Member of Provincial Executive Council
MFMA	Municipal Finance Management Act
MIG	Municipal infrastructure grant
MIS	Management information system
MM	Municipal manager
MSA	Municipal Systems Act
MSIG	Municipal systems improvement grant
MSW	Municipal solid waste
MTEF	Medium-Term Expenditure Framework
ND	National diploma
NEMA	National Environmental Management Act
NGDS	National Growth and Development Strategy
NGO	Non-governmental organisation
NHBRC	National Home Builders Registration Council
NQF	National Qualifications Framework
NT	National Treasury
O&M	Operations and maintenance
OECD	Organisation for Economic Cooperation and Development
OHS	Occupational health and safety
PDI	Previously disadvantaged individual
PEDP	Professional Engineer Development Programme
PETRO	Pond enhanced treatment and operation
PFMA	Public Finance Management Act
PMS	Pavement management systems
PMU	Project management unit
PPP	Public-private partnership
R&D	Research and development
RDP	Reconstruction and Development Programme
RED	Regional Electricity Distributor
RFQ	Request for qualification
RWS	Regional water scheme
S&T	Subsistence and travel
SAACE	South African Association of Consulting Engineers
SABITA	South African Bitumen Association
SABS	South African Bureau of Standards
SABTACO	South African Black Technical and Allied Careers Organisation
SACPE	South African Council for Professional Engineers
SADC	Southern African Development Community
SAFCEC	South African Federation of Civil Engineering Contractors
SAICE	South African Institution of Civil Engineering
SAISC	South African Institute of Steel Construction
SANRAL	South African National Roads Agency Limited
SARF	South African Road Federation
SARTSM	South African Road Traffic Signals Manual
SCADA	Supervisory control and data acquisition system
SCM	Supply chain management
SET	Science, engineering and technology
SETA	Sector Education and Training Authority
SG	Standard grade
SMMEs	Small, medium and micro-enterprises
SOE	State-owned enterprise
SOP	Standard operating procedures
TBVC	Transkei, Bophuthatswana, Venda and Ciskei
TLB	Tractor, loader, backhoe
UD	Urine diversion
UJ	University of Johannesburg
UNISA	University of South Africa
UP	University of Pretoria
USA	United States of America
VIP	Ventilated improved pit (latrine)
WEDC	Waste engineering for developing countries
WISA	Water Institute of South Africa
WITS	University of the Witwatersrand
WRC	Water Research Commission
WSA	Water service authority
WSDP	Water sector development plan
WSP	Waste stabilisation pond
WSP	Water service provider
WSP	Workplace skills plan
www	Worldwide web

EXECUTIVE SUMMARY

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Executive summary

INTRODUCTION

As far back as 1328, the Italian Byzantine artist, Ambrogio Lorenzetti,[1] understood the effect government has on citizens when he created his famous frescoes – 'The effects of good and bad government on town and country' – in the council room of the Siena City Hall. (See Figure 1.)

The central section of the fresco is said to represent democracy[2] with Peace presiding over the scene. The sides represent good and bad government. In the good town, the scene depicts happy citizens being attended to by angels[3] with justice prevailing and virtues abounding. In the bad town, citizens look sad, and are presided over by tyranny[4] in the guise of the devil, failed justice and evil vices.

Lorenzetti could almost have been painting the extremes of apartheid South Africa with the predominantly white population mostly living in well-serviced Western style towns and cities, whilst the predominantly black population was isolated and generally living in poverty in poorly or unserviced communities.

The dawning of the New South Africa brought with it the dream of a better life for all and an escape from the poverty trap through job creation. Radical changes have been made in local government to deliver social infrastructure and employment opportunities, and significant progress has been made.

However, a transformation process is seldom without pain. Local government has yet to settle into a stable new model capable of addressing all the needs of its consumers. Lack of strategic leadership, poor management, staff shortages and limited budgets have bedevilled the process of service delivery.

Most people take for granted the small, everyday miracles effected by engineering. It is expected that there will be clean water when the tap is turned on, that flushing the toilet will safely dispose of sewage and that there will be electricity when the lights are switched on. Civil engineering, however, plays a largely unseen role in providing these amenities. As a result there is little understanding of the skills and effort required behind the scenes to make these services possible.

Says Neil Macleod,[5] 2007 president of the South African Institution of Civil Engineering and an experienced municipal engineer:

> *Funding is not currently a constraint to growth in the civil engineering sector … but rather limited capacity … at the heart of the problem and the solution are South Africa's embattled municipal engineers who are unappreciated and even unpopular.*

Figure 1 Ambrogio Lorenzetti's frescoes – the effects of good and bad government on town and country

Macleod continues by saying that senior management in municipalities generally do not recognise or use the strategic skills of engineers, which are:

> *… of immense value in non-technical situations as well.*

Numbers and needs in local government adopts a change management approach of:

> *… analysing the past to elicit the present actions required for the future …*[6]

in order to overcome many of the current stumbling blocks.

OVERVIEW OF LOCAL GOVERNMENT

The origins of local government

Local government, as we see it today, is the culmination of years of evolution, with periods of rapid change and even upheaval, over several centuries. Essential to understanding its establishment is the municipality's unique role in supporting communities involved in commercial agriculture, manufacturing, trade and commerce.

In moving away from the agrarian way of life, structured environments became necessary to provide services to the crowded industrial communities who could no longer depend on the land.

These industrial communities required:

- Markets to distribute and provide easy access to food
- Sources of clean water
- Sewage and waste disposal to ensure healthy 'high-density' living
- Heating in the woodless confines of towns
- Lighting for safe movement at night
- Transport networks to deliver food, as well as products and equipment required for industry and agriculture

Thus the essential business of local government was to create everything that was required to promote industry and agriculture and so provide what today is called *municipal infrastructure.*

Engineers played a major role in shaping municipalities whose services were associated with hard-core engineering. Essentially, urban life itself was:

> *… dependent on and under-pinned by engineering.*[7]

Municipal infrastructure

In South Africa[8] municipal infrastructure covers

- Water supply
- Sanitation
- Roads, street lighting and stormwater drainage
- Solid waste disposal
- Electricity supply
- Community facilities and administration buildings

The South African Constitution

The South African Constitution regulates the division of functions among national, provincial and local government.

Facilities such as health, education, ports and airports are generally operated by provincial or national structures but also require services such as access roads, water, sewage, electricity and therefore add to the need for municipal infrastructure.

Revenues

Municipalities have powers to raise revenue for services provided by both direct and indirect charges, including rates and service charges and fines for non-compliance.

THE PAST

South African towns and cities

The major towns and cities in South Africa developed for one of three main reasons:

- To serve major trade routes, initially ports and later on rail and road routes
- To serve farming communities
- To serve mining operations

In each instance, settlements grew and required the supply of fresh water, some form of sanitation and waste disposal and the development of good transportation networks.

While the ports and adjacent agricultural towns developed over a period of time, often several centuries, agricultural towns in the interior and mining towns, in particular, grew very rapidly (for example, Johannesburg). Municipal infrastructure therefore had to grow equally rapidly.

Apartheid South Africa

The policy of separate development of white and black populations was finally formalised into the apartheid system after the country's independence from British influence in 1961.

In line with Prime Minister Verwoerd's views that natives should only come into white areas to serve,[9] a significant portion of the black population found themselves confined to independent states, such as the Transkei, Bophutatswana, Venda and Ciskei, as well as self-governing homelands. Most lived in appalling conditions with limited or no services at all.

The development imperative

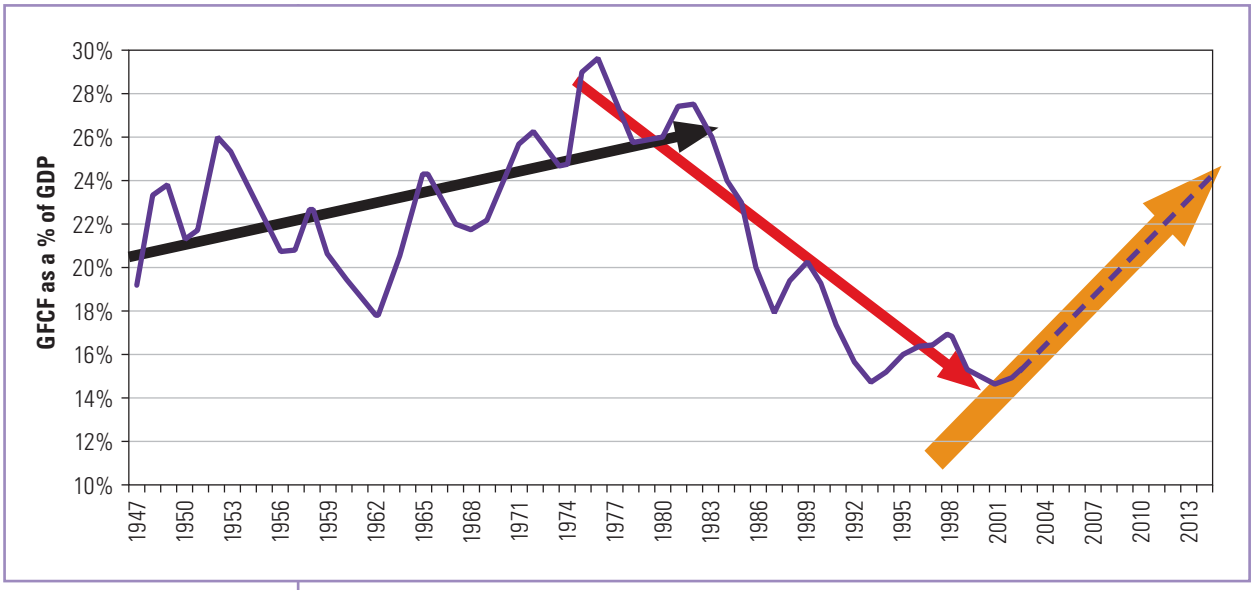
In contrast, with independence came ambitious development aspirations of the ruling party. Their sights were set on developing major economic infrastructure and services

Development of road networks around the major cities from the fifties to the early seventies

The off-ramp from the Southern Freeway to the Esplanade, Durban (1970)

Motorways constructed around Johannesburg (1962–1970)

Motorway development on the Foreshore, Cape Town (1958–1971)



Source: Neil Holzapfel (NWH), Murray and Roberts

Figure 2 The fifty-year construction cycle

for their voting public in formal towns and cities. Determined to build a model country that would prosper under its new government, skills development was high on the agenda to match the brisk development initiated in the late 1960s and 1970s, as shown in Figure 2.

(i) Bursaries and graduate training

The government recognised the need to train engineers and offered thousands of bursaries during that period to build capacity. In today's context they would be termed 'risk' bursaries as these bursaries were offered to first-year students who might have changed courses or dropped out.

The number of civil engineering graduates topped 300 in 1973 and reached an all-time high of 385 in 1977. These young people entered into formal 'engineer-in-training' agreements with their sponsors who were largely national infrastructure departments, such as the Department of Water Affairs, the Department of Transport and Public Works and large municipalities, as well as parastatals, such as the Electricity Supply Commission and the South African Railways and Harbours. Large companies, in particular mining groups and large consulting and contracting companies, also provided graduate training.

The graduates received rigorous workplace training under supervision of seasoned registered engineers and were able to gain professional registration within a few years of graduating. As a result, almost 50% of the engineering teams in the public sector at the time were registered professional engineers.

(ii) Municipalities and civil engineering capacity

There were some 250 urban municipalities, supporting a population of around 14 million, composed of slightly less than five million white, six million African, two million coloured and one million Indian people (see Figure 3). The engineering capacity so built meant that by the late 1980s there were 2 500 to 3 000 civil engineering professionals in these municipalities (that is, just over 21 civil professionals per 100 000 of the population served).

A feature of all professions of this time, including the civil engineering profession, was that they were almost exclusively white and male. This model of well-trained professional teams running well-serviced towns and cities was not unique to South Africa but was to be seen throughout the Commonwealth, Western Europe, the North Americas and in other major industrialised cities.

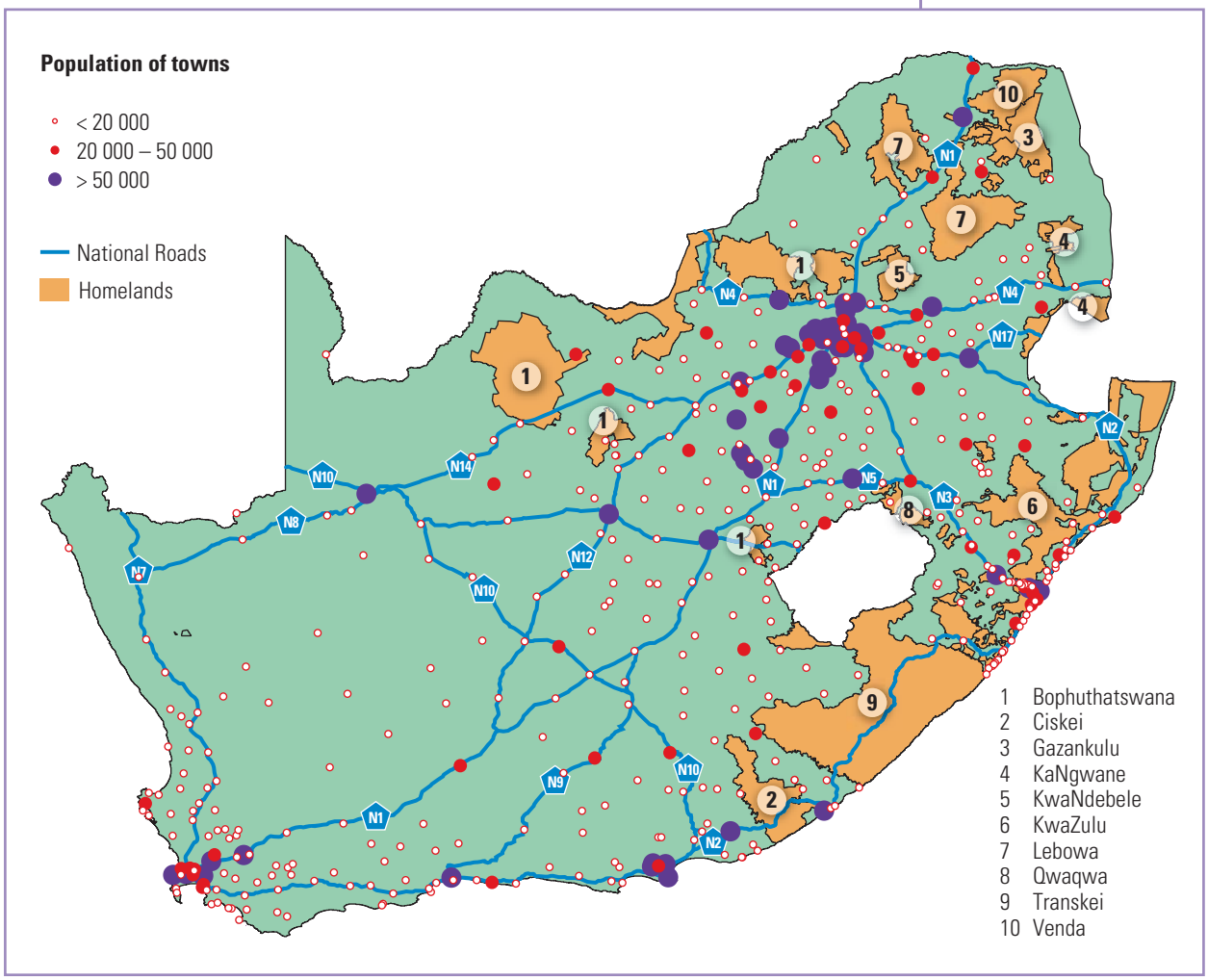
(iii) Artisans and municipal training centres

Although this book is directed at building civil engineering capacity, mention must also be made of the municipal training centres in place at the time, which offered excellent training for apprentices and ensured an ongoing supply of artisans.

South African engineers

South African engineers have a proud tradition of engineering achievement. Major developments commenced in the early 19th century with the construction of water and sewerage networks in Cape Town, followed by pioneers Thomas Baines and George Pauling[10] who developed significant road and rail networks throughout the country.

Figure 3 Developed towns and cities in South Africa, 1989



Map generated by GIMS

From the late 1950s, strong engineering leaders, such as Solly Morris in Cape Town, Bill Pryce-Rosser in Johannesburg and Geoff Boden in Durban, planned and built road networks around their cities. These road networks were ahead of their time and have contributed to their cities' growth, showing long-term vision and insight rarely seen in today's thinking.

Municipalities were financially sound and usually self-funding. Engineering departments were well structured, systematically managed, and boasted experienced and well-qualified staff at senior levels.

Engineering departments handled the entire project cycle, from long-term planning to detailed planning, design, construction and operations and maintenance. Strict processes were in place for operations and maintenance and ongoing routine and planned maintenance were the order of the day. In this way they were fertile training grounds for young graduates.

Engineering departments had control over their budgets, stores, appointment of their staff and the choice of projects and solutions to be rolled out, although these plans had to be approved by the councils of the day.

The Town or City Engineer was a prominent member of the municipality and usually an influential strategist and decision maker. He commanded respect, enforced strict discipline and was uncompromising with respect to the standard of work done.

Towards the end of the eighties, in line with business trends to focus on core activities, design and construction work was slowly but surely outsourced to the private sector, whilst municipalities continued with long-term planning, project management and operations and maintenance. Designers and construction staff thus started to migrate to the private sector. The exodus has proven counter-productive in many instances, particularly in small or remote municipalities which have found themselves with no technical staff.

The result of good engineering

South Africa thus became the economic leader in Africa. Mineral wealth, First World economic infrastructure and associated skills have allowed the country to develop into the powerful country that it is today, generating a GDP per capita several orders of magnitude larger than most other countries on the continent.

Urban and economic infrastructure developed by the three levels of government, is the envy of the rest of Africa and the Third World. The major centres are world class. John Mauldin, the president of Millennium Wave Advisors says:

> *Johannesburg is a world-class city, on a par with New York or London or any major city … Durban is a tropical jewel … Cape Town is the most beautiful city …*[11]

The country has rich and varied wildlife, culture and scenery that attracts millions of tourists from around the globe. The world-class infrastructure is a major benefit for tourism and played a substantial part in the 2010 Soccer World Cup being awarded to South Africa.

Skew objectives

In *summary*, the previous municipal structures and approaches worked relatively well – albeit with skewed, racially motivated objectives.

While development was focused on the commercial backbone and urban areas, alongside this prosperity, there was neglect, poverty and a range of associated problems that visitors rarely saw. High levels of unemployment, commercial and social exclusion, crime, deprivation and homelessness combined to create major challenges that still haunt South Africa today.

THE PRESENT

The New South Africa

With the advent of democracy, in 1994, came euphoria and many political and social challenges. The miracle of the peaceful change of power was celebrated and marvelled at throughout the world. A better and exciting future was predicted for all.

Municipalities in the New South Africa

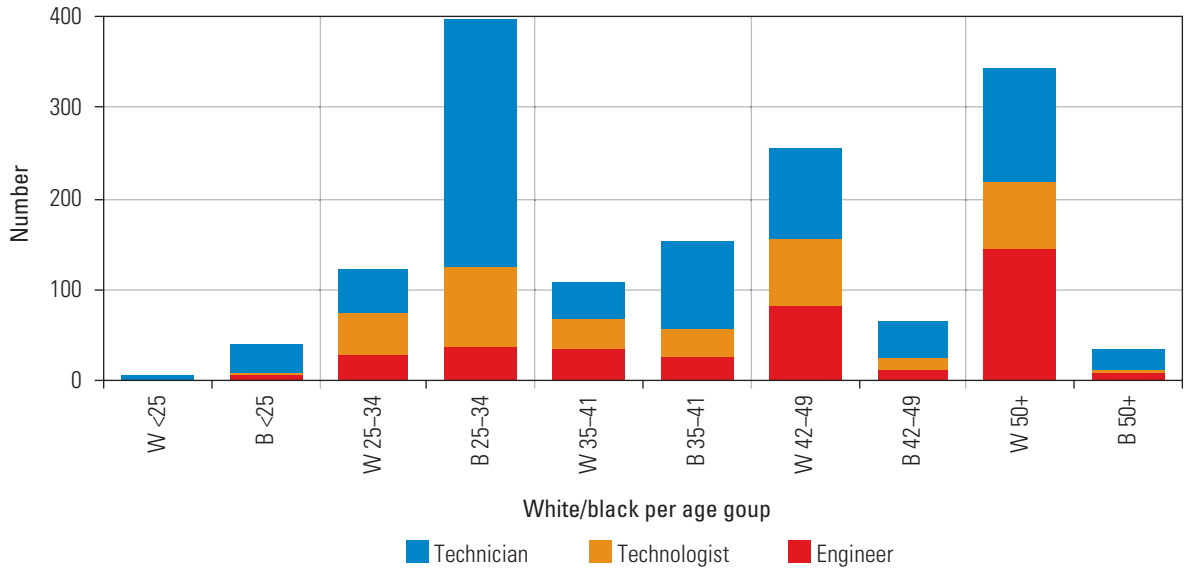
Objectives of local government – the Constitutional imperative

Clause 152 of the Constitution states that:

> *(1) The objects of local government are –*
> *a. to provide democratic and accountable government for local communities;*
> *b. to ensure the provision of services to communities in a sustainable manner;*
> *c. to promote social and economic development;*
> *d. to promote a safe and healthy environment; and*
> *e. to encourage the involvement of communities and community organisations in the matters of local government.*
>
> *(2) A municipality must strive, within its financial and administrative capacity, to achieve the objects set out in subsection (1).*

Clearly, 1(b) to (d) relate to engineering infrastructure. The challenge was to deliver services to all South Africans whilst maintaining existing infrastructure and developing more economic infrastructure in order to support growth, job creation and prosperity for the 47 million or more inhabitants. This would require vastly increased engineering skills and expertise.

Figure 4 Civil engineering staff in local government, April 2005



Source: *Numbers & needs*

Municipal restructuring and employment policies

One of the first major restructuring exercises in the new South Africa was that of local government. Transitional councils were established merging many smaller, often racially based, municipalities and absorbing adjacent rural areas.

This resulted in a quantum increase in the area served by municipalities, and particularly in the services required, as the newly adopted areas were generally under-serviced or unserviced.

Instead of building capacity, restructuring saw the rationalisation of the existing engineering departments and significant numbers of public sector staff were offered packages, were retrenched, retired early or left the service, including many senior engineers. The migration of technical staff out of local government has continued. By 2005, the total number of civil engineering staff in local government had dropped to 1 534 as shown in Figure 4 on p 9 (a drop of over 1 000 from the late eighties).

Employment policies have further reduced the level of civil engineering experience in local government. Senior engineers have been replaced by inexperienced young black technicians to address equity targets. Many of these young people have insufficient experience to drive or manage service delivery and are unable to progress professionally since few have the luxury of senior engineers available to guide them.

The guideline of limiting staff costs to 32% of the total income has also had an impact on the number of technical staff employed. This guideline is unrealistic, especially in low-income municipalities that are in desperate need of technical support. Conversely, in bigger municipalities this limit means that expenditure on technical staff must be reduced to accommodate the ever-increasing number of staff being employed for non-core activities. When analysing the cost of technical staff against their own departmental income, the national average is below 30%, indicating that the new expanded role of local government is not sustainable unless the new departments, appointees or activities can generate their own income.

When the final model for local government was rolled out in 2000, it reduced the number of municipalities to 284 (from the previous 843) including 47 district municipalities, 6 metros and 231 local municipalities.

The impact of reducing capacity when restructuring

Huge progress has been made in the provision of water, sanitation, electricity and housing with the rate of delivery possibly surpassing similar developments anywhere in the world (see inset below), but there is still a long way to go.

Progress with service delivery to 2006

2,2 million houses built

17 million connected to water

10 million received access to sanitation

In real terms, rationalisation has meant that areas being served have increased three- to ten-fold at the same time as the number of staff has been reduced. The population being served is three times that receiving municipal services in the previous dispensation. The workload of those remaining has become untenable resulting in much neglect.

Consequently only basic infrastructure is being rolled out, whilst development of economic infrastructure and operations and maintenance are not taking place and infrastructure is failing. This impact is felt most significantly by the voiceless, poorest of the poor, who have no alternative but to revert to their previously inadequate services, such as walking long distances for water or paying high prices to water sellers.

The capacity challenge is not limited to engineering departments. Finance departments battle with debt collection; planning, HR and procurement departments cannot process applications and approvals within acceptable time frames; and building inspectorates are unable to cope with the pace of development.

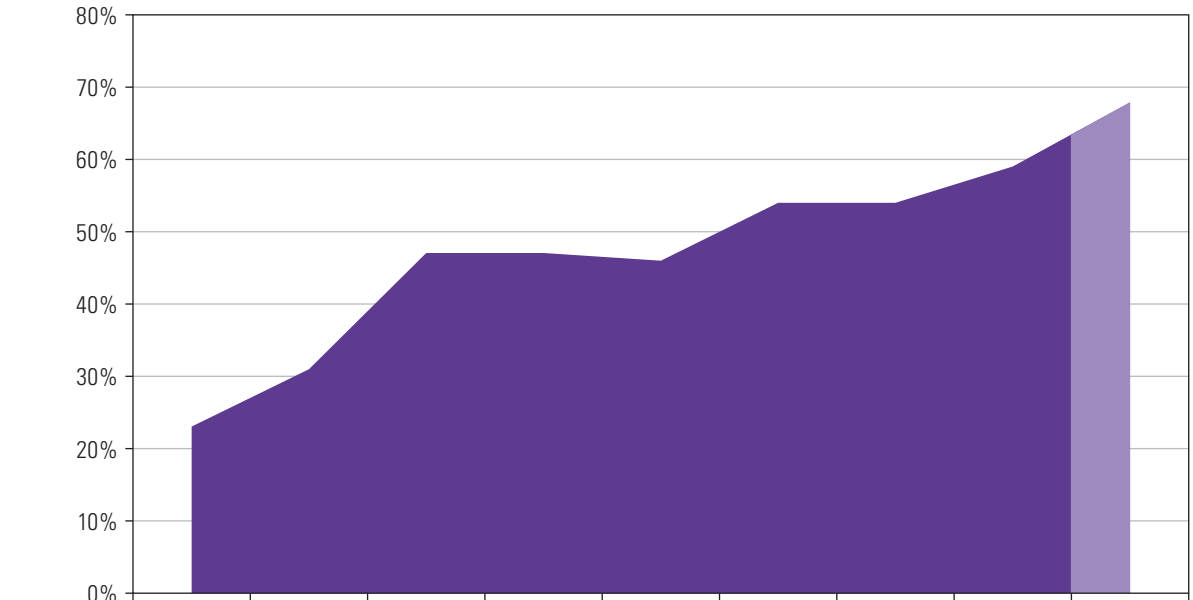
Community demonstrations regarding poor service delivery, of the intensity last seen in Apartheid South Africa, are no longer unusual. Action is clearly necessary.

Urbanisation

The lack of budgets, capacity and progress with service delivery in rural areas has resulted in rural dwellers descending on towns and cities in large numbers, in search of jobs, better education, health care and generally a better quality of life. (See Figure 5.)

The lack of adequate facilities to accommodate the urbanisation influx has given rise to extensive informal settlements, placing further load on the ever decreasing number of civil engineering staff.

Figure 5 Urbanisation over 100 years



	1904	1936	1960	1980	1989	1991	1996	2004	2025
Urbanisation	23%	31%	47%	47%	46%	54%	54%	59%	68%

In analysing local government in developing countries, Professor Harold Alderfer[12] of Pennsylvania State University concludes that trends in modern society apply enormous pressures on local government. The strong drivers of modern society are towards:

- Urbanisation
- Control
- The welfare state
- A higher standard of living
- Democracy
- Materialistic gains in everyday life

These drivers have transformed the way the public sector operates and will continue to do so. They will translate into the aspirations of political leaders and parties who want to be successful in the foreseeable future. Problems will arise, which will be:

> *… solely those of leadership, procedure and administration … the road ahead will be strewn with good intentions and mangled plans …*

However, he continues:

> *Local government, democratic, modern and efficient holds the key to national success and progress.*

The South African challenge is to develop a viable model for local government that addresses the aspirations of all those involved – communities, leaders and municipal employees.

The responsibility of developmental local government

Local government is the sphere of government closest to the people. In its new form, local government has been tasked with not only delivering infrastructure, but according to the Municipal Systems Act, 2000 (Act 32 of 2000) to:

> *… work with citizens and groups within the community to find sustainable ways to meet their social, economic and material needs and improve the quality of their lives …*

This requires:

- Maximising social growth, including the provision of free basic services and improving community facilities
- Maximising economic development, including strengthening industry to create more jobs
- Creating integrated towns and cities by developing and implementing spatial development plans and integrated development plans (IDPs)

These ideals place an ever increasing load on the ever diminishing number of civil engineering staff who are often called upon to implement impractical IDPs and who must take responsibility for managing an ever increasing number of inexperienced SMME service providers. Furthermore, the bottom-up approach has also resulted in the need for many more meetings, workshops and intergovernmental interaction to ensure coordination and that all views are shared and understood.

Municipal structures and decision making

Prior to 1994 mayoral positions were largely ceremonial and were held by directly elected councillors, and municipal managers, such as town clerks, town treasurers and town engineers were career positions. Councils were open forums for debate and councillors were almost always local rate payers.

Since 2000 mayoral positions are no longer ceremonial, but executive. Mayors are answerable to their political party, and so are less responsible to the local populace than to their central political structure.

Decision making

Mayoral executive committees and executive councillor status have excluded existing experienced municipal management from decision making. The need to address the basic service backlog has become the overriding imperative, which has often resulted in politicians and officials finding themselves at odds with each other, the one promising basic services at any cost, and the other understanding the overall need to invest in bulk services and continue with operations and maintenance to ensure that backlogs do not escalate.

Few councillors have municipal experience, or even management experience, which invariably results in delayed decision making and hence service delivery.

Powers, functions and authorities

After 2000 the functions and authorities of local and district municipalities were decided upon per province. In some provinces, districts became water authorities and service providers, whilst local municipalities carried the responsibility for road and stormwater provision and management; the opposite roles were assigned in other provinces. This split has negatively affected holistic and long-term integrated planning and management.

Support versus control

Not only have strategic and development decisions been moved from engineering departments, but 'support' departments have sprung up exercising vice-like control over functions such as:

- Budgeting
- Selection of staff
- Procurement

Management has become increasingly bureaucratic and rules based, rather than output based. Well-documented, this outcome is typical of organisations that need to protect themselves in the absence of requisite knowledge and skills to manage outputs directly. As a result non-technical staff now make decisions on:

- Who should be employed
- Who is competent to tender
- Who should be awarded a tender
- What equipment and products are necessary for the smooth operation of plants and infrastructure

Protracted periods taken to make decisions often mean that staff who apply for posts have accepted posts elsewhere long before a job offer is issued by the municipality, or the evaluation and award process for tenders exceeds the validity period and the project must be put out to tender again.

Further, whilst support staff may have authority to make decisions, they are not responsible or accountable for service delivery, hence there is no downside for them if the choice they make is incorrect.

Frustration levels have continued to grow as experienced professional staff find themselves being forced to support and implement decisions that fly in the face of sound engineering principles and sustainability. As a result, experienced engineers continue to leave for the private sector and even emigrate.

It is ironic that South Africa, with its enormous need for municipal infrastructure, is becoming an international source of experienced engineers for countries with relatively well-developed infrastructure. These countries are increasing their depth of skills whilst South Africa is determinedly creating an environment that does the opposite.

Communities do not toyi-toyi because the finance, procurement, HR, LED or a support department is not performing, but rather because service delivery has faltered – largely as the result of destroying the processes, systems and technical capacity to deliver them!

The American experience of the late eighties and early nineties haunts us:

> *We have become so obsessed with dictating how things should be done – regulating the process, controlling the inputs – that we have ignored the outcomes, the results!*

Advisors, consultants and quick fixes

A noticeable feature of the new environment is the procession of national, provincial and contract personnel carrying out investigations, writing reports, making policy proposals on technical functions, without any technical input and frequently without understanding the technical issues.

Fly in-fly out visits are perfunctory at best and cannot offer more than a superficial understanding of the problems of service delivery. That cogent technical input is not a prerequisite for such plans, and that these are not drawn up by technical people is difficult to understand. This approach may however explain why the plethora of plans, initiatives and reports have had limited impact.

Quick fixes are continually being requested but simply gloss over the real needs and divert time and effort from long-term needs and solutions.

Status of municipal engineering

By mid-2007, the number of civil engineering staff in local government was estimated to be some 1 300 to 1 400, indicating a net loss of 70 to 90 per annum since the late eighties. This much reduced number serving a population of 47 million or more means that there is now an average of fewer than three civil engineering staff per 100 000, a significant drop from the 21+ serving towns and cities in the previous dispensation. (See Figure 6.) If allowed to continue, service delivery will all but come to a standstill. The disparity between the current South African numbers and those gleaned from centres in English-speaking and Scandinavian countries dramatically highlights the challenge. The biggest backlogs that we suffer are those of capacity.

Furthermore, many of the current, reduced staff complement are also inexperienced and are unable to initiate projects, make decisions, manage or monitor projects.

The results of increasing demand and reducing capacity have given rise to many problems that require urgent attention. These include:

- Lack of integrated planning and providing long-term infrastructure for growth

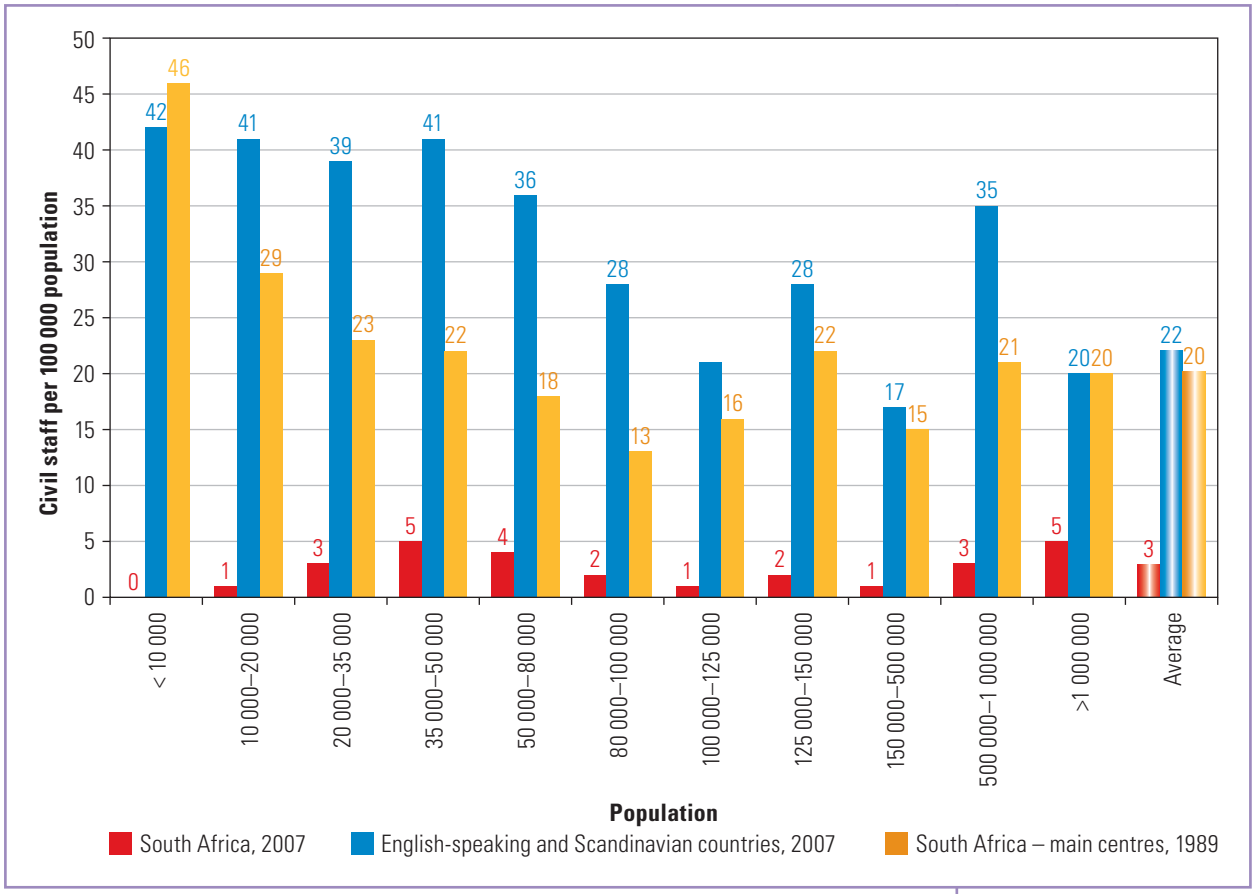


Figure 6 English-speaking and Scandinavian versus South African municipalities: civil staff per 100 000 population

- Indiscriminate development due to poor town planning control, resulting in an additional drain on services for no extra income
- Lack of budget for services other than basic services funded by the municipal infrastructure grant (MIG)
- Projects not being issued to consultants to initiate or manage resulting in underspending
- Decisions generally not being made resulting in underspending and non-delivery
- The inability to manage service providers, resulting in poor quality solutions, under- or overpricing, overpayment and underdelivery, including projects being abandoned
- New infrastructure failing due to the lack of technical capacity in local communities to operate it and limited local budgets to maintain it
- Operations and maintenance not taking place resulting in huge losses, poor quality, intermittent or complete failure of services
- Health risks increasing due to poor water quality and increasing sewage spills
- Lack of access to education, health services and supplies due to poor roads
- Ill-conceived housing developments that are likely to cripple municipalities
- The demise of systems and loss of data
- Loss of institutional knowledge
- Lack of capacity to train
- Lack of career pathing

It is critical that technical departments are rebuilt, including civil engineering staff, at all levels. Whilst they may not need to replicate the structures of the 1980s, unless there is capacity to plan, initiate and supervise, service delivery projects will not take place, may not be appropriate or sustainable or may falter or fail totally, creating additional backlogs.

Municipalities from a business perspective

In business terms, few municipalities are small businesses, which could be called SMMEs. Well over 200 municipalities fall into the large business category, with the turnover of some metros placing them in the upper quartile of South Africa's top 100 companies!

A business model

Businesses of this size require well-qualified and experienced CEOs and executives who would recognise the business imperatives of:

- Defining and achieving the business's goals and priorities
- Employing the best staff for the job
- Delivering quality long-term solutions – in the case of local government, sustainable infrastructure
- Offering the best possible service
- Setting prices (tariffs) at market-related rates that reflect the services provided as well as long-term viability
- Aggressively managing credit, income (that is, payments) and costs
- Being action-orientated

Such private sector CEOs would inspire their boards, motivate their staff and attract skills, and company shares would be sought after by investors. Sadly, few, if any, of the above imperatives form part of the vocabulary of councillors or senior management.

Municipal assets

Municipalities have only two assets – infrastructure and their debtors' book.

In essence, infrastructure is the cash cow against which a municipality can earn the bulk of its income. In business, its product (that is, service delivery) would be the driving force of the business, and assets, costs and credit control would be tightly managed to ensure its success and sustainability.

However, currently in local government these seem to get the least attention with infrastructure decaying as a result of not being maintained, and the national debtors' book having reached almost R40 billion. Many managers seem to be focused more on personal, political and ideological objectives than on service delivery.

Skills, leadership and a turnaround strategy are urgently required.

Skills

Skills required

Any operating structure requires a balance of staff across the five skills profiles shown in Figure 7, with development consciously moving people up the skills hierarchy.

The restructuring process in local government has seen technical structures collapse and experienced technical capacity being replaced with non-technical political appointees who, in many instances, have taken the place of town or city engineers.

Delivering municipal infrastructure requires sophisticated solutions to address not only immediate supply, but long-term operability whilst being environmentally friendly and economically viable. Furthermore, the value of assets managed is enormous. It thus seems incongruous that such responsibility be given to non-technical managers or young technical staff with limited or no experience in the field.

Skills gaps versus skills shortages

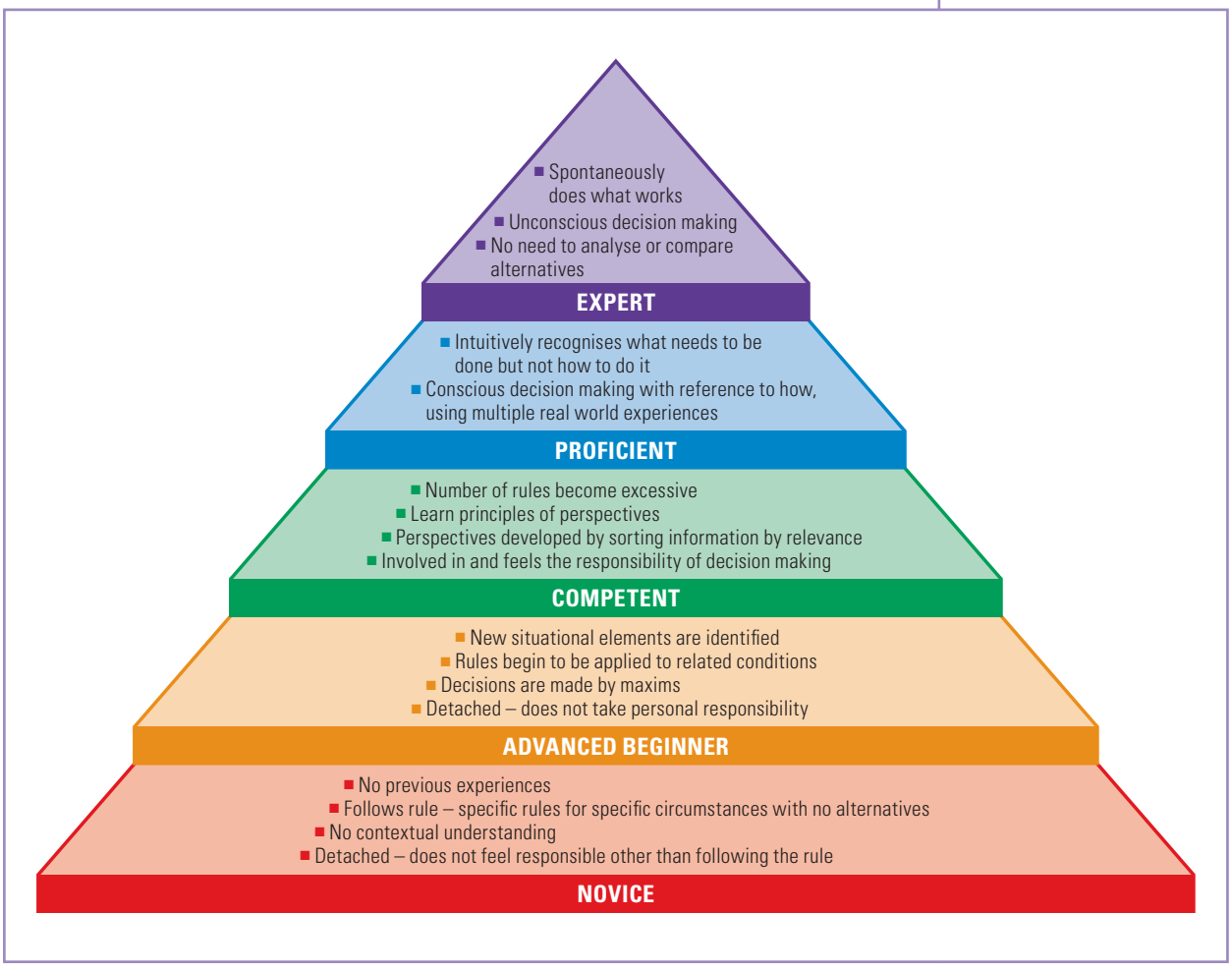
The press has been full of opposing claims and arguments regarding skills shortages.

Business says that there is a massive skills shortage, which is slowing growth; others deny that a skills shortage exists citing the large numbers of graduates who are unable to find employment.

The answer lies in understanding the difference between skills shortages, that is, scarce skills not being available at all, and skills gaps that occur where there are qualified people who do not have the appropriate level of experience required for specific posts.

Civil engineering suffers from both. Without addressing the shortage of highly skilled staff, the gaps will continue as there will be no mechanism for assisting those without experience to bridge the gap and develop skills.

Figure 7 The skills acquisition pyramid



Source: Adapted from *What is moral maturity?*

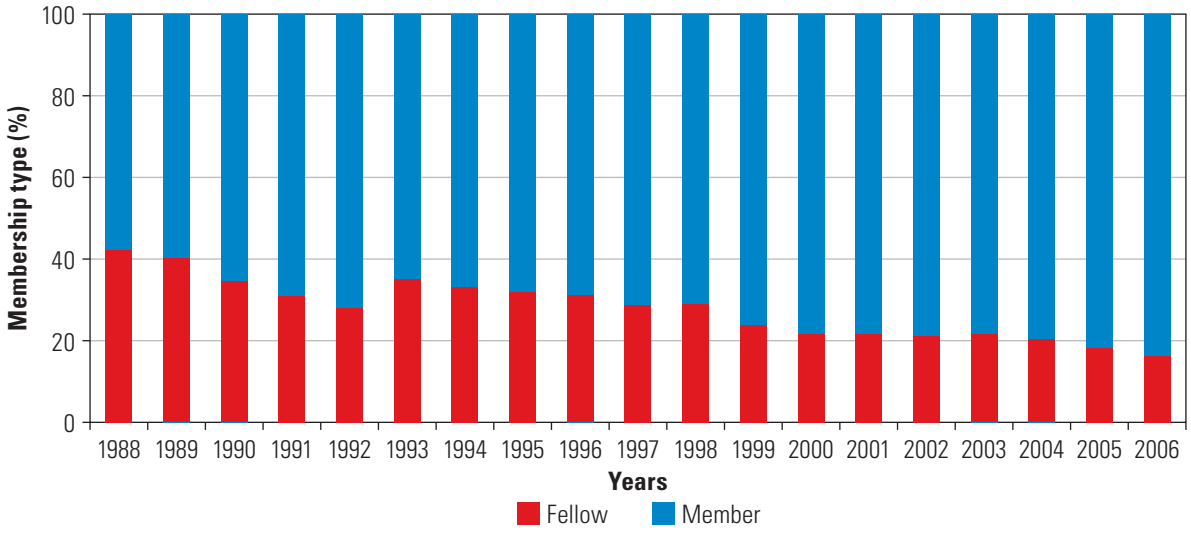


Figure 8 IMESA corporate membership

Skills development

Whilst many previously disadvantaged young people have been able to study civil engineering over the past 15 years, most have battled to gain the experiential training required.

Many of those who have graduated have found themselves employed in municipalities with no senior staff, and so have been unable to develop any technical competence and certainly not at the same rate as did their predecessors.

Theories of skills development

Research on international best practice carried out in preparation of this book, clearly demonstrates the increasing complexity of the business of local government.

The view of learning theorist Gagne[13] is that complex skills can only be developed as a result of the cumulative effect of learning. Unlike factual information, intellectual skills cannot be learned simply by hearing them or looking them up. The development of skills cannot be left to chance[14] but requires comprehensive, formal interaction, preferably on a one-on-one basis, with an expert in the field.

The very telling analysis of the skills development process suggested by Professor H Dreyfus[15] (shown in Figure 7), explains why local government, and indeed the public sector as a whole, suffers from lack of decision making capacity. The phases of skills development take time to develop and require input from experience practitioners, with skill levels of competent, proficient and expert!

Figure 8 shows the decline in the numbers of the more experienced Fellows of the Institute of Municipal Engineering of Southern Africa since 1993 (Fellows being a meritorious title), as they have slowly but surely left local government. Whilst it can be argued that the earlier numbers may have represented the 'old boys club', the reduction to some 16% of senior engineers is too low to carry the necessary strategic role as well as attending to skills transfer.

Legislation to guide the inexperienced

With many novice staff in the public sector, comprehensive legislation has become necessary to mentor and guide those now responsible for huge budgets and complex processes.

Unfortunately, the extent of the legislation is overwhelming and will do little to develop those at whom it was directed. This too has become a challenge worldwide.

Controls and levels of bureaucracy have increased to such an extent in many countries that departments are impeded in their attempts to deliver the very services that are the rationale for their existence.[16]

> *Every rule was originally laid down with the best intentions. But the cumulative effect is gridlock. Every group's prerogatives are protected. Unable to do what they know is right, fearful of punishment if they are found ignoring the rules, many public employees simply give up.*

These public sector changes have taken place at the same time that the business world has been moving in the opposite direction as a result of better communication spawned by the personal computer and is restructuring with the emphasis on down, or right-sizing, flat structures and eliminating bureaucracy.

The resulting frustration has persuaded many engineers to move to the private sector. The frustrations in the American public sector have been summarised as follows:

> *Our attempt to prevent bad management made good management impossible!*

Competing demands

In *summary*, the high level of stress in local government is the product of two distinct pressures.

On the one hand there is managerial paralysis and disempowerment as a result of the overlap between the role of councils and senior management, excessive controls, the burden of huge numbers of inexperienced staff who require ongoing training and workshopping, and the demands of intergovernmental relations, which require excessive engagement.

On the other hand there is the pressure of work overload, physical and psychological stress, decimated structures, staff shortages and general inefficiency. When managerial paralysis and inefficiency are combined with the daily operational crisis of excessive workload the result is going to be institutional stress and compromised service delivery.

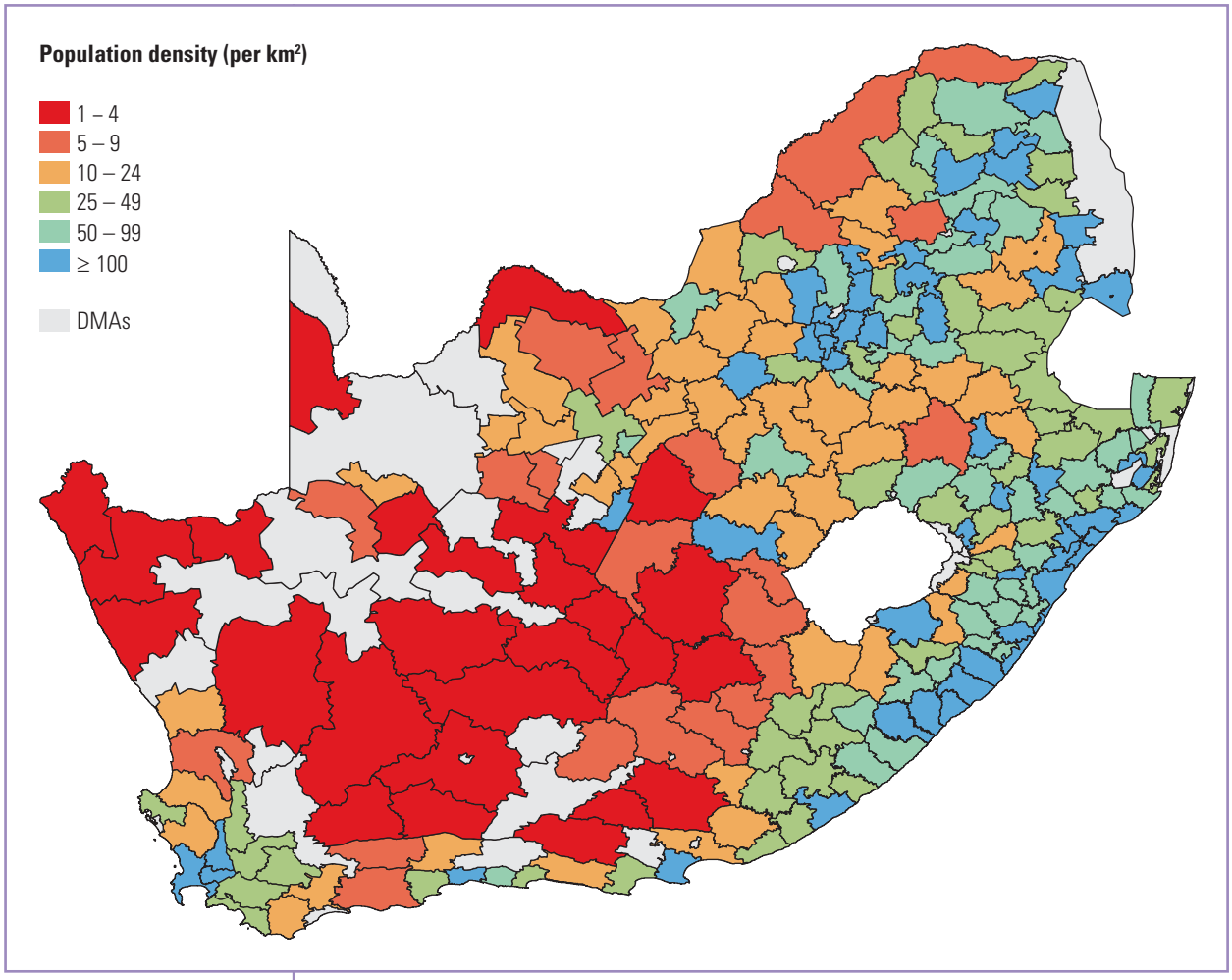
THE FUTURE

Bright hope for tomorrow

Whilst the current status quo may sound rather depressing, we must remember that society cannot change overnight. The new model for local government is relatively young, considering the long history of local government. The future of local government will depend on the foundations that are laid now.

Given the current boom conditions, huge investment in private developments, government expenditure on major economic infrastructure and the availability of grant funds for the development of basic infrastructure and support to the poor, there is no reason why the majority of municipalities should not be economically viable.

Success stories showcased throughout the book demonstrate that with capacity and experience, service delivery is indeed possible.



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 9 Population densities per square kilometre in local municipalities and the metros

A long-term systematic approach to stabilising and rebuilding local government needs to commence immediately, based on business principles of reducing costs, increasing income, controlling debts, developing appropriate structures and employing the right staff.

Macro-considerations

The **dplg** has called on the country to offer input into the debate on the structure of provinces and districts. The model of district and local municipalities has not performed as expected. It has become clear that a one-size-fits-all model does not work across all areas and provinces.

Viability of districts

Most engineers employed in districts have found little cooperation between district and local municipal structures and have invariably found themselves working in local municipalities to drive service delivery.

In terms of the number of households per number of technical staff it has been found that at least one civil engineering professional is needed for every 4 000 to 5 000 households. Thus a municipality with 200 000 households would need some 40 civil engineering staff.

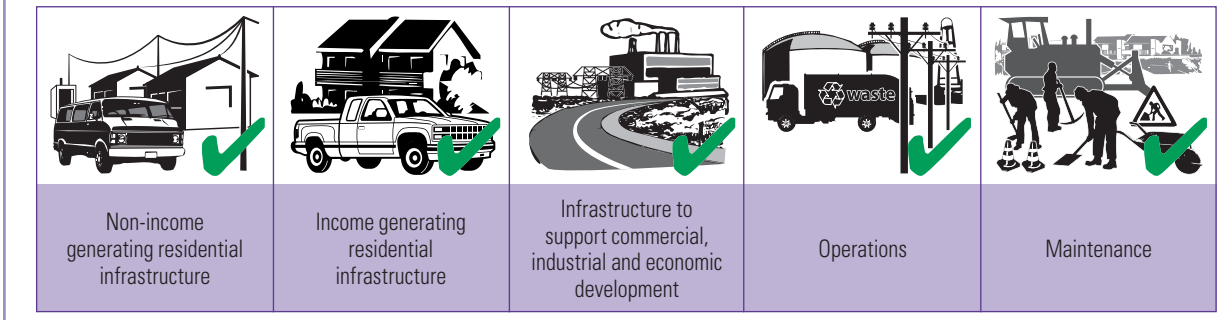


Figure 10 The optimum approach to service delivery in local government

Even in a small municipality of 2 500 households, at least one civil engineering professional is required to deal with the day-to-day technical problems that arise, supervise routine maintenance and provide planning input.

Only in the Northern Cape and Karoo districts straddling the Northern Cape is the population so sparse that setting up individual municipal structures per hamlet is not practical. (See Figure 9.) In most other areas, fully functional local municipalities need to be developed. The expense and efficiency of what is apparently a fourth tier of government is questioned.

Where a district operates efficiently as a provider of a specific service, such as road maintenance, this should be converted to a delivery agency independent of political structures or become a regional facility of a provincial sector department, leaving the locals to determine their needs and request support from the agency or province.

Local municipalities

Local municipalities apart from the sparsely populated municipalities in the Karoo should be supported to become stand-alone, viable structures. All suffer from high losses, outstanding debt, top-heavy structures and insufficient capacity to access or spend grant and other funding, to name but a few of the challenges. With careful pruning, planning and re-skilling or amalgamation with strong neighbours there is no reason why they cannot be streamlined to become efficient service delivery structures.

The development imperative

The swing from servicing the paying public to providing only basic services has impacted on the growth potential of the country. That development of social infrastructure must be accelerated is not open to negotiation. That economic infrastructure must be developed to support growth and improve local government income is abundantly clear. That operations and maintenance require urgent attention to improve the quality of service and ensure that the huge investments of past and present are protected should not be negotiable.

As shown in Figure 10, it is now critical that all types of service delivery, including operations and maintenance, be planned, budgeted for and executed.

Functions in engineering departments

Each stage of the project cycle requires knowledgeable input and control, rather than the vacuums that currently exist. Whilst much of the development work of local government has been outsourced to the private sector (as shown in Figure 11), if there is insufficient

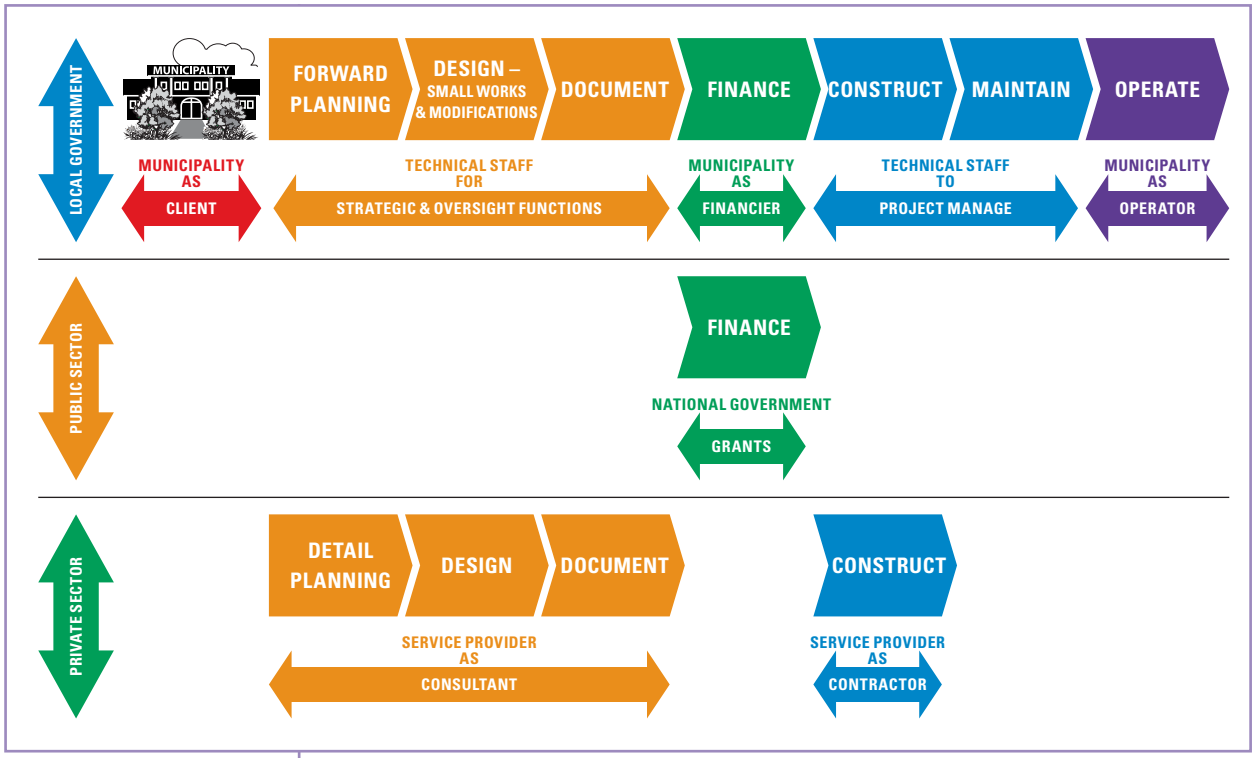


Figure 11 Recommended internal staff and functions to be performed or managed

capacity in local government little or no planning will take place, projects will not be initiated, suitable solutions may not be offered and quality and cost control will be a hit-and-miss affair. Innovative strategies must thus be developed to rebuild engineering capacity.

Planning

To build confidence and deliver adequate infrastructure, long-term planning is key. The development and maintenance of master plans are essential. Prior to developing integrated development plans (IDPs) bulk capacities, access, demographics, development and economic trends must be studied and long-term or forward plans must be developed for a 10- to 20-year horizon to ensure sustainability. The preparation of IDPs without the long-term view invariably results in local services being provided for which there are inadequate bulk supplies, systems or capacity for long-term sustainability. Planning functionality and capacity must urgently be reintroduced.

Leadership

Political leadership

Local government leadership requires a paradigm shift from ideological and personal agendas to service delivery as the overriding objective. This requires sound business practices including corporate governance, delegation of responsibility, and accountability.

Fundamental restructuring of the relationship between councils and administration is essential. That is, uncoupling the *business* of local government from the *politics* of local government. Substantial empowering of management and enhancement of their capacity is required.

Administrative leadership

(i) The municipal manager

The evidence suggests that neither tinkering with regulations, nor establishing new training programmes for municipal managers would be adequate to significantly improve the functioning of local government. Visionary, experienced leaders are required if long-term decline of local government is to be avoided. Furthermore, it is essential that the municipal manager be afforded more autonomy in terms of selecting his senior staff and managing the administration.

(ii) The chief engineer

Essentially local government is an engineering business that stands or falls by the quality of its engineering services The need to rebuild rather than restructure is key.

Senior civil engineers being some of the most highly qualified and experienced staff in the municipality and critical to service delivery (the major objective of the municipality) must once again be part of the decision making process.

A post of chief engineer should be created. Just as the municipal manager is responsible for the overall functioning of the administration, and the chief financial officer for the management of finance, the chief engineer should take responsibility for guiding service delivery. The chief engineer should attend council meetings to explain and motivate proposals and give advice when technical matters are being debated.

The chief engineer must be an experienced civil engineering professional registered with the Engineering Council of South Africa (ECSA).

(iii) The triumvirate

The municipal manager, chief financial officer and chief engineer should form a cohesive management unit, able to motivate and support each other on all issues, from the mundane to solving complex strategic challenges. On the top of their agenda should be streamlining processes and relationships to ensure timeous and decisive decision making.

Rebuilding the skills base

The title of the book captures the challenge. Civil engineering is the critical profession for service delivery. The need to rebuild rather than restructure is key.

Unless rebuilding the skills base is tackled with resolve, long-term erosion of public confidence and consequent decline of the local government sector are likely as the older generation of public service professionals retire or move on and the inadequately prepared younger generation battle with their new-found responsibilities.

Civil engineering is the critical profession for service delivery

Realistic organograms and competencies

In studying organograms and job descriptions it is clear that there has been a movement towards management at the expense of technical expertise. Few technical posts call for technical competencies, resulting in staff being selected who do not have the requisite technical skills and experience to lead and manage development and operations.

An assessment of the scope of infrastructure and future needs should be carried out in each municipality. Using norms and standards in terms of the number of technical, operations and maintenance staff, organograms and job descriptions, including technical competencies, must be redeveloped to ensure that all infrastructure is adequately handled.

In addition, few organograms make provision for a hierarchy of engineering staff, allowing juniors to progress as they gain experience. It is necessary for junior staff to leave one municipality and move to another in order to make progress. A review of the career path potential per municipality is also essential.

Numbers and needs in local government

Civil engineering skills are required aplenty.

(i) Number of civil engineering staff required in local government

In order to move from just under three civil engineering professionals per 100 000 population to around 6 to 8, it is estimated that an additional 1 200 to 1 500 civil engineering staff will be required in local government. A mix of junior, production and senior staff is essential to ensure sustainable solutions are delivered and ongoing operations and maintenance and capacity development can take place.

Formulae are proposed for determining the minimum number of civil engineering staff required per municipality and suggestions are made as to their experience and levels of qualification.

Figure 12 ENERGYS team attending IMESA conference, Soweto, October 2006

Where municipalities outsource the bulk of their services, strong management control is needed to develop and manage contracts and ensure quality solutions are delivered on time and within budget. (See Figure 11.)

(ii) Demand from industry

There is considerable demand for experienced engineers from the private sector. If the working environment in municipalities is not changed, the outflow of engineers from municipalities will continue.

No train, no gain

The new slogan needs to be: **no train, no gain**. Structured workplace training is essential, but should not be limited to young engineering students and graduates. It should be extended to all who have had insufficient workplace training. This could apply from student level all the way up to municipal managers who require grooming and councillors who require dedicated advisors or orientation.

The ENERGYS project, in which some 150 students and graduates were paired with 50 mostly retired engineers, offers a model for training large groups of civil engineering technicians and engineers whist addressing service delivery. (See Figure 12.)

Guided by university of technology or ECSA log books, activities in the field and office were planned for these young people to gain exposure to project management, operations and maintenance and in some instances design work. The success stories shared throughout are particularly heart warming as they demonstrate that with appropriate technical expertise service delivery and skills transfer is well within reach.

Retain

Public sector employers need to have knowledgeable staff to effectively shape policy and guide development. Hence there is a clear need for experience. A review of the targets in respect of employment equity in technical departments is urgently needed. There are insufficient experienced black and female engineers in South Africa. The only way to achieve targets therefore is to reduce the number of white staff. Being so critically short of staff this cannot be an option. Targets should be set based on the actual race, gender and age profiles in the civil engineering profession and not on ideological targets that simply rob municipalities of capacity.

The senior engineer category, which relies on registration (hence sound experience), is the most challenging, and will take a long time to develop. Technical staff need to be retained regardless of age and gender as they are the custodians of civil engineering knowledge in the country, and need to spend the next few years transferring the considerable skills they have developed! Removing seniors prematurely from local government denies young entrants their right to receive adequate workplace training.

Salaries and an enabling environment are critical areas to be considered when developing a retention strategy.

Optimum utilisation

Meetings, workshops, conferences and courses are robbing local government of valuable production time, as is the lack of secretarial and administration staff in technical departments. Poor time-keeping and absenteeism are also cause for major concern. Suggestions in terms of more efficient utilisation of staff and strict discipline are offered.

Gain – a career of choice

As soon as steps are put in place to allow municipal staff to progress in their careers and use their skills to lead development, local government will again become a career of choice.

Bursaries, salary reviews, training policies, meaningful organograms, career progression, more autonomy and authority for delivery departments, and uncoupling the business of local government from the politics of local government are but a few of the many stumbling blocks that must be overcome.

Window of opportunity

In terms of workplace training and building a new skills base, there is a window of opportunity of three to five years or maybe ten years at the outside, as the skills required, particularly of experienced senior engineers, are in short supply worldwide. The pool of older, experienced engineers will become ever older and less capable and inclined to work.

Innovative technology

Whilst civil engineering capacity is of major concern, it is also important to ensure that the most efficient civil engineering solutions are adopted. A range of innovative solutions is explored in Chapter 6, entitled *Thinking out of the box*. Life cycle costing to reduce the overall cost of ownership, low-maintenance solutions and automated operations are some of the many avenues explored. It is critical that knowledge sharing take place on an ongoing basis to ensure that all in the various fields adopt the most efficient and appropriate solutions.

Improving revenue streams

Millions of rands are being left on the table every year owing to poor revenue management.

In technical departments, water and electricity losses are high owing to a combination of poorly maintained infrastructure, incorrect tariffs and inaccurate or no meter readings.

In the finance department connections are not always recorded, accounts are not issued, or, where all details do exist and accounts are issued, debtors are not chased. Outstanding debts thus soared to some R40 billion in 2006. However, this does not represent the total amount that could be collected were all the other parameters correctly managed. In addition, expanding the property rates base represents a further opportunity to earn income.

Much of the remedial, capture and control work to address these challenges can be handled by discipline-specific students and graduates under the direction of senior staff. Initiatives to improve revenue should urgently be mounted nationwide.

Streamlining processes

In the absence of a sufficient number of skilled staff, comprehensive systems and processes should be in place to assist those remaining with their extraordinary workload. Whilst this will in no way reduce the need for more staff, introducing standard operating procedures, for example, will reduce the opportunity for error in an environment where there is little time to supervise or check on work.

The workload associated with excessive legislation also hampers productivity. Simplistic, online, real-time reporting on a select number of KPIs should be all that is required to ensure progress. The overbearing demand for reports, statistics and adherence to complex procedures is time consuming and adds little if any value to the process. In particular, the complex process associated with procurement and supply chain, and lengthy human resource processes are all but crippling the system and must urgently be

reviewed. Suggestions are made on reducing the number of steps and setting upper time limits between each stage.

The local economic development imperative

The load on local government continues to grow. The need for local economic development (LED) to allow communities to enter the economy is well understood. However, few municipalities have the capacity or budget to address the range of opportunities. Sector departments such as the Department of Agriculture, and the Department of Environmental Affairs and Tourism should be called upon to drive LED in each of their fields nationwide.

However, central to achievement of the LED dream is sound infrastructure, particularly roads, to allow communities to gain access to materials, products and markets. Adequate budgets are therefore necessary to improve transport networks.

A turnaround strategy

Viable local government is not out of reach but strategies and capacity are required to increase income, reduce losses, root out failures and ensure that delivery and growth go hand in hand. Clearly, a coordinated, determined effort is required to address the many shortcomings outlined.

A turnaround team

Figure 13 on p 28 depicts three parallel streams of activities. The block on the right represents current municipal structures, with their vacancies and various weaknesses. The middle block describes the activities that need to be handled by short-term fire fighting interventions. The block on the left represents the activities of a turnaround team in engineering departments who would systematically work through every activity, system and process in order to identify gaps and rebuild systems, procedures and capacity.

Dedicated external staff should work directly with the municipal manager and existing structures to implement the changes required to bolster technical departments, without disrupting their already delicate day-to-day operations.

In some instances this would simply mean advising the municipal manager on permanent appointments, promotions, and junior staff who should be brought in to support the existing staff whilst in others this would be a 'reinventing' exercise where an entire department would need to be built from scratch.

A Marshall plan

A Marshall plan is required in which municipalities step up technical appointments, the public sector offers support and the private sector offers capacity by way of secondments, coaching and 'adopting' towns until internal capacity has been rebuilt and the backlogs have been cleared. Major campaigns need to be mounted to attract as many back into the sector as possible. Systematic training of students and appointment of graduates are also essential.

The spirit of Ubuntu

All that remains is instilling the spirit of Ubuntu. Turnaround strategies cannot simply be mechanistic. Team spirit and buy-in are critical factors. Bishop Desmond Tutu[17] reminds us that Ubuntu:

> *… embraces hospitality, caring about others, being willing to go the extra mile for one another …*

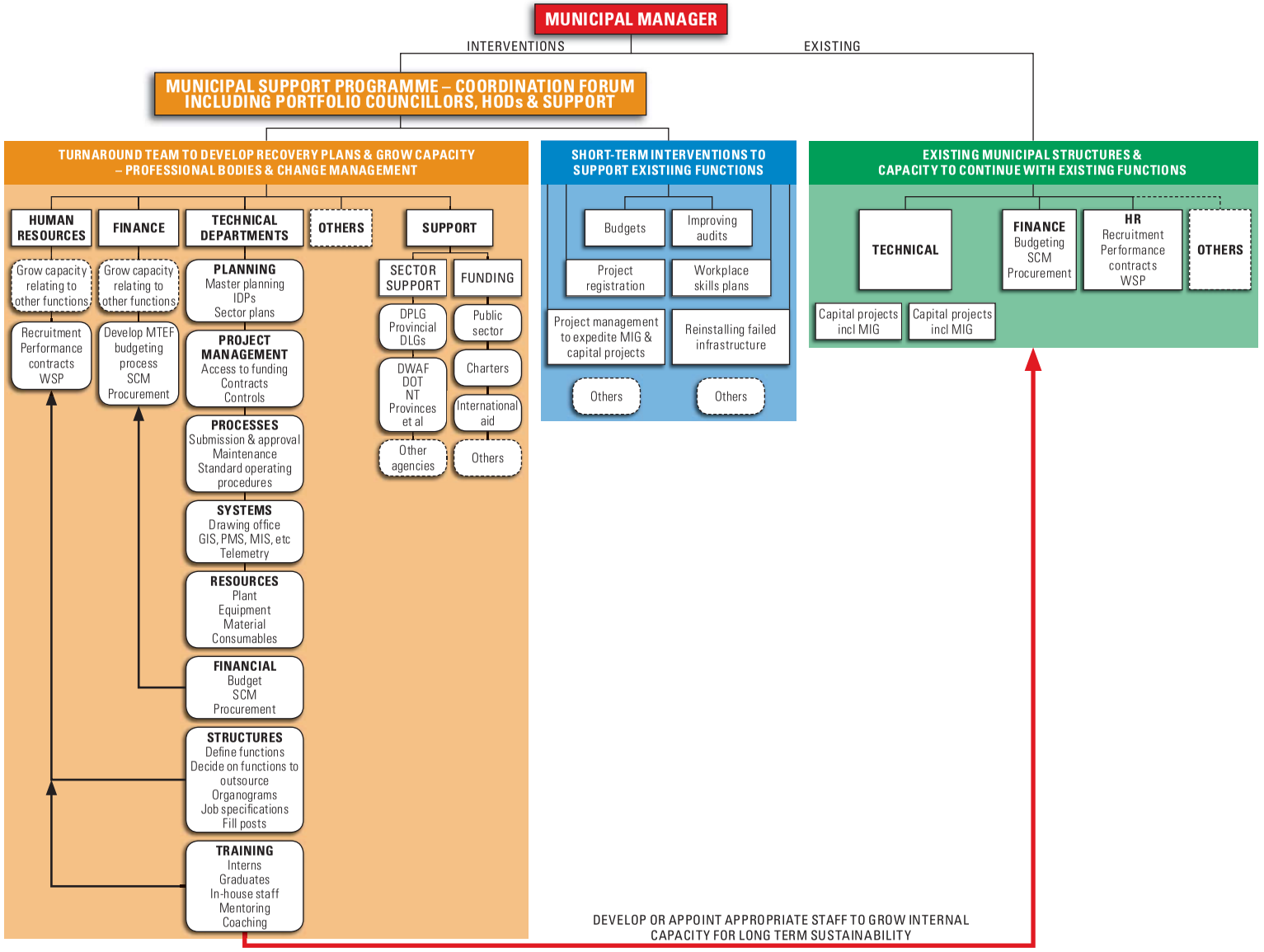


Figure 13 The turnaround strategy

The divides of politics, age, gender, race and sector must be put behind us, and all must be encouraged to work together for the greater good of the South African population. Job insecurity cannot be a factor – all technical staff, plus more, are needed!

Proudly South African

In *summary*, human resource development, organisational development and institutional development are critical for a bright future. In particular, if we do not accelerate the deployment of experienced capacity we cannot accelerate service delivery. However, if the correct building blocks are laid, we can build a uniquely South African local government that can deliver and maintain the service levels required.

IT IS TIME

The time for talking is over. Practical solutions are offered to address the numbers and needs.

Political leadership must accept the reality that current policies and operating procedures in local government will not achieve the desired improvement in living conditions and must drive the required changes. Changes in policy and imaginative change management will be required to ensure that engineering capacity and delivery match the proud traditions of the past for the benefit of all our citizens.

Transforming local government is feasible and achievable with strong leadership, practical structures, adequate capacity and controls. The professions and industry are ready, able and willing to assist and facilitate the process, but cannot initiate it – this can only be done by political leadership.

Even if it is ideologically uncomfortable, it must be accepted that investment in all types of infrastructure is essential for growth and utilising all skills is the only sure way of:

- Maintaining existing infrastructure
- Addressing the substantial backlogs
- Developing the next generation of mostly black engineering graduates who are critical for sustainability

Whilst there may be initial euphoria at receiving a house, if:

- It is without water, sanitation or electricity, or
- Access to schools, job opportunities and products is not possible due to impassable roads, or
- Refuse is not removed due to lack of vehicles, or
- Health and safety are threatened owing to poor quality water, sewage spills and flooding …

… the dream of living in dignity will not be realised. With the many restructuring exercises, we have lost sight of the business of local government, that is, to provide engineering infrastructure and services to ensure that all can live in dignity.

Let us extend the spirit of Ubuntu and work together to help all South Africans achieve this dream.

CONCLUSIONS

Essential services and service delivery at local level are the most important building blocks of the economy and prime contributors towards quality of life and human dignity. There is an urgent need to act now as the deterioration of services and capacity in local government will undermine South Africa's desire and need to grow.

Carrying out desktop research it was distressing to note that most challenges outlined have been raised in the past but with limited success. Indeed in the year 2000,

Source: *Engineering News*, June 2000

President Mbeki made a plea for more engineers to join the public sector (See inset). Sadly, policies and the environment did not support his plea and numbers have continued to decrease. It is encouraging that **dplg** is calling for input from the country at large to address current concerns.

It is hoped that by supplying quantitative data to back up the many recommendations, interventions may be implemented with confidence, and that the country will start seeing a reversal of the demise in technical capacity. *We must urgently build and expand the engineering skills base.*

To succeed will require a collective effort involving political will and the cooperation of all tiers of government, the private sector, academic institutions and the civil engineering workforce.

Transforming local government is feasible and achievable. There is no alternative for South Africa but to build a strong third tier of government – local government.

RECOMMENDATIONS

Interventions required to ensure that the building blocks are in place are discussed in detail under each chapter. A summary of the most important short-, medium- and long-term interventions to be initiated immediately are as follows:

Short term

- Retain senior professionals and appoint retired professionals to initiate and manage projects, and supervise and train young graduates
- Review conditions of employment, including remuneration, qualifications, grading, responsibility, authority and employment equity targets
- Attract senior technical skills back into local government
- Reintroduce structured workplace training
- Reintroduce town planning, forward planning and master planning
- Invest in basic and economic infrastructure, operations and maintenance
- Drive revenue enhancement programmes

Medium term

- Increase the number of civil engineering staff in local government to at least 2 700
- Increase the number of technologists and engineers in local government
- Develop meaningful organograms and job descriptions, including technical competencies
- Legislate the post of chief engineer
- Implement comprehensive succession planning and associated training
- Review and streamline appointment processes
- Review and streamline procurement and supply chain processes
- Hold workshops on the complexities of infrastructure service delivery
- Reopen municipal training centres and reintroduce artisan training

Long term

- Increase the number of civil engineering staff in local government to at least 3 500
- Redesign the political versus administrative structures, to allow the administration authority in support of accountability
- Adopt or develop and enforce professional qualifications with commensurate experience for all senior positions

NOTES

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Figure 4: Lawless, A 2005. *Numbers & needs: addressing imbalances in the civil engineering profession.* Midrand: SAICE.

Figure 7: Adapted from Dreyfus, H L 2006. *What is moral maturity? A phenomenological account of the development of ethical expertise.* Paper presented during the Research Course on Phenomenological Approaches to Moral Philosophy and Education, Norwegian School of Sport Sciences, Oslo, 6–8 June.

There is no alternative for South Africa but to build a strong third tier of government – local government

PART I
INTRODUCTION

Contents

Scope

This book is essentially about business re-engineering, or more correctly since we are looking at the public sector, reinventing government. Past and current experiences in both South Africa and internationally are drawn upon to make recommendations on improved approaches to the structuring and management of local government to ensure sustainable service delivery.

There is always a danger that in analysing the status quo one is seen to be criticising. In their book *Uprooting poverty*,[1] which was a very bold publication for the late 1980s, Wilson and Ramphele were at pains to explain that in order to develop strategies against poverty it was essential to know the nature of the problem in detail:

> *… this implies not only a factual description of what exists but also an analysis that illuminates as clearly as possible why it exists. The scandalous, particularity of the detail … can jolt people into an awareness that something must be done.*

They go on to say:

> *… facts are necessary as a foundation on which to build strategies for action …*

In line with parliament's 2007 theme of 'masijule ngengxoxo mzansi' (let's deepen the debate South Africa) it is hoped that in uncovering the challenges, *Numbers and needs in local government* will also play a pivotal role in reversing the losses in civil engineering capacity in South African local government.

The book is structured as follows:

PART I: INTRODUCTION

Scope

Chapter 1 – Background and purpose

Explains research experiences and the rationale for writing the book

PART II: PAST AND PRESENT – LESSONS LEARNT

Chapter 2 – Structures and capacity of the past

Describes the models of the past, including the systematic but top-town approaches, and discusses their advantages and limitations

Chapter 3 – Structures and capacity today

Describes the current structures and approaches to local government and outlines the benefits and weaknesses of various approaches. Staff shortages and levels of service are discussed

Chapter 4 – The consequences of reduced engineering capacity and expenditure

Describes the consequences of staff shortages and the impact of current policies on quality and long-term growth

PART III: THE FUTURE – IDEAS SHARED

Chapter 5 – Structures and capacity for the future

Suggests future civil engineering structures and modifications to policies to create a more enabling environment for service delivery

Headings are repeated in chapters 2, 3 and 5 by way of comparison, to capture the past, present and suggested hybrid solutions for the future. The broad section headings in these three chapters are as follows:

- Topology and population served
- Services provided
- The number of civil engineering staff
- Sources of funding
- Functions in engineering departments
- Structures
- Qualifications and experience
- Processes
- Governance and decision making
- Training

Chapter 6 – Thinking out of the box

Outlines many innovative ideas that can be adopted to address more efficient service delivery, local economic development and job creation

PART IV: CONCLUSIONS

Chapter 7 – Numbers and needs

Considers the actual number of civil engineering staff required to address the current service delivery challenge and suggests change management strategies to transform local government into long-term sustainable entities

Chapter 8 – The way forward

Is the rally cry for all to work together to create local government that will address its vision of service delivery for all

NOTE

1 Wilson, F and Ramphele, M 1989. *Uprooting poverty: the South African challenge*. Johannesburg and Cape Town: David Phillip.

CHAPTER 1

Background and purpose

1.1 INTRODUCTION

The idea for this book emerged as a result of three major interactions in local government, the first being a data collection exercise for the production of *Numbers and needs: addressing imbalances in the civil engineering profession*, published in October 2005, the second being the ENERGYS project, which commenced in early 2006, and the third being the analysis of South Africa's civil engineering infrastructure as published in *The SAICE infrastructure report card for South Africa: 2006*.

1.2 NUMBERS AND NEEDS

When collecting data for *Numbers and needs*, it was found that the sample collected in local government was inadequate to simply extrapolate the figures to the real world since so many of the municipalities contacted had no civil engineering staff. As a result a complete census was carried out in early 2005, which told a sad story.

Some 83 municipalities had no civil engineering staff, a further 45 had only one civil engineering professional and 43 employed only technicians or technologists under the age of 35, the majority of which were in fact under the age of 27! Research at the time indicated poor performance where structures were totally depleted.

1.3 ENERGYS

Other findings of *Numbers and needs* were the fact that there were many civil engineering students and graduates who could not gain experiential training opportunities and there were a large number of retired engineers with considerable experience who were available to serve local government and act as supervisors and coaches. Hence the idea of the ENERGYS programme was born, adopted by government and initiated in early 2006. The full project name, **Engineers Now to Ensure Rollout by Growing Young Skills (ENERGYS)** explains it all.

The project, in which senior engineers have been deployed to help accelerate service delivery and train young students and graduates in local government, exposed all involved to many challenges that must be addressed. It was felt that they should not go undocumented, but that the ideas developed should be shared to contribute towards reinventing local government.

Although many findings are quite alarming, this book should not seen as criticism, or knocking government, but rather as a book of hope that outlines the many turnaround strategies developed to help the municipalities in which the ENERGYS teams are deployed climb out of the situation in which they presently find themselves.

Based on the premise, 'if you can't see success you can't learn from it', past good practices, pockets of current good practice, the success of the ENERGYS programme and others are outlined to offer direction for the future.

1.4 THE INFRASTRUCTURE REPORT CARD

Based on the US and UK infrastructure report cards, which awarded an **A** to very good condition down to an **F**, for failed infrastructure, SAICE launched South Africa's own

infrastructure report card in November 2006. Ratings from **B** (good) to **E** (very poor) found that much of South Africa's infrastructure needed attention. The two areas identified as requiring the most urgent attention were maintenance and …

> *… the extreme shortage of skills and the terrible impact this has on planning, procurement, design, construction and care of infrastructure …*[1]

The many ideas shared in this book address these issues.

1.5 THE STATUS QUO

South Africa is not alone in its current predicament. Countries the world over have found themselves bogged down by bureaucracy, lack of skills, accountability performance challenges, and in financial difficulty, to the point where an assessment read as follows:

> *Our public schools are the worst in the developed world; our health care system is out of control; our courts and prisons are so overcrowded that convicted felons walk free; our cities succumb to mounting crime and poverty; and are handcuffed by staggering deficits and many of our proudest cities are virtually bankrupt.*

South Africa? Sounds familiar, but no, this was published in the 1993 best seller, *Reinventing government*,[2] which addressed the enormous challenges faced by the USA in the late 1980s and early 1990s, before brave new leaders decided to adopt different approaches to the delivery of services. There is no reason why South Africa cannot adopt their own bold turnaround strategies to reinvent local government.

The New South Africa was born slightly more than a decade ago. However, the transitional phase only ended in 2000. Hence the new structures and approaches are young and still in their installation stage. We are beating our chests about poor and slow service delivery. However, says Michael Armstrong:[3]

> *… change will always involve failure as well as success. The failures must be expected and learned from.*

He continues to say:

> *… the installation phase can also be painful. When planning change there is a tendency for people to think that it will be … going from a to b. It is not like that at all. Change is an iterative, cumulative and reformulation-in-use process.*

1.6 REINVENTING LOCAL GOVERNMENT

With such encouraging words we need to look critically at changes in approach where necessary.

There is a propensity to move directly from problems to solutions, without an analysis of what is actually occurring. The most obvious answers are more money when money is not the essence of the problem. As a result, money is used incorrectly for the many problems it cannot solve.

Clearly, a change in approach to service delivery is needed. In seeking to offer guidance, *Numbers and needs in local government* looks at:

- The skills and sources of finance that were used to develop infrastructure prior to 1994
- The change in emphasis in development, sources of funding and policies affecting skills usage since 1994
- The current challenges related to lack of leadership, skills and finance
- The business approach to delivering products and services
- Solutions to address bottlenecks and ensure sustainable development

The latter ideas have largely been contributed by the ENERYGYS seniors, who have workshopped their experiences and shared their views on several occasions.

The key solutions in their view, drawn up within a couple of months of deployment, were as follows (the most important being number 1):

1 Appoint the right person for the job (qualification, experience, etc)
2 Create an ENERYGYS corps to fire fight, help with change management and develop young professionals
3 Define correct structures/functions
4 Improve operations and maintenance (O&M)
5 Emphasise faster and firmer decision making at council level
6 Reduce interference/review powers and functions
7 Confirm acting posts and restore morale
8 Apply more energy to revenue generation and collection
9 Simplify/improve IDP and other processes
10 Implement a spend audit to ensure funds are being correctly utilised
11 Outsource more
12 Streamline supply chain management
13 Empower councillors in terms of infrastructure
14 Make better use of time
15 Review MIG criteria – one size does not fit all
16 Motivate for more money from Treasury
17 Ensure that national leadership demands and enforces performance
18 Relax complex legislation

The first item, the right person for the job, was way out in front when it came to the vote. Items 3 to 9 and 11 to 15 are symptomatic of local government being managed and operated by people with limited experience in the field. Spend audits and more funds from Treasury would possibly not be necessary if municipalities were operated on sound business principles.

The philosophy of developmental local government has been extended to offer those with limited experience the opportunity to develop skills whilst in positions beyond their level of expertise. This is costing the country dearly. Learning theorists confirm that concepts that are not intuitive cannot readily be learnt by trial and error, but require instruction.

The notion of an engineering corps with the experience to direct and attend to many strategic issues has not only been well received locally, but was suggested by Professor Steven Kelman of Harvard, when the capacity problems were outlined in a meeting with National Treasury.

His view was that South Africa should consider building civil servant technical teams to attend to the many areas that are increasingly being overlooked.

As several bottlenecks can be unblocked in the short term by harnessing the experience of senior engineers, there will be recommendations throughout the book on areas in

which such teams should be deployed. They should of course also be harnessed to build skills and fully capacitated departments over a number of years to achieve sustainable local government – but more about this later.

Numbers and needs in local government is a research tool of unequalled voracity in its extent, its closeness to the realities of municipalities, and its understanding of the practical issues of service delivery.

The proposed models are robust, practical and proven, and are probably the only way to achieve the service delivery and skills development that will ensure sustainability of the services delivered.

1.7 OUTCOMES

Implementing the many recommendations in this document will result in:

- Improved and populated structures
- Relevant job descriptions and duties
- Improved systems and procedures
- Quality workplace training
- More students graduating
- Enhanced attraction and retention of staff, hence improved capacity
- Significant transformation
- Appropriate governance including clearer lines of responsibility
- Understanding between politicians and officials
- Informed and motivated leadership and improved morale
- Firm, timeous and decisive decision making
- Improved income
- Accelerated infrastructure delivery and enhanced operations and maintenance

1.8 WHO SHOULD READ THIS BOOK?

The document is composed of findings and suggestions contained in many reports, hence the style is somewhat informal. Having become so extensive, it was decided to publish the material to give guidance to all in the sector. The findings and recommendations will be of value to management, human resource practitioners, educators, trainers, politicians, inexperienced and experienced civil engineering employees, as well as consultants and contractors working in the field.

In preparing such a book there is always the temptation to write a complete engineering text on each subject instead of simply giving background and experiences on which to base recommendations for the future. Apologies to non-technical readers, who feel that the book is too technical, and to technocrats who may consider many topics handled too simplistically! We trust that an adequate balance has been struck.

1.8.1 A special note to the press

This book is not intended to expose or embarrass, but to highlight the challenges and chart a way forward towards sustainable service delivery and local government. Many suggestions should be adopted as constructive input towards appointment and training regimes and policy development or amendments. Taking examples of the breakdown of service delivery out of context and sensationalising them would cause immeasurable harm to the South African Institution of Civil Engineering and indeed the general population as such publicity would alienate the audience who will most

benefit from the experiences and the findings, namely the policy makers. You are requested to phrase any press releases in the spirit in which this publication has been prepared, a constructive document aimed at contributing to the long-term wellbeing of the country.

1.9 RESEARCH INPUT

- Local government interviews, July 2004
- Local government civil engineering staff census, April 2005
- Yellow machine research, August 2006
- O&M needs, August 2006
- Artisans in local government research, September 2006
- Organogram research, October 2006
- Metro civil engineering capacity research, November 2006
- SAICE report card, November 2006
- Town planning research, December 2006
- Staff movements, April 2007
- International research on civil engineering numbers and functions in local government, August 2007
- P1 and P2 results, October 2007

1.10 REFERENCE DATASETS

Many datasets have been studied in the preparation of the document. National websites proved most useful. Thanks must go to those departments that made unpublished data available. Where up-to-date data was not available, backlogs, powers, functions, etc were gleaned from the Municipal Demarcation Board (MDB). (The demographic and service backlog data of the MDB is based on the 2001 census, and municipalities provided the balance of the information in the 2002–2005 MDB capacity assessments.) The maps presented are largely based on analysing MDB data with respect to service delivery challenges. Detailed data covers metros, local and district municipalities as a whole. There are however some 80 000 people residing in district management areas (DMAs), which generally cover game reserves or nature conservation areas. These have been excluded from the analysis.

Sources for all graphs and diagrams are acknowledged on the sides of the frames.

1.11 ORIGINAL RESEARCH

Where there are no acknowledgements, the data, figures and stories have been gathered from original research or input from the ENERGYS project. The success stories are particularly heart warming as they demonstrate that with the appropriate technical expertise service delivery and skills transfer are well within reach.

1.12 DESKTOP RESEARCH AND REFERENCES

In order to put the South African local government experience into context, a comprehensive desktop study was carried out. Quotes extracted from the various documents studied are shown in italics.

South Africa is not alone in grappling with many of the problems facing the sector. Much of the Western world has suffered reducing numbers entering the public sector and faces shortages because of an aging workforce nearing retirement and inadequate infrastructure, largely owing to inadequate O&M.

In researching innovative solutions it was found that the proceedings from annual IMESA conferences contained leading-edge ideas and reflected local and international best practice. This conference should thus be attended by all civil engineering professionals practising in and associated with local government.

NOTES

1 Amod, S 2006. *The SAICE infrastructure report card for South Africa: 2006*. Midrand: SAICE.

2 Osborne, O and Gaebler, T 1993. *Reinventing government: how the entrepreneurial spirit is transforming the public sector*. New York: Plume.

3 Armstrong, M 1984. *How to be an even better manager: a complete A–Z of proven techniques & essential skills*. London: Allen and Unwin.

PART II

PAST & PRESENT – LESSONS LEARNT

Contents

CHAPTER 2

Structures and capacity of the past

2.1 ORIGINS

Local government, as we see it today, is the cumulative result of years of change, upheaval and evolution. Essential to understanding its establishment is the municipality's unique role as a centre of trade and commerce.

Amid the agricultural world of medieval Europe, cities existed as alien bodies requiring extraordinary powers to protect the livelihoods of those who depended on manufacturing and commerce.[1]

Townspeople required freedom from trade barriers and tax burdens imposed by rural nobility. Trading required rules of conduct, standards of price and measure, and services, which necessitated structures different from the needs of communities who tilled the land and harvested crops.

Similarly, the major centres in South Africa developed for one of three main reasons:

- To serve major trade routes, initially ports and later rail and road routes
- To serve farming communities
- As a result of the discovery of minerals

In each instance, settlements grew and required the supply of fresh water (see Figure 2.1),[2] some form of sanitation disposal and the development of a good transport network to deliver products to the work force and industry, and to transport completed goods to markets elsewhere.

Initally in South Africa military engineers played a major role in protecting strategic bases, such as ports, and were involved in river control, reclamation and the provision of basic services for troops and suppliers. The expansion of services beyond the military domain gave rise to the term 'civil engineer'.

The first formal local government appeared in 1682,[3] some 30 years after Jan van Riebeeck had landed in the Cape of Good Hope, but these structures were confined to settlements in the Cape.

The Municipal Ordinance of 1838 saw a change from Dutch to English structures of local government.

Householders could elect commissioners to address law enforcement and service delivery (including lighting, roads, streets, water systems, other public works and fire fighting). These commissioners could also establish markets.

As such, local government was largely associated with the business interests of contributing

Figure 2.1 Water being sold by the bucket in Johannesburg, 1895

Source: *Johannesburg one hundred*

individuals or companies and the public sector, both local and international, which relied on well-serviced communities and infrastructure to support trade routes and the movement of goods to and from South Africa.

Engineers played a major role in shaping these municipalities since services were associated with hard-core engineering. Little attention was paid to the economic or social well-being of the working class.

Engineers were autocrats whose job it was to address the needs of the paying population. For instance, in the 1890s, the newly formed municipality of Johannesburg did not charge rates, but it did charge inhabitants for the removal of night soil.[4] The penalty for non-payment was imprisonment in view of the constant threat of epidemics.

Although Johannesburg only constructed its first networks and disposal works in the early 1900s, engineers in the other major centres had been busy. In Durban and Cape Town[5] the development of water-borne sewerage systems and outfalls commenced in the 1890s, followed by Bloemfontein, Pretoria and Pietermaritzburg.

Engineers were systematic problem solvers who ensured that services performed the functions required by the growing population. It must be remembered that the population was limited to those who were paying, which resulted in a large percentage of the South African population living in absolutely appalling conditions, as will be seen in 2.2.

2.2 TOPOLOGY AND POPULATION SERVED

Municipalities were discrete entities and reflected patterns of colonisation. With the passage of time, service and land distribution became increasingly skewed. This distribution was finally promulgated in the infamous Land Act, 1913 (Act 2 of 1913). In terms of the Act no Africans could purchase land outside the 'reserves' assigned to them.[6]

In 1921 Transvaal Province initiated the development of policy that was to later lead South Africa to the shocking model of dividing her people and causing pain and damage to black South Africans for almost a century. The final policy read:

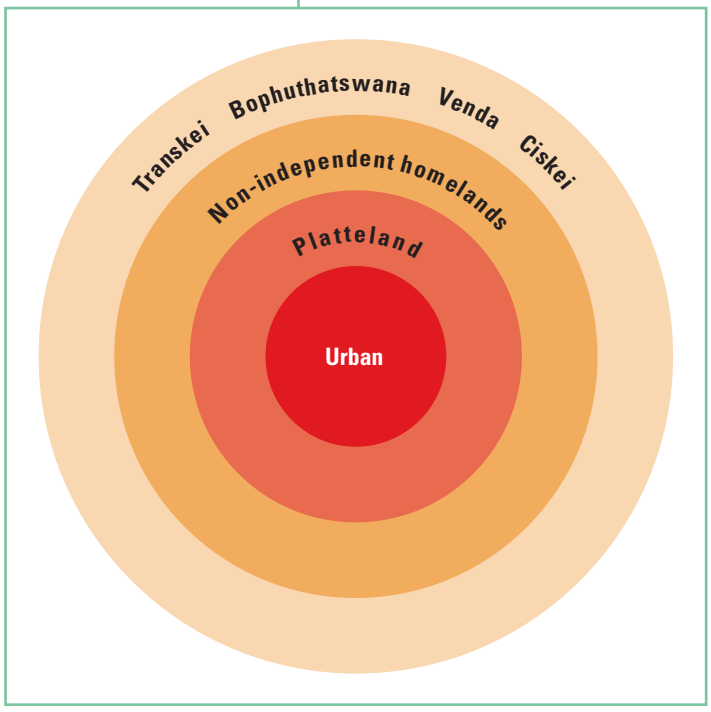
> *The native should only be allowed to enter the urban areas, which are essentially the white man's creation, when he is willing to enter and to minister to the needs of the white man and should depart therefrom when he ceases so to minister.*[7]

The Native Laws Amendment Act, 1937 (Act 34 of 1937), which was promulgated to control the flow of black people to towns, further entrenched the divide.

When the National Party came into power in 1948 government intensified its anti-urbanisation policy towards black people. By setting up independent states it sought to reverse this flow, allowing, in the words of Dr Verwoerd (1956),[8]

> *… natives who come to white areas … to serve.*

Figure 2.2 The South African 'landscape' until 1994



Source: *Uprooting poverty*

Thus the migrant labour system became well entrenched and along with it, deep divides in terms of the levels of service.

The development that took place varied according to the landscape represented by the series of concentric circles shown in Figure 2.2. Using the quaint terminology of the time, urban South Africa and the surrounding 'platteland' of commercial farms were under white ownership and control and lay at the centre. Urban services were of an excellent standard and developed by well-managed, capacitated and financed structures.

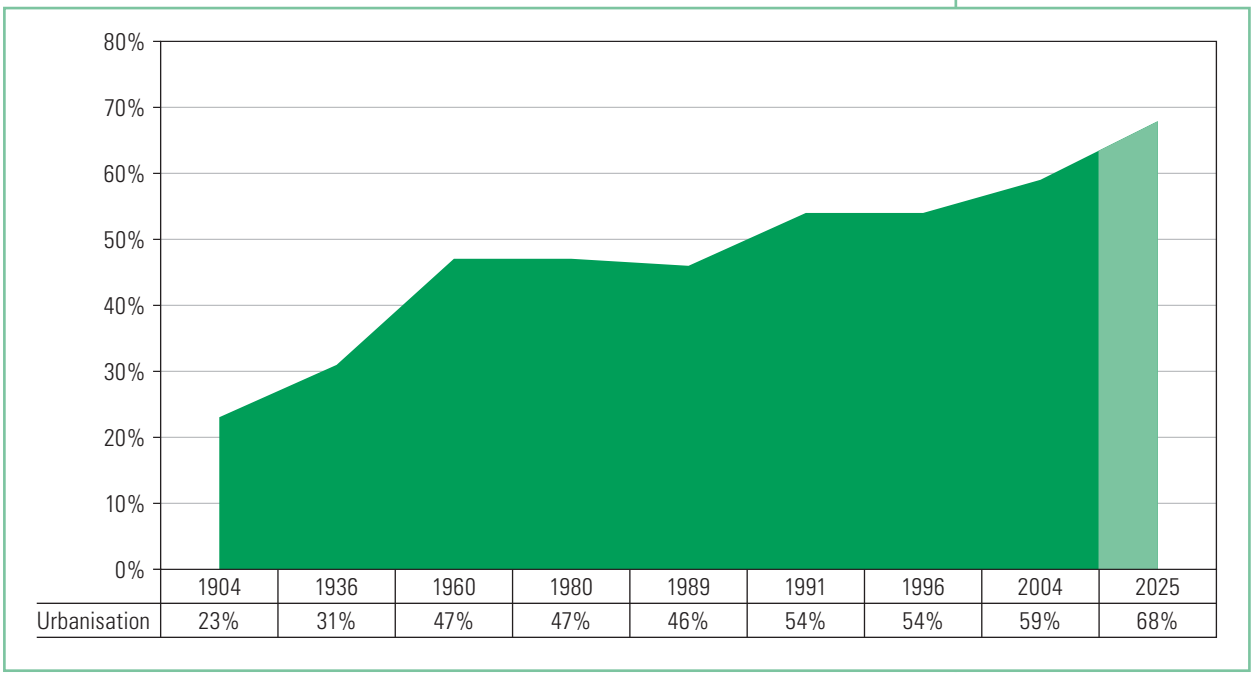
Beyond the urban centres and surrounding platteland lay the non-independent homelands of Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa and Qwaqwa which covered densely populated rural areas housing mostly indigent communities. These areas (also known as Bantustans) were the responsibility of provincial and national government and were serviced by various Development Boards and Councils.

Beyond the non-independent homelands lay densely populated rural areas that had been given independence and were not managed or developed by the South African government although they were heavily dependent on South Africa for 'foreign aid'. This was the case in Transkei, Bophuthatswana, Venda and Ciskei (known as the TBVC states). In most of these areas limited income and skills prevented their governments from undertaking mass development to offer formal housing, infrastructure and job opportunities.

Even some urban areas that were inhabited by Africans who provided the labour necessary to service the adjacent major centres were abandoned to the independent governments. The most significant of these areas were KwaMashu and Umlazi outside Durban, Mdantsane outside East London (which was incorporated into Ciskei) and Winterveld outside Pretoria (which was incorporated into Bophuthatswana).

The policy of reversing urbanisation resulted in some 3,5 million people suffering forced removal between 1960 and 1983. Hence the dip in urbanisation trends shown in Figure 2.3.[9, 10,11,12,13]

Figure 2.3 Urbanisation over 100 years



	1904	1936	1960	1980	1989	1991	1996	2004	2025
Urbanisation	23%	31%	47%	47%	46%	54%	54%	59%	68%

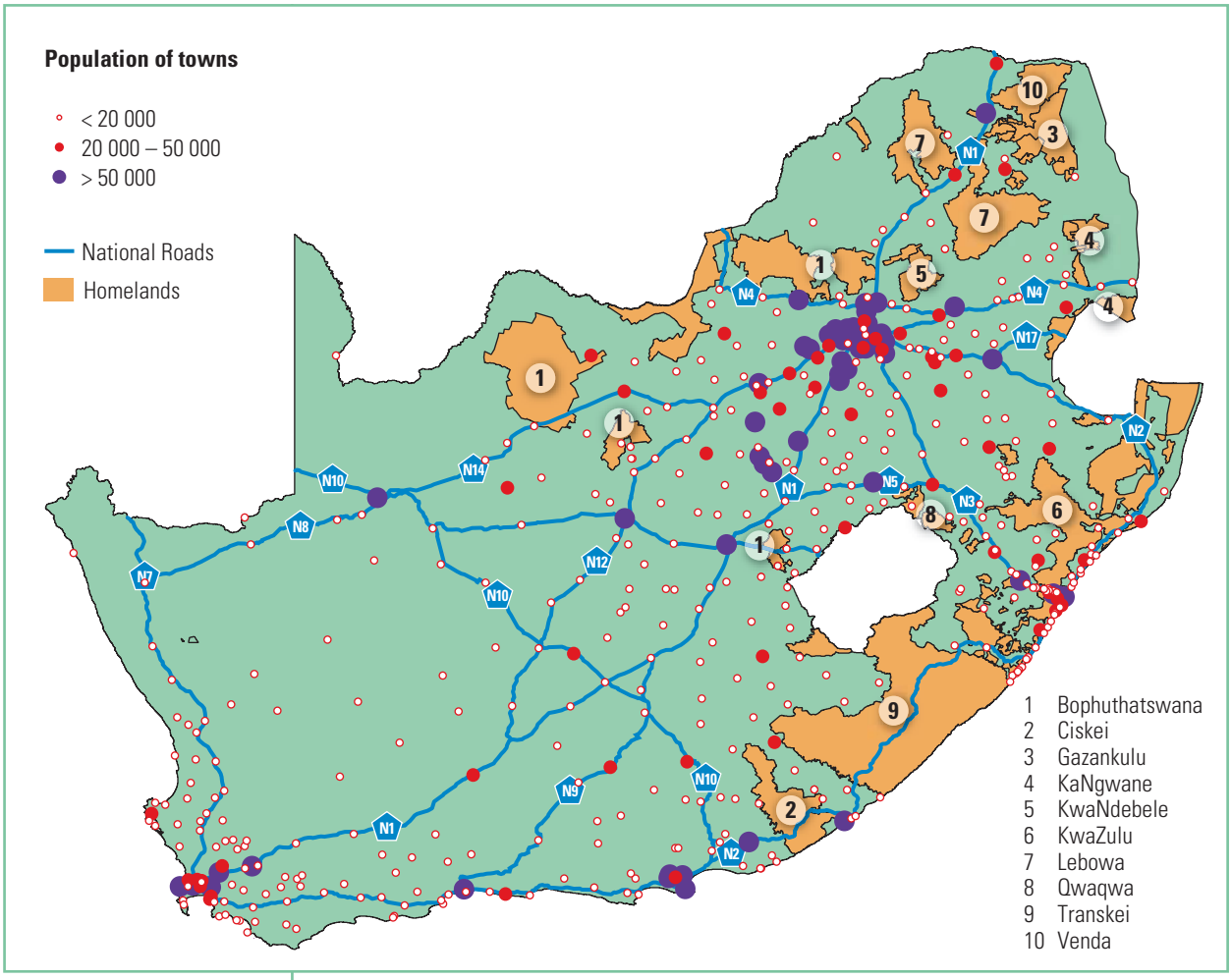


Figure 2.4 Developed towns and cities in South Africa, 1989

This represented a movement of 10% of the population at the time – an extraordinary effort that was to increase the deprivation and suffering of millions. Conditions in many areas were absolutely appalling. The lack of housing, sanitation and access to clean water resulted in high mortality rates, long hours spent collecting water and living conditions that were unbearable. This was in stark contrast to conditions in the formal urban environment of white-controlled South Africa.

The final number of municipalities prior to 1994 was 843. They were graded from 1 to 15, with one being the smallest, such as Flagstaff and Hoedspruit, and 15 being the largest, such as Johannesburg, Pretoria, Durban and Cape Town.

Grading was related to size, turnover and the level of services offered, with thirteen factors contributing to the formula, as follows:

- Certified revenue per financial year
- Number of stands
- Number of water meters
- Number of electricity meters
- Number of sewerage connections
- Roads

- Housing
- Water purification
- Sewage treatment
- Fire fighting
- Ambulance services
- Number of library books
- Number of trade licenses

The 843 municipalities were racially segregated and only some 250 were urban and platteland towns, represented by the central concentric circles shown in Figure 2.2. The balance were rural and district structures. The population in urban and platteland municipalities in 1989[14] was of the order of 4,5 million white, 5,7 million African, two million coloured and one million Indian people – which amounted to roughly 40% of the total population residing within the borders of present-day South Africa. (See Figure 2.4 for the distribution of developed towns and cities in this era.)

2.3 SERVICES PROVIDED

Efforts were concentrated largely on town and city dwellers, as well as on the development of infrastructure to support industry, tourism and other land uses that earned income for municipalities through a substantive rate and service base. As a result of the continuous flow of income, funds were available for ongoing operations and maintenance (O&M). (See Figure 2.5.)

Municipal engineers were responsible for the planning, design and delivery (including in many cases construction) of all municipal infrastructure. This included:

- Water supply
- Sanitation
- Roads, street lighting and stormwater drainage
- Solid waste disposal
- Electricity supply
- Community facilities and administration buildings

Engineers in provincial or national departments were responsible for infrastructure beyond the urban edge and in instances where:

- Roads or rail were through-routes or major arterials
- Airports served more than one local community
- Dams were required to serve populations in more than one municipality

Figure 2.5 The emphasis of service provision in local government until the early 1990s

Although the emphasis on servicing city dwellers rather than the suffering masses seems unforgivable, this chapter will be devoted to the capacity, processes and systems in place which achieved the high standard of infrastructure in the formal centres. Local government today is striving to offer improved levels of service to the entire population, and may in this regard learn from some of the approaches of the past.

2.4 THE NUMBER OF CIVIL ENGINEERING STAFF

As the population grew, so did the local government workforce. The number of civil engineers, technologists and technicians in the 250 or so urban municipalities prior to 1990 were significant, totalling some 2 500 to 3 000.

The small municipalities, grades 1 to 4 or thereabouts, generally only required an artisan to deal with their day-to-day operation and maintenance needs, hence the above workforce was found largely in municipalities of grade 5 and upwards, representing a total population of just over 13 million, that is, 21 or more engineers per 100 000 inhabitants.

The smaller municipalities were supported by very strong provincial sector departments, who were in turn supported by strong national engineering departments.

As an example, in its engineering heyday the national Department of Transport (DOT) employed some 150 engineers, and the provinces almost 300. Today the total number of engineers employed by the provinces is a little under 100 and the national DOT has only a few engineers, although the South African National Roads Agency Limited (SANRAL) has taken over much of the delivery function. Thus the total number of 450 engineers employed in developing road networks is now down to about 150, which is totally inadequate to support small municipalities and also deliver the 2010 and other major projects.

2.5 SOURCES OF FUNDING

As outlined in 2.3, those receiving services could afford to pay for them, that is, income was derived from rate paying clients who accepted the need to pay for dependable water and power supplies, sanitation and refuse removal, as well as other services that were of benefit to them. Municipalities were financially sound, which meant that when additional funding was required for major developments, it was easy to raise loans.

Accounting departments were generally managed by autocratic financial leaders who had no difficulty in implementing their credit control policies, which included prompt disconnection for non-payment. As a result, income was almost always derived from each service rendered. Furthermore, clients were sophisticated users in terms of on-site and off-site service responsibilities, so losses due to leaks, illegal connections, vandalism, etc were not as high as they are today. For instance, Durban's water losses were recorded as 14% in 1995. They shot up to 43% after creation of the metro.

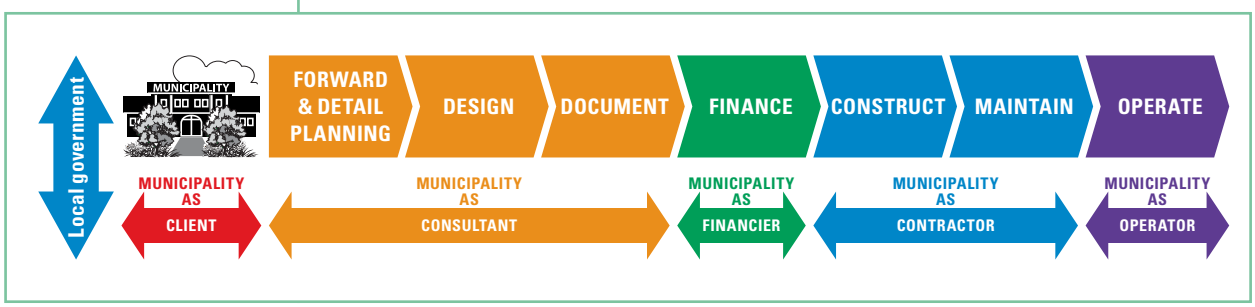


Figure 2.6 Functions performed in local government up to the late 1980s

2.6 FUNCTIONS IN ENGINEERING DEPARTMENTS

The complete civil engineering process, including planning, design, documentation, construction and O&M, was carried out by local authorities.

In effect, the engineering department was both client and service provider, offering consulting and contracting services for new projects, as well as O&M, while the local authority either provided finance or was able to raise its own funds through commercial loans. (See Figure 2.6.)

2.7 STRUCTURES

The engineering departments were staffed with engineers and technical assistants, and the execution was handled in a very structured manner with the hierarchy of superintendent, foreman, master artisan, artisan's assistant to general labourer being well understood.

Detailed organograms existed, outlining roles and responsibilities and lines of reporting. In large municipalities individual departments existed for each service. These were then split into capital and O&M. In smaller municipalities roles and responsibilities were combined and only one or two technical staff, trained in big municipalities, carried the management responsibilities, relying on provincial capacity and consulting engineers to assist with production phases. O&M however remained firmly rooted in the municipality.

2.8 QUALIFICATIONS AND EXPERIENCE

Qualifications and experience were very important in this era and municipalities were fertile training grounds for young professionals.

Large numbers of young engineers and technical assistants were managed through a rigorous workplace training programme that covered the entire project cycle.

Technical assistants were notionally equivalent to the technicians of today, but may have started work in municipalities or other public sector departments as matriculants. They were generally appointed as learner draughtsmen or performed office functions in technical departments.

Having shown promise, they were encouraged to further their studies. They progressed to senior levels through a combination of ongoing studies (in many cases, attending technical college at night for a number of years) and experience under the guidance of experienced engineers who took them through structured workplace training. Technical assistants could progress to the status of senior technical assistant, such personnel forming the backbone of service departments.

The focus of training for technical assistants was in O&M. Having been trained to follow procedures and being practical people they had a lot to offer in terms of smooth operations and ongoing maintenance. They were also invaluable for offering practical input to planners and designers.

Young engineers, on the other hand, had generally completed their tertiary studies before joining municipalities and were involved in many activities that covered a broad range of services. When the engineer developed a preference for a service he or she would settle in that division and work up the ladder to eventually become the leader of the division and perhaps the town or city engineer.

Engineers, though initially exposed to O&M in their training, were mainly involved in planning, design, finance and management, being promoted as their experience allowed them to become increasingly strategic. Their broad but detailed theoretical training allowed them to cope with the many 'what-if' scenarios facing engineering departments.

Table 2.1 Experience and responsibilities of civil engineering staff until the late 1980s

Function and years of experience	Planning and vision	Budget and finance	Design	Construction	Operations and maintenance
Engineer > 15 years	Strategic or long term	Strategic decisions	Strategic decisions on design solutions	High-level trouble shooting	Strategic input
Engineer 11–15 years	Gave input into long-term issues	Set budgets and maintained financial limits; balanced the books	Specialist designer who would also check major projects done by consultants	Oversight of major projects	Ensured long-term sustainable and viable service while considering consumer needs
Engineer 6–10 years	Medium-term planning, setting policy, plus setting and maintaining by-laws	Input into budget from planning process; involved in O&M budgets	Independent designer but work signed off by senior	Project and construction management; authorised payments, signed off, etc	Established operational requirements and procedures; set policies and guidelines
Engineer 0–5 years	Did field investigations to give input into planning process	No influence on setting budget; controlled expenditure within set parameters	Designed under supervision	Carried out site inspections	Involved in day-to-day problem solving and might control O&M teams
Technical assistant > 15 years	Gave input into strategic decisions	Assisted with budget preparation	Independent designer – work signed off by senior Could guide junior designers	Managed major projects	Oversight of O&M
Technical assistant 11–15 years	Valuable input from practical O&M experience – could often advise without doing detailed analysis	Gave input into budgets and might control individual project budgets	Competent designer in chosen field – work signed off by senior	Project and construction management; recommended payments or signed off small projects	Managed an O&M section
Technical assistant 6–10 years	Gathered information from old reports and site work	Worked within constraints of a budget	Could undertake most designs	Managed small projects under supervision	Became proficient in O&M processes
Technical assistant < 5 years	Limited involvement; followed exact instructions	Got permission for any expenditure	Basic design work; did field work to input into designs; prepared production drawings	Carried out site inspections; worked under supervision	Worked in O&M teams

Career paths are shown in Table 2.1. Each promotion was linked to increased experience rather than a new qualification, and young engineering staff worked hard to progress.

Where specialist knowledge was required, young engineers were encouraged or even sponsored to further their studies to MSc or PhD level. Until the mid 1980s, transport engineers in Johannesburg held international post-graduate qualifications.

Interestingly, in the 1950s a young civil engineering graduate from UCT was instrumental in transforming interchange design worldwide. As a budding engineer in Belville Municipality he was encouraged to read for a PhD at Texas A&M, recognised as a leading institution in transportation, even back then. A precursor to the Hell's Angels, this high-speed motorbike-mad young man had become frustrated with the traffic jams he experienced on the first motorway interchanges constructed in Cape Town, which were based on technology of the 1930s. So, he took up the challenge and applied his mind to improving access and egress. His final solution was simple: bring everybody up to the same speed at the point of access and egress by lengthening the ramps to allow for the required amount of acceleration. The design of all new interchanges from then on included longer ramps, which vastly improved traffic flow.

In smaller municipalities there would not be the range of staff at all levels of experience. Instead, one or two engineers and one or two technical assistants would attend to each of the functions outlined. For very big projects, designs would be outsourced, but would be scrutinised and approved by municipal engineering staff.

This section would not be complete without examining the role of the city engineer.

2.8.1 The city engineer

The city or town engineer of the past was 'god'. He controlled huge assets and infrastructure budgets, and made both short-term and long-term decisions about the development of bulk and end user infrastructure. He was responsible for town planning, building control, architecture, land survey and all civil engineering infrastructure.

To attain the position of city or town engineer required that the incumbent was sufficiently:

- Technically qualified to be able to address all types of service (for example water, sanitation, transportation, roads and stormwater drainage), which meant that he needed to be an engineer
- Experienced as he needed to have worked in, and understood all the activities outlined above, and
- Qualified in terms of finance and management to lead large and complex organisations

The city or town engineer was thus a highly qualified, highly experienced and highly astute person who carried out the duties required of him by the rate payers and government of the day.

Engineers today are no less willing to satisfy the needs of their public and address current government goals, but have largely been removed from centre stage, causing a vacuum which will be explored in Chapter 3.

Major South African cities developed under this regime during the 20th century and have become centres of growth, urbanisation and tourism. Figure 2.7 on p 55 shows the training patterns and extended period of experience gained by each of the city engineers of Johannesburg in the 100 years from the beginnings of the city in 1886 to its centenary celebration in 1986. Whilst little is known about the early city engineers those in place from 1905 had 20 to 30 years' experience before assuming the role and each served

On sustainability

When we build, let it not be for present use alone. Let it be such work as our descendants will thank us for

John Ruskin (1819–1900)
English philosopher

the municipality for many years. The much experienced, long-serving city engineers of Johannesburg were typical of this era. The pattern was no different in Pretoria, Durban, Port Elizabeth and Cape Town and many other smaller centres.

The foresight of these city engineers gave us the major ring roads developed around Cape Town, Durban and Johannesburg in the 1960s, without which these cities would not have developed to their current size and prosperity. The ring roads of Pretoria and Port Elizabeth followed in the 1970s. This type of long-term strategic thinking is essential for the long-term prosperity of any business or town.

It has been said, 'Cities are forever.' A long-term view on the provision of infrastructure, including its impact on the environment, acceptability to its users, financial viability and sustainability are fundamental to its efficient management, operation and maintenance (see inset below).

Is there perhaps a way to encourage taking the long view now to ensure that the decisions we make are for the good of all, for an exceptionally long time? Nations that still have a tradition of respect for elders may have an advantage. We often think of elders as

The Clock of the Long Now

In a world where everything moves faster and faster – and will continue to do so – how do we think, and what do we do, about the things that move very slowly, and need to be able to keep doing so?

The Clock of the Long Now, which chimes only once a millennium, was launched at the turn of the millennium to remind mankind to take a long view.

Most of our human intelligence is caught up with assimilating, applying and making sense of the things that move fast and change constantly. It seems that we no longer think about things that change over decades, centuries or millennia.

In his book *The clock of the long now – time and responsibility* Stewart Brand proposes six levels in the working structure of a healthy and sustainable civilisation. Based on an operational hierarchy, these layers are of different pace and size. From fast to slow, the levels are:

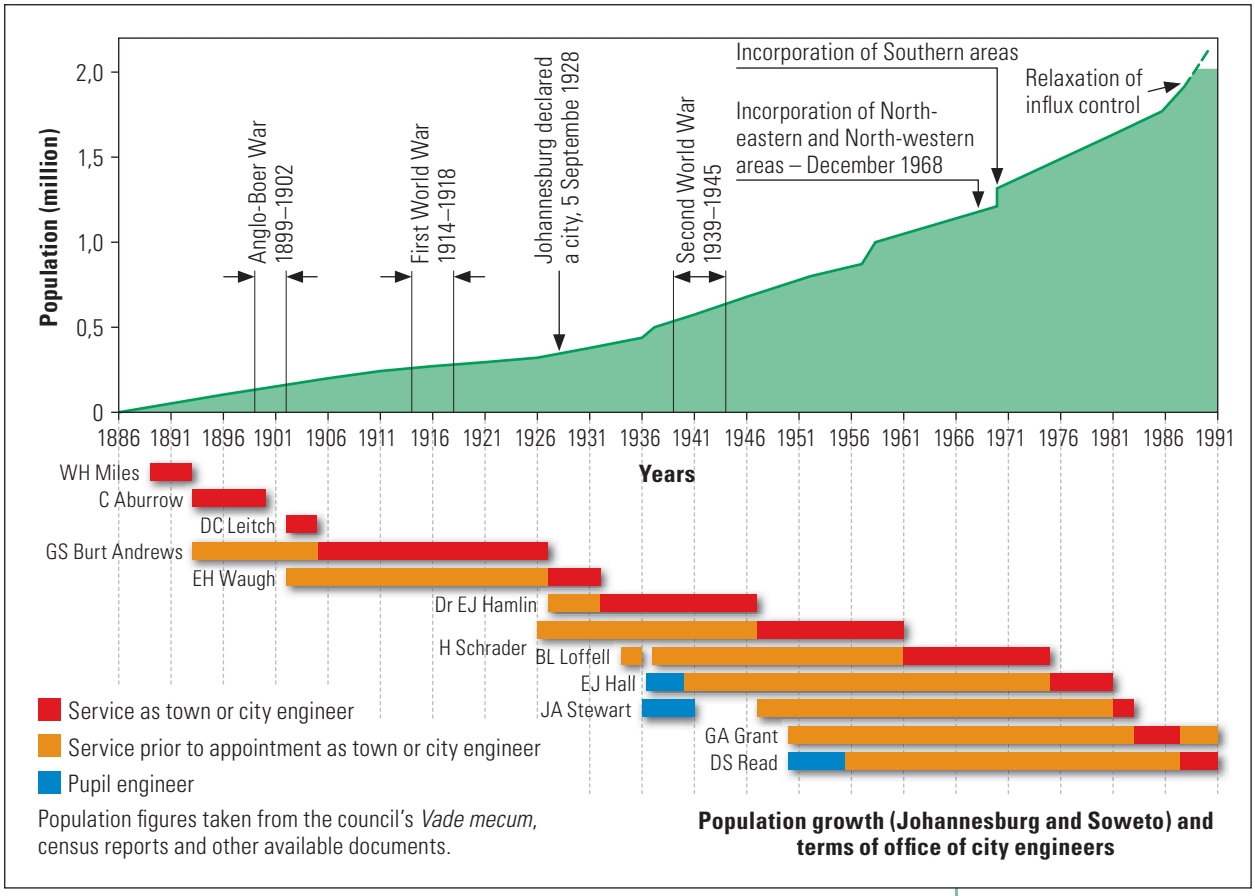
- Fashion and art
- Commerce
- Infrastructure
- Governance
- Culture
- Nature

Each layer needs to be able to operate at its own intrinsic pace. The slow, powerful levels sustain a society, while the lively levels encourage flexibility and adaptability. Nature overlaid with culture forms the resilient bedrock, enabling fashion and art to freely engage with the fast and exciting. The deep, stable levels should change so slowly that generations live and die without perceiving any permutations. However, climate change, degradation of ecosystems and accelerated extinction of species are all causing such great changes to nature that the current generation and certainly future generations are unlikely to escape the consequences.

Every day we are making faster and faster decisions, taking quicker and quicker action in the context of a shorter and shorter view. Development-driven South Africans would do well to pause and think about the next generations. Daily, our political, business and social leaders make decisions that will have an enduring impact on our environment, our natural resources, our culture and our society.

It might seem radical to suggest such an extraordinarily long view when the need to improve the basic quality of life is so urgent. But if we do not, the danger is that we shall grab the most immediate, short-term gains available and bestow a depleted, damaged legacy on future generations of South Africans.

Source: Brand S 1999. *The clock of the long now – time and responsibility* [online]. Available at <http://en.wikipedia.org/wiki/The_clock_of_the_long_now> [accessed 3 October 2007].



Source: *Watershed town*

Figure 2.7 Experience and service history of Johannesburg's city engineers

being doggedly conservative (and that's often true), but they also have the long view – they think in multi-generation terms and can help make hard and important decisions from that perspective.

The experienced seniors, once revered, not only have more detailed practical experience, but also have lived through the changes of two or three generations and can offer the long-term and mature view. This is an area where the ENERGYS resource can be harnessed most effectively.

2.9 PROCESSES

The processes in place were well understood and hardly changed over time. Important processes relating to infrastructure are discussed below in 2.9.1 to 2.9.10.

2.9.1 Planning

Planning was multi-faceted. It comprised detailed planning per project including feasibility studies, but more importantly forward planning and master planning were key municipal activities.

Integrating infrastructure planning in a holistic fashion that considered all facets of the municipal environment was cardinal. Service delivery could not move ahead without input and interaction on commercial, social and town planning issues. Often it was the city engineer who took the lead.

Durban Corporation bulk infrastructure developments in the 1960s and 1970s

To support sustained growth, the Durban City Engineer's Department planned and constructed much of the infrastructure backbone of Durban today, in the 1960s and early 1970s.

Photographs supplied by the eThekwini Metro

Pipeline suspension bridge over the Umgeni river (1961)

New intake tower for the third aquaduct – Nagle dam (1964)

KwaMashu sewage disposal works (1965)

Williams Road on-ramp to southern freeway (1970)

(a) Forward planning

Forward planning was generally handled by the 'city fathers'. They would consider future business and community needs, possible catalysts for growth and the appropriate infrastructure development and service levels needed to achieve these goals.

The development of bulk infrastructure was initiated to support long-term growth. (See Figures 2.11 to 2.13.)

Feasibilities were circulated to all departments. Each had the appropriate level of skills to conceptualise service requirements, comment on, or contribute to proposed developments.

(b) Master plans

Master plans were key documents that contained details of all existing services and their capacities, as well as details of communities serviced. The demands of the forward plans were captured on the master plans. If any services were considered to be inadequate to support future development, plans were drawn up to accommodate the required expansions.

One of the most remarkable sets of 'city fathers' were those serving Durban City in the 1950s. These noble gentlemen decided that they should increase their income from sources other than rate payers in a bid to ensure that Durban was a debtless city. They set about making very astute investments which would increase their income in the future. The resultant financial health of the municipality has allowed it to aggressively tackle the supply of basic infrastructure in recent times without the need to raise loans – an excellent example of the benefits of long-term thinking.

2.9.2 Budgeting

(a) Capital development

Growth was achieved through raising long-term loans. Each department prepared its own budgets. The total budget comprised operating, capital, interest and staff costs. Service departments would determine their own infrastructure growth costs, calculate the new tariffs required to balance the books and submit these figures to the finance department.

Those departments that did not earn service fees (for example roads), would also submit their operating, capital, interest and staff costs to the finance department who would then calculate the appropriate rates to be charged to balance the books.

(b) Operations and maintenance

Motivations to increase operation and maintenance budgets were common practice to accommodate increased demand due to, for instance, new areas or new treatment works being commissioned.

(c) Emergency repairs

The treasury department (now referred to as the finance directorate) ensured that major breakdowns were accommodated through the creation of a repairs fund for emergency repairs.

As it is not possible to foresee the failure of a major transformer, the damage that a lightning strike or storm can cause, or the bursting of a high-pressure water main, contingency plans are essential. The engineer had the authority to set funds aside each year to allow for such eventualities.

Thus departments were generally able to access the funds they required to handle development and O&M although there has always been pressure on budgets owing to competing priorities. In the 1930s, a levy was introduced in Johannesburg to deal with road development, as follows:

> *It is gratifying to be able to report that steady progress has been made with the construction of suburban roads, due mainly to the continuance of the 1 d special rate, the proceeds of which are applied wholly to road construction, with the exception of a small amount devoted to street improvements. This system producing as it does a settled annual income for road construction, has proved to be an enormous benefit as it permits a steady progressive policy in this important work. Prior to the introduction of this system, votes of varying amounts were passed at irregular intervals, and it was not therefore possible to organise properly for the supply of either labour, materials, transport or plant, but present conditions have entirely overcome these difficulties.*[15]

2.9.3 Approving building, town planning and development plans

Town planning[16] was devoted to the built and social environments of municipalities and communities and encompassed economic development planning, community development planning and environmental planning to achieve sustainable cities.

In an article written in 1998, Stephen Wheeler[17] suggests the following definition for sustainable urban development:

> *… development that improves the long-term social and ecological health of cities and towns.*

He goes on to suggest a framework that may help all to better understand what a 'sustainable' city might look like. Features of his framework include compact and efficient land use, less automobile use yet better access, efficient resource use with less pollution and waste, the restoration of natural systems, good housing and living environments, a healthy social ecology, sustainable economics, community participation and involvement, and preservation of local culture and wisdom.

Town planning schemes were the order of the day and defined land uses, development zones, densities, height restrictions, etc to control development and ensure the desired town and city topology, including segregation, which was policy at the time.

Town planning controls and the approval process of building and development plans were well established, to the frustration of individual developers but for the benefit

Figure 2.8 Draughtsmen possessed a treasure trove of institutional knowledge

of the municipality as a whole. Land use and town planning criteria had to be satisfied, and building standards were jealously guarded by the many well-trained building inspectors.

The public knew that they could only see inspectors from 07:30 to 08:30 in the morning. Thereafter they were in the field, checking foundation excavations before concreting, ensuring that brickwork and waterproofing were to specification and standards, such as building densities, building lines, pipe and manhole sizes, and height restrictions, as depicted on the building plans, were adhered to.

Contractors were obliged to pay pavement or sidewalk deposits to cover any damage they may cause to municipal property.

Development thus took place in a controlled manner.

2.9.4 Drawings, designs, records and reference material

Cabinets contained neatly filed and well-indexed drawings. There were libraries of standard details from drains and pipe laying cross-sections to retaining walls and road signs. Tried and tested solutions were built into the culture of the organisation for all to use.

Whilst detailed designs had to be carried out from scratch for each project since parameters would vary, the final solutions all had the look and feel of the particular municipality and the quality of the solution could be relied upon.

Extensive drawing offices and, more recently, CAD and GIS offices existed, with most municipalities of grade 6 and higher having set up geographical information systems (GIS) by the mid-1990s. These systems were invaluable for both planning and O&M since the graphical model was linked with component data, for example pipe material, diameter, supplier, age and level, to give the complete picture of the asset.

Tracers and draughtsmen were valuable members of the technical team and produced working drawings for every project. The engineer explained his requirements to these team members, who would faithfully produce the final drawings. In this way the production team was a knowledge centre for the organisation and could answer queries on infrastructure anywhere in the town or city. Figure 2.8 shows a typical draughtsman of the era, always in the office and available to resolve queries.

Librarians were other key role players in the system. They ensured that the latest codes and standards were always available, and that reports, minutes and in-house standards were recorded and made available for reference by all. Even structures as small as grade 4 had a librarian.

2.9.5 Project management and quality control

Project management, that is, the management of construction projects, was handled by the line department which initiated the project. As already outlined there were numerous sources of funding for capital projects. Line departments, having decided on the scope of the project, would determine the appropriate type of funding to access and would be responsible for motivating for the funding, managing the project from beginning to end and for repayment, where appropriate, of the capital amount.

In-house staff plus, more recently, consulting engineers would handle the actual project management function, each reporting to the line manager responsible. Quality control was fiercely enforced, with material testing, alignment surveys and many other checks being carried out to ensure that developments were within specification. Quantities were measured monthly to verify contractor claims.

2.9.6 Housing

The responsibility for low-cost housing varied from town to town. Generally, government (through various development boards and the Department of Community Development) funded low-cost housing and the development of appropriate bulk services. Townships were developed outside urban areas to enforce the segregation that was policy prior to 1994.

Independent consultants were employed to manage the design and construction of these areas and dedicated staff were employed to run the new township developments.

Source: *Watershed town*

Figure 2.9 Housing development in Soweto in the 1950s

Only where the new areas tapped into existing municipal bulk infrastructure, or where they were within existing city boundaries, were municipal engineering departments involved in the planning, design or at times site supervision under contract to the funding department. In these cases services were supplied by the established local authorities with government paying the municipality for the service. Therefore, once again the municipality was not out of pocket in terms of delivering services to low-income communities. Figure 2.9 shows a housing development in Soweto which was funded by national government and the mining industry, among others.

There was also considerable development of subsidised housing for coloured and Indian communities, which was funded by the House of Representatives and the House of Delegates, respectively.

Housing in the TBVC states was handled by each of the states. In some of these states, limited housing development took place; hence the huge backlogs in formal serviced housing that exist today.

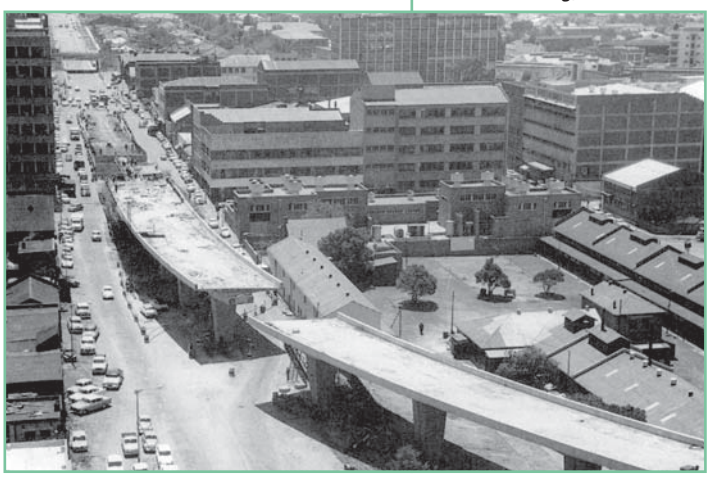
2.9.7 Construction

Most of the large municipalities had major construction teams who carried out the development. They were well equipped and resourced and provided a valuable training ground for artisans, technicians and engineers alike.

Having built most of the infrastructure, there was detailed departmental knowledge of each service, and the related O&M requirements.

Most of the major motorways built in the 1960s and 1970s, such as shown in Figure 2.10, were built by in-house construction units.

Figure 2.10 Construction of the motorways around Johannesburg, 1962–1970



Source: *Watershed town*

2.9.8 Operations and maintenance

(a) Maintenance of infrastructure

To maximise the life of infrastructure, three levels of maintenance were in place, namely planned upgrades, routine maintenance and response to breakages or failures (see below).

(i) Planned upgrades

Capacity upgrades of roads, networks or treatment plants were planned to ensure that infrastructure was not damaged by exceeding design capacity.

(ii) Routine or preventative maintenance

Assets were assessed annually and corrective action was planned to restore infrastructure to tip-top condition and prevent failure. Maintenance activities were scheduled and carried out on a regular basis.

(iii) Emergencies – response to breakages or failures

In instances where water pipes burst or sewers became blocked, where roads, buildings and community facilities suffered storm damage, where fires occurred or power failed, in-house maintenance teams would attend to the failures within defined response times.

Stores carried the necessary spares and elaborate job card systems were in place to ensure that stores remained stocked and depots were running smoothly.

(b) Operations and maintenance processes

O&M processes were strict and comprehensive. Some of the many activities carried out are detailed below.

(i) Buildings

Handymen moved around municipalities, tool boxes in hand, repairing loose hinges, ill-fitting windows, cracked or broken window panes, leaking toilets and taps in order to prevent major damage, such as windows or doors flying off hinges, carpets or tiles lifting due to the damp, etc.

Job card records, costing and analysis and links to the GIS provided invaluable information for future budgeting.

(ii) Treatment works and reservoirs

The business of ensuring quality at the various treatment works was 24/7 (24 hours a day, 7 days a week). There were three shifts a day and operators were trained to take readings regularly. Laboratories were well equipped, samples were analysed and remedial actions were taken where necessary by senior technicians who visited regularly, or who were called when the operator realised that results were outside the prescribed range.

Reservoirs were emptied, inspected for cracks and cleaned every two or three years.

(iii) Distribution networks

Maintenance superintendents knew their networks like the backs of their hands!

Sewer lines were dragged on an annual basis to prevent blockages. In flat areas lines were dragged more often.

Stormwater drains were inspected and cleared on a regular basis and action was taken against consumers who dumped foreign objects in both sewer pipes and stormwater drains.

Figure 2.11 Wemmershoek dam, completed in 1956, was constructed by the City of Cape Town. It was the last dam the city built before the Department of Water Affairs and Forestry assumed responsibility for developing South Africa's dams

Dr Kevin Wall

In water networks, pumps and valves were tested and glands were repacked. Illegal service connections were unheard of and all connections were paid for.

Pipes that had served their term were replaced as and when required. Preventative maintenance in order to pre-empt failure was the order of the day.

Dedicated teams worked on a fixed rotation basis attending to the range of maintenance programmes essential for ongoing provision of service.

(iv) Fire network

Hydrants, valves and pressures were regularly checked and where necessary were attended to, to ensure that the much needed water was available in times of emergency.

Hydrants that had been covered were exposed and hydrant numbers and locations were painted on the nearest street poles.

(v) Road maintenance

Attending to potholes and crocodile cracks, and repainting road markings were all on the annual schedule of activities determined during regular assessment of the road condition. Roads were assessed and upgraded as required. This included resealing or regravelling.

Explains George Grant, City Engineer of Johannesburg from 1984 to 1988:

> *There was an elaborate system in place to report on potholes and trench subsidences with input from bus drivers, traffic cops, members of the public, ward councillors, our departmental staff and the large contingent of district inspectors.*

Stormwater maintenance was ongoing in terms of keeping kerb inlets and drains clear. Sidewalk inspectors ensured that overgrowth and illegally hoarded building materials were removed, to ensure safe passage for pedestrians.

(vi) Solid waste

Collections took place twice a week with staff entering each rate payer's yard to collect the garbage. Over time rate payers were asked to place their bags or bins in the streets to reduce the number of staff required. To achieve further savings, collections were later reduced to once a week.

The landfill site, being essentially a major earthworks and drainage exercise, was the responsibility of the city engineer's department.

2.9.9 Purchases

The buying department was responsible for purchasing goods for the municipality as a whole. Service departments would pay the buying department a small fee to handle the purchasing of consumables, such as chemicals and bitumen, as well as fixed assets, such as computers, desks and tools.

Development projects were however handled very differently. The complete project specification, bill of materials and tender document

Dr Kevin Wall

Figure 2.12 Constructing a two-metre deep box culvert stormwater drain under Mitchells Plain to allow for its long-term development, 1979

were developed by the specific service department. Tenders were issued, adjudicated and awarded by technical staff and once awarded, an in-house technician, or a resident engineer from a consulting firm would monitor progress, verify quantities and sign off monthly payment certificates.

2.9.10 The general climate

Until the late 1980s, most of the processes outlined were controlled by comprehensive paper systems. Forms had to be completed, standards needed to be honoured, and criteria of compliance were well understood and adhered to by all involved.

Systems were in place. All knew what was expected of them and did not dare step out of line for fear of the consequences. However, all knew where they stood and were happy to be part of the system. The braai was part of the institutional culture, and regular get-togethers ensured that all were committed to working together and delivering the high quality service that was expected of a municipality.

Ambitious staff worked extremely hard in order to make their way up the hierarchy.

There were few courses or workshops, as knowledge and processes were handed down from those in place to those coming into the rigidly structured system.

By the end of the 1980s the personal computer was being adopted. CAD and GIS systems were becoming common place and building, pavement, bridge and stormwater management systems were emerging. These required a higher level of operator than those who had been trained to fill in forms. These new form filling 'geeks' were intent on getting the most out of their systems and used them to drive performance.

By 1990 building inspectorates were developing IT systems to shorten their approval times from two or three weeks to a maximum of three to five days.

Animated discussions on these short turnaround times took place at their conference in Johannesburg, with several municipalities claiming to guarantee their public the much dreamt of one week turnaround.

2.10 GOVERNANCE AND DECISION MAKING

The term 'governance' derives from a Latin word that suggests the notion of 'steering'.[18] This sense of 'steering' a group or society can be contrasted with the traditional 'top-down' approach of governments which involves 'driving' society, or the distinction between 'power to' in contrast with 'power over'.

Governance refers to the leadership processes that make decisions, define expectations, grant powers, and verify performance.

The World Bank defines governance as:

> *… the exercise of political authority and the use of institutional resources to manage society's problems and affairs.*

The worldwide governance indicators measure six components of good governance.[19] They are:

- Voice and accountability – measuring political, civil and human rights
- Political stability and absence of violence – measuring the likelihood of threats of violence, including terrorism
- Government effectiveness
- Regulatory quality

- Rule of law
- Control of corruption

In terms of the above indicators, there were many weaknesses in the government of the day. They had power over the country. With the masses not having a voice, instability and violence were a threat. However, strict law enforcement controlled not only political activism, but ensured that activities were carried out to the letter.

Municipalities exhibited similar characteristics, adopting the top-down paternalistic approach, where decision making was in the hands of a select few.

Source: *Watershed town*

Figure 2.13 Construction of arch bridges to support the new Diepsloot sewer – a massive development in the 1970s to accommodate long-term residential expansion in the northern suburbs

2.10.1 Council

Municipalities have always had a council of some sort and production staff, known as officials. In the early days, councillors were volunteers from the public and represented their community's interests. Later, councillors were politically elected per ward, though many stood as independent candidates or represented the rate payers association in the area.

The mayor, the deputy mayor, speaker and chairmen of standing committees were selected by the council who voted on these appointments at the first council meeting of the new term. Generally, councillors were businessmen and women, whose business acumen and leadership were the qualities that won them a seat. The final selection of the mayor was usually based on his or her achievements in the private sector.

In effect, councils in this era performed functions similar to those of the advisory groups or boards composed of non-executive directors, or tertiary institution councils composed of eminent persons offering strategic direction for token remuneration, but who do not get involved in day-to-day operating decisions.

The council generally acted in a paternalistic manner, making decisions 'for the good' of communities without actually consulting with those communities, although some input and oversight was offered by rate payers associations.

2.10.2 Expertise

(a) Councillors

As mentioned earlier, councillors were generally business people who were familiar with negotiating and decision making.

(b) Officials

The town clerk was the most senior official, supported by the treasurer, city engineer and city electrical engineer. In the town clerk's absence the city engineer would act on his behalf.

All these positions were filled by experienced, qualified staff. Even in the smallest of rural towns top management had worked their way through the ranks in local government before being appointed to top positions.

In instances where services did not require a qualified engineer to manage infrastructure, it was the seasoned artisan who performed this role, having worked his way up from

apprenticeship to being a foreman and then supervisor, usually in a larger municipality, to ultimately becoming the technical manager in a small town.

The various professional institutes of town clerks, treasurers, and civil and electrical engineers (ITC, ITT, IMESA and AMEU) applied strict membership criteria that related to qualifications and experience.

An engineering degree, professional registration with the South African Council of Professional Engineers (SACPE) (the forerunner of the Engineering Council of South Africa, ECSA), as a PrEng and 20 years' experience were considered the minimum requirement for one to assume the role of town or city engineer in all municipalities of grade 6 and higher.

2.10.3 Legislation

Although legislation covered land use, separate development, safety, health, water, environmental control and financial procedures, few Acts actually impacted on individual project delivery, operations or maintenance.

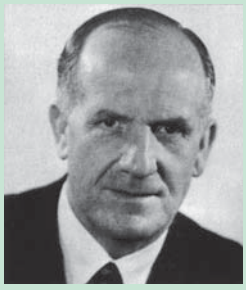
Whilst there was limited national top-down control, there were strong legal departments in municipalities and these compiled and enforced sound by-laws based on provincial and national legislation and their own need to enforce good citizenship.

2.10.4 Duration of appointment

This was the era of staff being appointed as permanent employees, and many municipal staff remained in the municipal environment, if not in one municipality, their entire working careers. Mr G S Burt Andrews and Dr E J Hamlin (see inset) were such long-serving staff.[20]

Long-serving town and city engineers in Johannesburg

Mr G S Burt Andrews



Dr E J Hamlin

Between them, Mr G S Burt Andrews (town engineer) and Dr E J Hamlin (city engineer) served for a total of 57 years of the 61-year history of the Johannesburg City Council.

- **Mr Burt Andrews** served the council for 35 years, and was town engineer from 1905 to 1927, providing streets with all-weather surfaces for the first time. The introduction of kerbs and gutters heralded a great improvement in terms of durability and maintenance. By the mid-twenties a vast network of roads had been developed in and out of the city.

- **Dr Hamlin** served the council for 22 years, and was city engineer from 1932 to 1947. During this time Dr Hamlin had the challenge of steering the City Engineer's Department through the Second World War, with a very much depleted staff complement while coping with a doubling of the population and demand for services. The pioneer of formal graduate training, Dr Hamlin developed a pupil engineer scheme offering bursaries and post-graduate practical training under the direction of 'qualified men, especially university graduated' in the council's employ.

Source: *Watershed town*

Thus a wealth of institutional knowledge was shared by the staff. Continuity meant that long-term plans could be set and contributed to over a long period. The depth of knowledge was invaluable in the training of young staff who had a wide selection of experts to turn to.

Systems were jealously guarded and all were expected to comply with the rules and regulations of the day, including strict time keeping and honouring deadlines.

The downside of this model related to staff who were not performing adequately. Municipalities simply had to wait patiently until such incumbents left for greener pastures or reached retirement age!

2.10.5 Autocratic decision making

Each council had a management committee (MC) consisting of three to five elected councillors. The mayor was a figurehead who chaired council meetings and attended functions. The chairman of the management committee was the real leader.

The MC met at least twice a month and no report went to council unless they had approved it. The town clerk and heads of departments attended MC meetings where they would participate in the debates. MC meetings lasted for hours, whilst public council meetings seldom lasted more than an hour.

Service departments would determine what they considered was necessary in terms of developments, conduct feasibility studies, cost projects and submit motivations to the MC for approval. These were debated at length and, where necessary, were returned with queries, but once accepted by the MC would be accepted by council with few, if any, objections.

In many instances development was carried out at the expense of the environment in the name of progress. There was limited consultation with national or provincial departments. Once decided upon, a solution could be designed and developed in a relatively short time.

Once a concept had been accepted, there was no need to write detailed monthly progress reports during execution or complete copious forms to feed into central systems. When the job was complete it was handed over with a full set of as-built drawings and details were added to the local GIS model.

2.10.6 Technical solutions and level of service

Generally, the city engineer was the technical leader, planner, strategist and father figure in the organisation. Long-term plans and service levels were in his hands and there were few, if any meetings. When meetings were held they related to selecting alternative solutions for a major project, or to advancing systems.

2.10.7 Autonomy per department

Typically each department was autonomous, made its own decisions after consultation with other departments, and had support functions under its jurisdiction.

2.10.8 Human resources

Each department appointed its own staff. The HR department would simply handle the statutory paperwork relating to each appointment.

Service departments would send an advert for a vacant post to the human resources department for placement on the appropriate notice boards and in the media. Service departments would conduct the interviews and make the selection themselves, after which the human resources department would issue a letter of appointment.

Table 2.2 Durban Corporation engineer-in-training programme, 1979

Hydraulics Branch	Water Supply Branch	Works and Housing Branch Construction Division	Roads Branch	Traffic and Transportation Branch
PROBLEM SOLVING				
Problem formulation Engineer-in-training (EIT) should prepare statement that clearly defines parameters laid down for achieving design and/or construction or for meeting required end result. All constraints should be included. Important to state parameters and constraints initially. In addition, new parameters and constraints should be added during course of investigation.	**Problem formulation** **Design:** Determine long-term city growth and changes in area zoning (business, residential). Request information on reticulation networks from Operations. **Operations:** Investigate water reticulation problems and determine solutions within constraints of water reticulation system.	**Problem formulation** Obtain plans from designers. Do site inspection of work. (EITs in Construction Division work on capital projects ranging in costs from R80 000 to R2 million.)	**Problem formulation** Investigate and determine structural systems and choose materials. Analyse road failures and determine remedial works.	**Problem formulation** **Traffic engineering:** Investigate and determine problem areas with respect to road capacity, route location, hazardous location and traffic control systems. **Investigation of complaints:** For all modes of travel, public and private.
Finding and using information Following completion of statement, data must be gathered using all sources, such as correspondence files, record drawings, technical library, verbal discussions and external sources (such as plant suppliers).	**Finding and using information** **Design:** Water consumption trends (using computer data) Analyse flow characteristics. Request Operations to conduct field tests to confirm that calculations comply with SABS standards. **Operations:** Contact appropriate people for advice on for example parts to be made and spares.	**Finding and using information** **Sources:** Technical literature, senior staff.	**Finding and using information** **Sources:** Codes of practice and handbooks. Conduct tests in accordance with SABS methods.	**Finding and using information** **Sources:** Do literature searches, traffic surveys, and interview surveys to determine existing and potential needs/situations.
Application of engineering principles Apply correct engineering principles on basis of problem and data collected.	**Application of engineering principles** Principles of hydraulics, strength of materials, corrosion control, structures and computer analysis.	**Application of engineering principles** Handbooks, codes of practice, computers and experience of other engineers.	**Application of engineering principles** Compaction, use of plant, etc.	**Application of engineering principles** Handbooks, manuals of standard practice, computing techniques and experience of other local engineers.
DECISION MAKING				
Types of decision Evaluate various inputs and their relative importance to reach a decision. Often detailed design is done unnecessarily at an early stage before initial decisions are made which make such detailed design redundant.	**Types of decision** **Design:** Choice of materials (such as size of pipe), reticulation layout, positions of control valves. **Operations:** Conflicting priorities (for example, decide on most urgent of ten problems). Decisions usually have to be made on the spot.	**Types of decision** Determine structural system. Choice of materials. Type of founding (for example, spread footing or piles).	**Types of decision** Largely organisational, for example organising work to be carried out in respect of plant, materials and staff.	**Types of decision** Formulate alternative systems and select optimal solution.
Scientific consideration Apply correct scientific/ engineering design criteria to problem. Important to utilise design aids rather than to work from first principles.	**Scientific consideration** **Design:** Evaluate new materials or control valves.	**Scientific consideration** (Not as extensive as in Design.)	**Scientific consideration** Consider durability.	**Scientific consideration** Capacity analysis, computer modelling techniques based on data collected, accident analysis, future projections (forecasting from trends).

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Staff who left the municipality were replaced as a matter of course, often through the 'old school tie' or by means of adverts placed shortly after resignations were received.

2.10.9 Finance

The treasury department (now referred to as the finance directorate), under careful direction of the town or city treasurer, supported the engineering section in good bookkeeping practices. They neither dictated how much should be charged for services, nor how the money should be distributed throughout the coffers of the town.

Apart from producing the final consolidated budget and effecting payments when required, they had little involvement in the actual spending in service departments.

They did however make sure that the service departments were paid their dues by applying sound business principles – 'no pay, no service'.

Approval for purchases was handled along similar business principles. Technical departments did not buy the cheapest product or appoint the lowest-quoting contractor but ensured the municipality got value for money. The engineer had authority to spend money because it had been approved on the annual budget. There was no necessity for him to obtain further authorisation during the year. Council still formally approved major expenses and contracts and accepted reasonable motivations advanced by engineers when reporting on expenditure. No formulae were applied; funds were used on a needs basis.

2.10.10 Appointing suppliers and service providers

As previously explained, purchasing goods versus purchasing services was handled very differently.

(a) Purchases

The buying department offered the service of purchasing goods, including the annual tender for consumables and equipment, for all departments in accordance with line department specifications. Whilst there was opportunity for corruption in these processes, rewards were usually limited to entertainment and the proverbial bottle of whiskey rather than cash payouts. Stores handled issuing and stock control.

Land was purchased or disposed of by the estates department that consulted engineering departments at all times, to ensure that land would not be acquired that was unsuitable for development, or land would not be sold that had been earmarked for longer-term development.

(b) Development projects

Developments were managed entirely by the service department responsible for the project. The mechanisms for appointing service providers are set out below.

(i) Consultants

A roster of competent consulting engineers was compiled by each technical department. Where design and project management services were procured, services were acquired based on a match between the project at hand and the skills sets available.

In small municipalities, local consultants were utilised for all but the largest projects, and in bigger municipalities consultants were selected on a roster and competence basis. The consultant was called in from the outset to investigate needs and develop the scope of works and estimates for presentation to council. After project approval, they were

Continued from page 66

Hydraulics Branch	Water Supply Branch	Works and Housing Branch Construction Division	Roads Branch	Traffic and Transportation Branch
DECISION MAKING				
Economic considerations Important to realise economic results of design proposals and refine parameters to give most economic end result.	**Economic considerations** **Design:** Materials and pipe network to be cost effective. **Operations:** Economic consequences always a factor in determining priorities, for example cannot test systems on weekdays for this would stop factory production.	**Economic considerations** Consider different materials and structural forms. Compare price of alternative schemes.	**Economic considerations** Estimate project costs based on drawings. Compare costs of alternative materials.	**Economic considerations** Cost/benefit analysis of alternatives.
Practical considerations Practical implications of any design solution is important, particularly in respect of on-going maintenance, repairs, accessibility, etc.	**Practical considerations** **Design:** Ease of construction and future maintenance. **Operations:** Take decisions within time frame of ongoing water distribution network. Time and limitations of plant and terrain are important in emergencies.	**Practical considerations** Various	**Practical considerations** Ease of construction, future maintenance, speed of construction.	**Practical considerations** Ease of implementation and maintenance, timing of implementation (for example, this year or next year?).
Social considerations Ensure that proposed solution does not affect environment or, if it does, minimise such effects. Also ensure there are no bad social effects during construction or afterwards, such as high noise level, particularly in residential areas and after hours, odour problem, unsightly security precautions.	**Social considerations** **Design:** Moral responsibility to supply water demands that any design provide for construction of duplicate mains and alternative systems of supply. **Operations:** Consequences of priority selection for convenience of public.	**Social considerations** Noise and safety factors.	**Social considerations** Choose construction methods that limit noise, dust, and vibration. Consider safety and aesthetics.	**Social considerations** Social benefits. Factors such as pollution, disruption, safety and inconvenience are important.
Checking data and conclusion On conclusion of all design work it is essential to recheck against original brief, to ensure that data has been used correctly and to come to correct conclusion. Formulate recommendations clearly and succinctly.	**Checking data and conclusion** **Design:** Check calculations in house after checking in field. **Operations:** In case of a problem: identify where it lies, take steps to rectify and follow up with flow and pressure tests and pressure recording charts (under direction of engineer). Pass temporary solution on to Design for detailed investigation of ultimate solution.	**Checking data and conclusion** Routine procedure for all structural design. Especially important when working with computers. Engineers are taught never to accept results without checking.	**Checking data and conclusion** Check daily against conclusions.	**Checking data and conclusion** Check data for accuracy. Do computer output consistency tests.

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appointed to design and manage the entire project from beginning to end, regardless of the duration and number of phases of the project, as they would be au fait with the concepts and goals of the project.

Consultants were an extension of engineering departments. Consultants and municipal technical staff worked as a single team.

(ii) Contractors

Where construction work was outsourced, small projects could also be awarded on a roster basis using agreed tariffs, or through an annual tender for small works and services.

Large tenders were drawn up either by the technical department or by a consultant as described above. Tenders were also adjudicated by technical staff who drew up and issued the appointment letter to the chosen contractor.

2.10.11 Information technology

Technical departments did not waste time in harnessing the 'new' phenomenon of the personal computer. Engineering design programs, CAD, geographical information systems, and pavement, stormwater and bridge network management systems, store systems, town planning and building plan approval systems improved the efficiency of departments to a greater or lesser extent from the late 1980s. Generally, the specifications were developed by technical departments and, where functionality existed as part of commercial software, technical staff would review all the packages on the market and select the one that suited them best. Where the product was sold by more than one supplier, quotes would be requested. Where the favoured product was available from a sole supplier, technical staff were at liberty to purchase the product of their choice.

2.10.12 The overall effect

Decision making was not centralised. Instead, decisions were made by the appropriate department in the context of their need. Human resources, finance and buying departments were administrative services supporting the technical department to achieve their service delivery targets. Generally, senior technical staff, if not the city engineer himself, made the decisions based on the technical needs of the moment.

There was little consultation, and limited interaction with communities. Though autocratic, management made decisions which they considered were for the good of their rate payers.

The success or failure of projects and O&M would rest on their decisions and timeous actions. They were accountable, proud of their work and confident of the products and services they delivered.

So involved were they that the town engineers of many small municipalities ran their towns as if they were their own businesses.

The analogy of buying a present for yourself or someone else with your own money or someone else's money is well known, but applies equally to the dedication of staff towards their municipalities and their attitude towards service delivery. The example suggests that if you:

- Buy a present for somebody else using somebody else's money the quality will be above average and the price above benchmark
- Buy a present for somebody else using your own money the quality will be poor and the present the cheapest you can lay your hands on

Continued from page 68

Hydraulics Branch	Water Supply Branch	Works and Housing Branch Construction Division	Roads Branch	Traffic and Transportation Branch
PREPARATION AND PLANNING OF PROJECTS				
Types of project Sewerage reticulation, pump stations, trunk sewers, sewer flow analysis, catchments analysis, treatment works, design incorporating, screening aeration, sedimentation, digestion, sludge dewatering, maturation ponds, etc. Stormwater flow analysis, culverts, canals, beachfront structures, flood line analysis, statistical analysis, river control measures, sand movement analysis.	**Types of project** **Design:** Structural design of reservoirs, pipe crossings of rivers, reticulation networks. **Operations:** Telemetry – computer work and design expansion of system. Water zoning and implementation of double hydrant system. Control of reticulation system during water restrictions. Putting out and monitoring of contracts for control valves. Operating Dunkeld and Montille reservoirs.	**Types of project** Structural design of municipal buildings, reservoirs, sewerage works, retaining walls, bridges (road and pedestrian), electricity substations, roads, foundations.	**Types of project** Major roads, stormwater drains and pipes, kerbing and channeling.	**Types of project** Road intersections, public transport facilities, traffic management systems, control systems.
Design work Hydraulic and structural design associated with the above projects, together with statistical analysis.	**Design work** **Design:** Structural design of projects as above. **Operations:** Determine practical limits of zone by considering contours and pipe reticulation and undertaking field tests of water pressure.	**Design work** Various	**Design work** Structural design of projects as above, including detailed design and preparation of reinforcing schedules. Foundation designs based on soil investigations.	**Design work** Roads and public transport facilities. Detailed design of traffic signal control systems.
Planning of work Prepare programme that indicates steps necessary to achieve end result. This means being able to recognise critical path at any stage of project.	**Planning of work** Plan so as to take traffic conditions into account to ensure supply is maintained. Warn public before shutting down mains and arrange alternative sources of supply if possible.	**Planning of work** Plan project in respect of organisation, plant, materials and staff.	**Planning of work** Plan project to suit construction procedures, traffic conditions, future additions, etc.	**Planning of work** Plan roads and public transport facilities, and traffic control systems utilising computer models.
Specifications Essential, where necessary, to be able to specify work to be carried out. Use previously drawn-up specifications but critically analyse these with a view to improvement. Seek specialist advice where item required has not been previously specified.	**Specifications** **Design:** Preparation of project specifications. **Operations:** Advice to Design Section on practical aspects of specifications.	**Specifications** Carry out work in accordance with specifications.	**Specifications** Prepare project and road specifications.	**Specifications** For traffic operations and management, draw up specifications for signals, computer systems, parking meters, signs, etc.
Estimates Importance of realistic estimating must be recognised. Ensure that, besides bare project costs, all other incidental costs are included, for example contingencies, establishment, departmental works and landscaping.	**Estimates** Prepare estimates and schedules of materials.	**Estimates** Cost control, in conjunction with departmental accountant, to estimate costs of all work to be carried out.	**Estimates** Prepare estimates and schedules of quantities, when required.	**Estimates** Prepare budget estimates for roadworks and for traffic control systems.

Continued on page 72

- Buy a present for yourself using somebody else's money the quality will be excellent and price will not be a factor
- Buy a present for yourself using your own money the quality will be fit for purpose and the price will be cost effective

These were indeed engineers who subscribed to the behaviour outlined in the fourth option. Municipalities ran like clockwork and anyone stepping out of line suffered the consequences.

2.11 TRAINING

As can be expected, training was very structured.

2.11.1 Engineers

In the late 1960s and 1970s, when large numbers of engineers were needed to meet the development imperatives of the government of the day, the South African Council for Professional Engineers (SACPE) required all companies offering training to engineers to submit detailed workplace training plans. This was known as the engineer-in-training programme. Organisations were expected to expose young graduates to planning, design, documentation and construction so that they could develop a complete understanding of the project cycle.

The detailed training programme towards registration that was drawn up by the legendary city engineer of Durban, Donald Macleod, is set out in Table 2.2 on pp 66, 68, 70 and 72.

Initially graduates were involved in the drawing office and in O&M under supervision of experienced staff. When they had some experience they would become involved in projects, under the supervision of line managers who were senior engineers. Thus they quickly gained experience in the workplace and were normally ready for registration within three or four years of graduating.

Training plans were scrutinised by SACPE and needed to be approved before a company could take on graduates. A company could be rejected for a number of reasons, including insufficient attention to any one of the phases in the project cycle, or if managers responsible for training were not considered to be sufficiently experienced or skilled in the appropriate field to offer adequate guidance.

The registration process included submitting details of all experience gained with each activity signed off by the supervising engineer, who had to be registered. Where there was any doubt about workplace progress the applicant was asked to attend a professional interview and was put through his or her paces (this author being one of those who attended a two-hour grilling – for being one of the first women to go through the system!)

As mentioned earlier, bright graduates were then encouraged to continue their studies after registering. In the *Numbers and needs* survey it was found that 32% of all municipal engineers of this era had post-graduate qualifications – mostly MSc or MBA degrees.

2.11.2 Artisans

Although this book relates to civil engineering staff it would be irresponsible not to mention the effective training that was in place for artisans. Municipal training boards offered the theoretical component of artisan training, including opportunities to apply what they were learning in a workshop environment. Weeks were broken up into two days of theory and three days of application.

Continued from page 70

Hydraulics Branch	Water Supply Branch	Works and Housing Branch Construction Division	Roads Branch	Traffic and Transportation Branch
EXECUTION OF PROJECTS				
Types of project Physical projects, as above.	**Types of project** As above.	**Types of project** As above.	**Types of project** As above.	**Types of project** As above.
Experience of different materials Familiarity with different materials used to solve particular problems, for example steel pipes, asbestos cement, UPVC and HDPE.	**Experience of different materials** Reinforced concrete, pipes (stainless steel, cast iron, asbestos cement, copper, PVC), rubber gaskets, pump seals.	**Experience of different materials** Reinforced concrete, structural steelwork, structural timber, load-bearing bricks and blocks, soils, asphalt and aggregates.	**Experience of different materials** Reinforced concrete, pre-stressed concrete, structural steelwork, structural timber, load bearing bricks and blocks, soils, asphalt and aggregates.	**Experience of different materials** Not applicable.
People contact Ability to relate to other people in order to involve all in problem solving and awareness of input required from others, whether small or large.	**People contact** Public, architects, consultants, electrians, legal (such as Factories and other Acts), staff (own section and department, other departments).	**People contact** Public, designers, service organisations, General Post Office, electricity department foreman and artisan staff.	**People contact** Liaise with architects and quantity surveyors. Interdepartmental consultations with other branches and representatives of other departments. Supervise subordinate staff (that is, technicians and draughtsmen).	**People contact** Liaise with public, traffic police, town planners, architects, bus operators, SA Transport Services and all engineering disciplines (including City Electrical Engineer), other staff (labourers, artisans) and suppliers of equipment. Involvement with inter-departmental liaison committee.
ACCEPTANCE OF PROFESSIONAL RESPONSIBILITY				
Essential that EIT assume professional responsibility for his work and, if challenged, be able to justify recommendations and parameters, and be prepared to stand up for his proposals.	Supervised, but EIT must make decisions on his own within a few weeks.	Full responsibility for carrying out work in accordance with design.	Accept responsibility for structural adequacy of own design under supervision of professional engineers.	Responsible for design.
CONDUCT				
EIT to conduct himself with decorum at all times in discussing with, instructing and relating to other people of all races and educational levels. Should not be in fear of superiors but prepared to meet them and discuss matters with dignity.	Must prove stable and not panicky for he often has nobody to fall back on. Leadership and mature judgement required.	Expected to have organisational ability and to be capable of motivating people.	Conduct expected of an engineer.	Conduct expected of an engineer.

Once sufficiently familiar with the job in hand, apprentices were sent to work in a team, managed by a master artisan or journeyman. After three or four years the apprentice was sufficiently skilled to take his trade test and qualify as an artisan himself.

Many of these artisans were exceptionally skilled and could fault find and trouble shoot in the most complex of situations. The old millwrights and fitters and turners were particularly important where fittings and equipment had become obsolete and spares were not available, since they were able to cannibalise good parts from scrapped equipment or even to make parts to keep equipment going. In many municipalities today equipment will simply seize when the last artisans of this era leave or retire.

CONCLUSIONS

With a limited, but paying population to serve, structured training and the development of a highly experienced local government workforce, foreign visitors to our established towns and cities could be forgiven for not realising that they were in a region challenged by abject poverty and a low skills base. The services in major towns and cities were world class, functioned well and continued to grow to meet the demands of the rate and service paying consumers that they served. The challenge is to replicate the post-war and post-independence development phases to address the needs of the much extended population of the Rainbow Nation.

RECOMMENDATIONS

The successful structures, operating procedures, training models and systems of the past should be adopted and adapted to suit future needs.

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Sources for figures and inset

Figure 2.1: Palestrant, E 1986. *Johannesburg one hundred: a pictorial history*. Johannesburg: AD Donker.

Figure 2.2: Wilson, F and Ramphele, M 1989. *Uprooting poverty: the South African challenge*. Cape Town and Johannesburg: David Philip.

Figures 2.7, 2.9, 2.10, 2.13; inset p 64: Grant, G and Flinn, T 1992. *Watershed town: the history of the Johannesburg city engineer's department*. Johannesburg: Johannesburg City Council.

CHAPTER 3

Structures and capacity today

3.1 THE NEW ENVIRONMENT

We believe that in the long run the special contribution to the world by Africa will be in the field of human relationships. The great powers of the world may have done wonders in giving the world an industrial and military look, but the great gift still has to come from Africa, giving the world a more human face.

– Steve Biko

The New South Africa brought with it great excitement and many new challenges.

The first phase of local government transformation began with the Local Government Transition Act, 1993 (Act 209 of 1993). This saw the consolidation of many smaller structures and, after demarcation in 2000, 284 municipalities emerged covering the entire country in a wall-to-wall model of local government, that is, the extent of municipalities were expanded to cover all who required servicing nationwide, as can be seen in Figure 3.1. The number of municipalities has recently been reduced to 283.

Section 152 of the Constitution identifies the following objects of local government:

- *To provide democratic and accountable government for local communities*
- *To ensure the provision of services to communities in a sustainable manner*
- *To promote social and economic development*
- *To promote a safe and healthy environment*
- *To encourage the involvement of communities and community organisations in matters of local government*

Section 153 continues to talk about the developmental duties of municipalities, as follows:

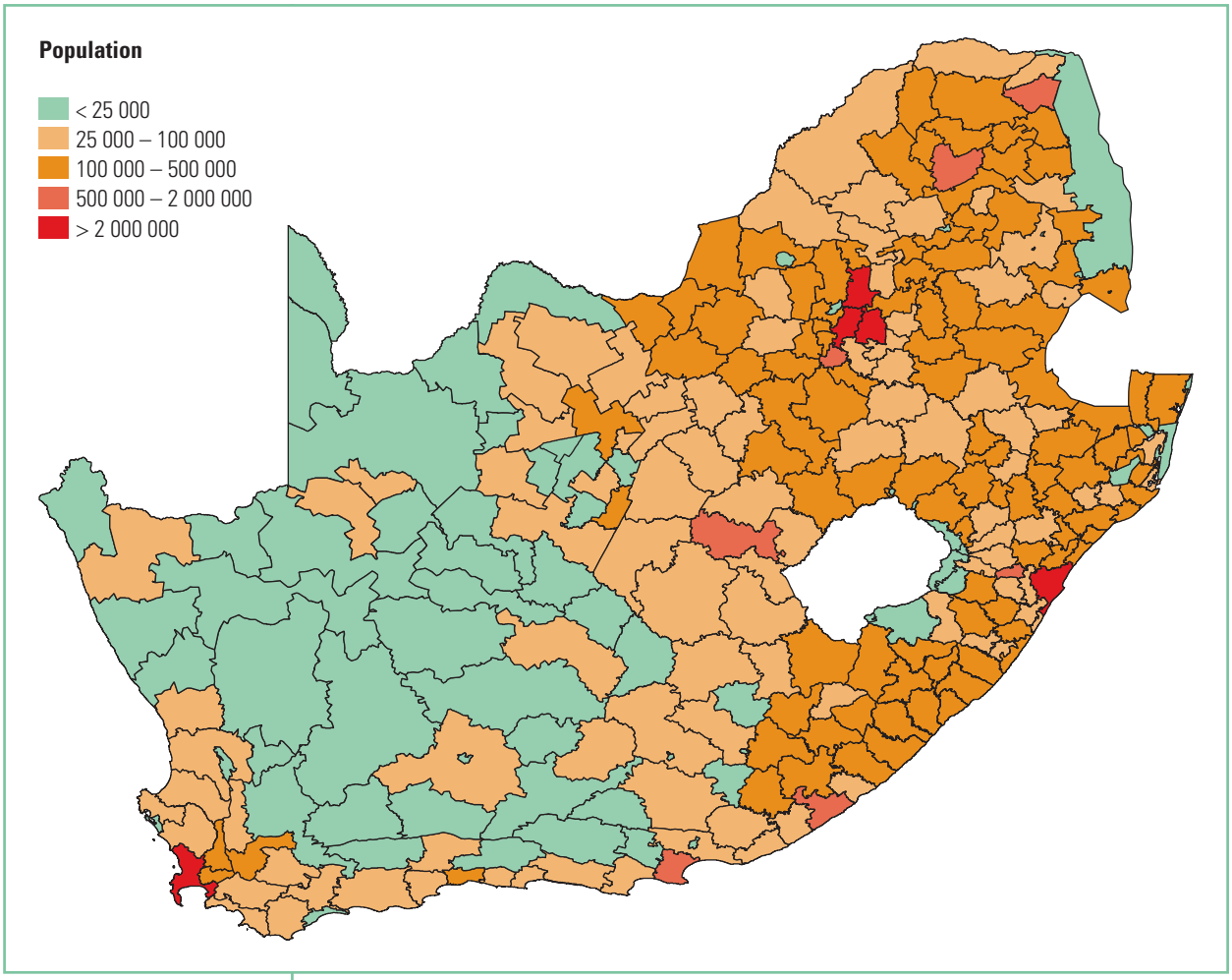
A municipality must:

- *structure and manage its administration, and budgeting and planning processes to give priority to the basic needs of the community, and to promote the social and economic development of the community; and*
- *participate in national and provincial development programmes*

The objectives outlined would not seem that different from the philosophies of the past, but the approach to achieving them is significantly different. The top-down approach has been replaced by bottom-up community participation, which affects decisions at all levels.

In adopting this approach, every structure, process and system needed to be revisited – a huge task, well described in the *Manual for the application of section 139 of the Constitution:*[1]

The transformation of South African local government from an illegitimate institution with unprotected powers into a fully fledged sphere of government



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 3.1 Population per local municipality, metro and district administration area

whose existence, as well as its legislative and executive acts are accepted and endorsed by its citizens is a mammoth task. Local authorities are faced with a legacy of painful disparities in wealth, infrastructure and provision of services.

In addition to the all-inclusive role local government is now expected to play, the resolutions emerging from the Earth Summit of 1992 placed further demands on local government, who were considered to be at the coalface of sustainable development.[2]

Agenda 21 was developed at the summit and outlined a global action plan for sustainable development. Local Agenda 21 was developed for local authorities and calls on them to:

- Integrate social, economic and environmental issues
- Work in partnership with civil society
- Consider the future – take a longer-term view
- Adopt a multi-sectoral approach
- Recognise and work within ecological limits
- Link local issues to global impacts

The new energy ploughed into service delivery has produced impressive results. National sector departments in particular mounted major social infrastructure development

campaigns. Since 1994 more than 17 million people have been given access to water, but there are still some 7 million people living below RDP (Reconstruction and Development Programme) levels of service in terms of water. Almost 10 million people have been served by various sanitation programmes, but sadly there are still 14 million people living below RDP sanitation standards.[3] An impressive 7,7 million households had been connected to the electricity grid by 2005[4] and 2,2 million houses had been built by September 2006.[5]

The government has formulated a multi-pronged attack on the alleviation of poverty,[6] including:

- Growth and development of the First Economy
- Increasing opportunities for job creation to address the challenges of the Second Economy
- Building a social security net based on free services and grants supporting individuals and structures not financially independent

Progress made to date is impressive by any standard and has possibly far exceeded the rate of development per capita for the poor anywhere in the world. However, the backlogs in rate of delivery are such that many are still faced with a long wait.

This chapter is devoted to the current approach to local government: the challenges and consequences of staff shortages, restructuring, and changes in powers and functions, and seeks to highlight the weaknesses requiring attention. Subsequent chapters will examine a range of solutions.

3.2 TOPOLOGY AND POPULATION SERVED

After 1994 the TBVC states were re-incorporated into South Africa and the needs of the non-independent homelands were considered. Consequently the country came face to face with the challenge to provide services to some 12 million people for whom little had been done under the previous dispensation. Isolated rural communities and areas administered by national and provincial government also required incorporation into local government. A number of new municipalities were formed whilst others were integrated as transitional bodies in an attempt to offer better services to the overall population.

In 2000 the new model of 'wall-to-wall' municipalities was launched, with many existing municipalities being merged into larger units. The net result was a total of 284 municipalities, composed of six metropolitan municipalities, 231 local municipalities and 47 district municipalities. Metros are large, stand-alone structures serving 200 000 to almost one million households, whilst local municipalities range from large, such as Buffalo City and Emfuleni (servicing just under 200 000 households), to small (serving as few as 1 500 households).

Several districts were already in existence, whilst others were set up along the lines of the Canadian model to strengthen local municipalities and take care of very small settlements consisting of only a few households. These could not realistically be constituted as stand-alone municipal structures able to take care of their own water supply, sanitation disposal, police, parks, public transportation, capital borrowings or strategic planning.[7] Consequently the three-tier model of local government was born.

The district model has however not been as successful as had been expected since in many areas there is conflict between local and district municipalities as they compete for funds and supremacy in decision making. In several districts, one or more local municipalities have long been established, have functioning structures with more capacity and significantly greater funding than the district, and resent being 'told what to do' by

external, newly established, often inadequately capacitated structures, let alone sacrificing some of their national grant funding to their districts.

A further frustration has been the transfer of various authorities and provider duties to the districts. For instance, in some provinces the districts have become the Water Service Authority (WSA) and the Water Service Provider (WSP). As a result they collect all the income but the water staff have remained in the local municipalities in order to be closer to the networks they must service. Although the district pays their salaries, overheads such as office space, phone bills and vehicle costs are still carried by the local municipalities, without any compensation. This situation must be addressed urgently.

3.3 SERVICES PROVIDED

Municipalities are responsible for providing the communities within their local jurisdiction with basic services. Section 1 of the Municipal Finance Management Act, 2003 (Act 56 of 2003, MFMA) defines basic municipal services as a service that is necessary to ensure an acceptable and reasonable quality of life and which, if not provided, would endanger public health, safety and the environment.

Municipalities therefore must be in a position to provide the basic services to address poverty and offer people the opportunity to live in dignity. During the post-apartheid era, with the absorption of the many millions who had been excluded from this right, the public sector has been devoted to the development of basic infrastructure to address the wrongs of the past, thus addressing the human face of South Africa, as called for by Steve Biko.

Operations have generally been the only other infrastructure-related activity to continue, as shown in Figure 3.2, but in many instances the new, shared services approach to support line functions has resulted in inadequate equipment, materials and staff being made available to handle operations efficiently.

Sadly, as a result of the neglect of the other aspects of development and maintenance, municipalities have exposed themselves to huge costs to rehabilitate completely run-down assets. However, they have taken little action to collect outstanding debt or increase their income base from industry and the paying residential sector. Thus many municipalities find themselves in a precarious financial position.

These challenges are witnessed not only in new rural structures but in municipalities nationwide. The wall-to-wall model has resulted in most expanded municipalities incorporating large areas of low-cost housing which were either underprovided in respect of

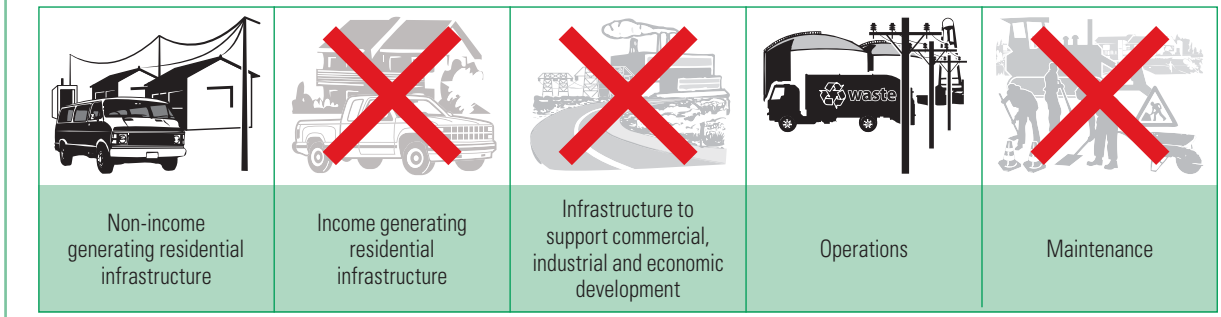


Figure 3.2 The emphasis of service provision in local government from the mid-nineties to 2007

Table 3.1 Civil professionals employed in all levels of local government, April 2005

	Municipalities	Engineers	Technologists	Technicians	Total
District municipalities	47	43	43	154	**240**
Local municipalities	231	98	100	377	**575**
Metros	6	240	226	253	**719**
Total	**284**	**381**	**369**	**784**	**1 534**

Table 3.2 Age distribution of civil professionals in local govenment, April 2005

	District	Local	Metro	Total
Total staff aged below 35	131	208	230	**569**
Staff aged 35 to 49	80	212	292	**584**
Staff aged 50+	29	155	197	**361**
Total	**240**	**575**	**719**	**1 534**

basic services or had basic services that had been inadequately maintained for many years, resulting in appalling conditions.

3.4 THE NUMBER OF CIVIL ENGINEERING STAFF

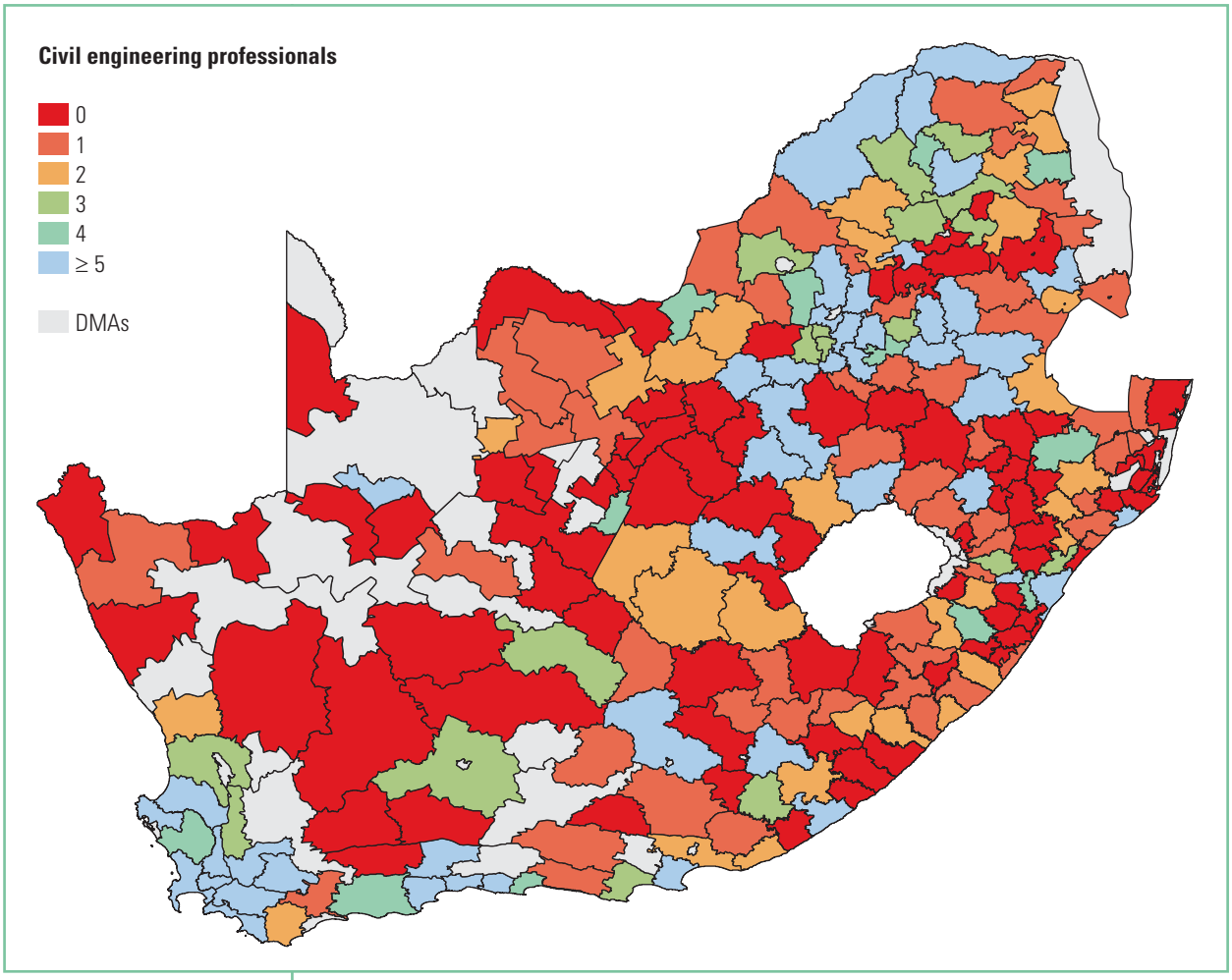
Although the need for engineering skills actually increased dramatically by virtue of the fact that the entire population and not the elite few required servicing, the restructuring process did not recognise this. The rationalisation of the existing engineering departments thus resulted in significant numbers of engineering staff being retrenched, retiring early or leaving the service, including many senior engineers. Restructuring and offering packages have continued unabated.

A study of local government, carried out by the South African Institution of Civil Engineering (SAICE) in March and April 2005, revealed that:

- There had been a migration of staff to the private sector
- There was a shortage of civil engineering professionals in municipalities, with 83 municipalities having no civil engineering staff and 49 with only one or perhaps two very young and inexperienced civil engineering staff
- There were many student technicians who were unable to obtain experiential training or employment after graduation
- There were few experienced staff in production positions with sufficient time to act as supervisors or mentors for young staff members

A summary of the numbers are given in Tables 3.1 and 3.2. These shortages manifest themselves as follows:

- **Where there are no civil engineering professionals,** non-technical staff carrying technical responsibilities are not confident to take decisions and therefore little or no spending and O&M takes place
- **Where there is only one civil engineering technician** there is generally inadequate capacity to deal with the myriads of problems and, consequently, limited spending or O&M takes place



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 3.3 Civil engineering professionals employed in local municipalities and the metros, April 2005

- **Where there are only young staff,** they are not experienced enough to make decisions with confidence and, consequently, limited spending or O&M takes place

The same picture emerges wherever there are no technical staff with authority. Figure 3.3 shows how widely this problem is spread with the orange and red shading denoting municipalities that have only one or no technical staff, respectively.

The SAICE report further highlighted the fact that most municipalities that do have civil engineering staff are nevertheless suffering from vacancies of 35% to 50% against their current organograms. When considering appropriate organograms the percentage of vacancies could be considerably higher!

In developing organograms the increased workload is not understood. Given that most municipalities became at least three times larger after 2000, staff were required to carry at least three times the workload. However, as outlined, the staff complement has reduced. As will be seen, the amount of paperwork and reporting has increased significantly, suggesting that these factors further double the workload. This means that the remaining staff are carrying about six times the load of the past and simply cannot cope.

This situation is exacerbated in the case of project managers when large projects are broken into many smaller projects so that labour-based solutions can be deployed to allow

small, micro- and medium enterprises (SMMEs) to participate. In effect this means that there are many more projects to manage.

The complexity of development today also requires more man-hours since environmental, health, safety and job creation considerations, as well as community liaison, are critical components of the planning phase.

Some staff are therefore carrying as much as ten times their load prior to 2000 and are close to collapse. At several meetings staff have been absolutely exasperated when asked to also assist with student training, or with unexpected developments being requested by the private sector.

Furthermore, the handful of key technical staff in each municipality is expected to fulfil many non-technical roles and attend numerous meetings and workshops.

As a result, a significant percentage of municipalities are

- Unable to spend their municipal infrastructure grant (MIG) allocations
- Unable to plan and access other sources of development funding
- Unable to cope with O&M, resulting in sewage spills, water quality problems and refuse piling up in the streets
- Unable to cope with developers and large projects, such as housing developments, being introduced under their jurisdiction due to a lack of bulk services and by-laws to raise the required funding from developers
- Suffering from very high losses in terms of water and electricity supply
- Unable to attend to improving their service income

It is interesting to note that in almost 80% of the municipalities who spent 70% or more of their MIG funds in 2004/2005, the number of civil engineering professionals over the age of 35 equalled or exceeded the number under 35. Where there were young or no civil engineering professionals, the percentage MIG expenditure was much lower, as can be expected.

The metros, in particular, complained of the burgeoning workload as urbanisation continues unabated. Therefore, of even greater concern should be a sequel to this research, carried out in the metros in November 2006.

It was found that in the ensuing 19 months, 101 civil engineering professionals had left the six metros and only 33 'replacements' had been employed. The former group were

Invisible success story

Despite capacity constraints, thousands of kilometres of pipes have been laid, but of course they cannot be seen since they are covered up by the time the projects are completed successfully.

Air valve on bulk line

Laying stormwater pipes

Pipe jacking across the R40

generally senior, registered professional engineers and technologists and the newly appointed group were generally inexperienced, unregistered technicians. Many of those leaving were 'pushed' or 'jumped' out of frustration with the lack of support and decision making in the new environment and several had been encouraged to take early retirement in the interests of cost saving, transformation or both.

The most shocking drop in staff was found in Cape Town where 44 civil engineering professionals had left shortly after the first survey had been carried out.

This has had devastating effects. *The Weekend Argus* of 24 February 2007 reported Ian Neilson, mayoral committee member for finance in the City of Cape Town, as saying that the city was battling to spend its budget because of a lack of people with the necessary skills and experience. He is further reported to have said that the inability to spend the budget has led to a deterioration of infrastructure and ineffective service delivery.

Section 57 of the Municipal Systems Act 2000 (Act 32 of 2000) states that senior staff are to be appointed on contract rather than permanently, presumably to ensure that municipalities do not find themselves with 'dead wood' at the top. But this requirement has given rise to another problem in that few contracts of the original senior technical staff appointed after the 2000 elections are being renewed. Significant losses have been seen in KZN during 2007. Many of these experienced civil engineering staff, finding themselves without work after a lifetime in local government, have accepted senior posts in Australian municipalities, after a determined Australian local government delegation came head hunting!

Also of concern have been the resignations and/or retirement of many experienced civil engineering staff in North West Province since early 2007, a huge loss considering that this province had a total of merely 40 such staff in local government when the 2005 census was conducted. As at June 2007, there were only three experienced registered professional engineers in the remaining group of some 20 civil engineering trained staff.

This means that at the time of writing (mid-2007), possibly only about 1 300 to 1 400 civil engineering professionals are employed in local government. Considering that the population is now some 47 million, that means that there are 2 to 3 civil engineering professionals for every 100 000 members of the public – a dramatic drop from the 20 to 21+ of the previous dispensation.

Vast areas thus have no one to attend to their civil engineering needs, draw up project specifications or call for private sector involvement in delivering much needed infrastructure. Worse still, there is no one to ensure ongoing operation of critical plant or maintenance of existing infrastructure.

Worrying quotes from reports read as follows:

Operating of sewage package unit – locked up and no operator, electrical problems, no chlorination of final effluent …

Sewage treatment plant – nothing working, raw sewage running into veld, electrical switchgear must be rehabilitated etc …

3.5 SOURCES OF FUNDING

The municipal consumer base has expanded enormously in recent times. However, many of the new consumers cannot afford to pay for services; unsophisticated consumers do not

realise that they must pay for services and expect municipalities to take care of all their infrastructure, including on-site repairs to taps, toilets, etc, and others simply do not pay in the hope that the bills will go away.

Consequently massive outstanding debts have mounted. Furthermore, municipal financial departments now challenged with administering many more accounts generally lack capacity, and many new staff are insufficiently experienced to cope with the complexities of municipal creditors and debtors.

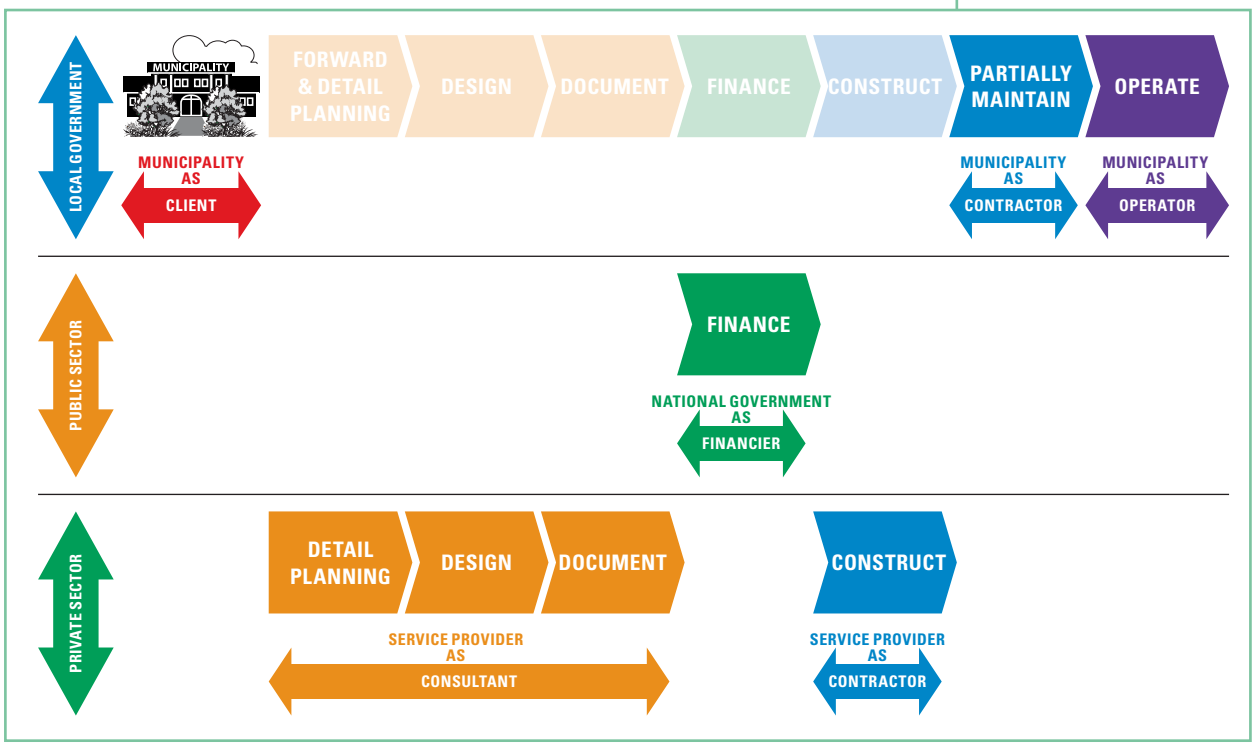
Municipal accounts therefore do not inspire the confidence of financial institutions, so it is difficult for most municipalities to raise loan finance. Consequently the only funds available to municipalities are those that are available through the Division of Revenue Acts (DORA). Municipal income has therefore been reduced to rates and services charges from a limited number of consumers, the Equitable Share and MIG. The latter addresses the delivery of basic services and the first two are generally needed to cover municipal costs, which means that there is little available for maintenance or strategic infrastructure to support economic and population growth.

3.6 FUNCTIONS IN ENGINEERING DEPARTMENTS

The trend worldwide has been to transfer responsibility to the private sector and South Africa has followed suit. Figure 3.4 shows how the private sector has taken over the consulting and contracting functions previously carried out by local government.

Local government remains the client and on the whole continues to be its own maintenance contractor and operator. But, with construction having been outsourced, the budget, facilities, staff and vehicles remaining in local government are generally inadequate for maintenance. Hence municipal assets have been neglected or overlooked and have

Figure 3.4 The split of responsibilities in terms of functions performed in local government in 2007



deteriorated rapidly in recent times. Operating capacity has also reduced, a problem in the face of increased development and a much expanded infrastructure base.

Of even greater concern is the complete gap in knowledge of local authority staff with regard to design parameters, appropriate documentation and construction and project management. As a result, local authorities are totally at the mercy of the private sector for these services, are at times overcharged, or receive inferior products or solutions.

In the process of outsourcing, planning for long-term sustainability has been lost. The distinction has not been drawn between detailed planning per project, which the private sector must naturally carry out, and forward or master planning for the municipality as a whole. Few municipalities have any form of recent master plan. Without understanding the current status and capacity of infrastructure, long-term development cannot be planned responsibly.

3.7 STRUCTURES

From the above it is clear that structures, including design departments and construction units, were no longer considered necessary and organograms needed to be revisited. In doing so, the holistic approach to planning and the rollout of services has been dismantled.

Where in the past the town or city engineer ensured coordination of engineering departments and all considered each other's needs when carrying out major works, each service department is now a silo, usually reporting to a non-technical director. Cross-discipline coordination and decisions cannot take place since there is no mechanism for departments to work together.

In many instances, an integrated development planning department has been established, which totally excludes input from technical departments; budgeting, purchases and stores have been moved from those responsible for delivery on the ground into central services; environmental issues, such as solid waste management, have been moved out of service delivery, etc. Thus decision chains have been extended significantly and in many cases this fragmentation has resulted in little coordination, unsustainable solutions and poor control.

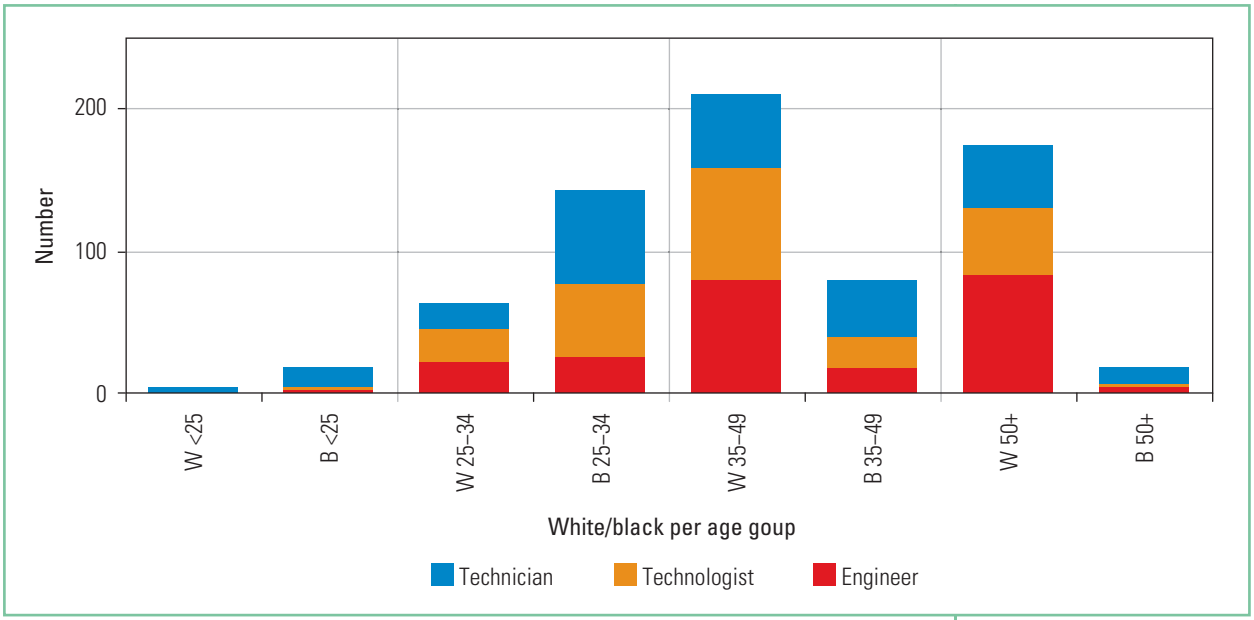
The rest of this chapter will be devoted to the problems that have arisen as a result of these structural changes.

3.8 QUALIFICATIONS AND EXPERIENCE

The depth of knowledge, international qualifications, exposure and the number of years' experience seen in the earlier municipal engineering communities is a thing of the past. Inexperienced technicians and unfortunately, in many instances, non-technical staff are found running technical departments and project management units (PMUs).

The hierarchies, activities and responsibilities of technical staff as shown in Table 2.1 have largely been dismantled resulting in the demise of technical skills in local and district municipalities. The executive role of councils means that many decisions previously taken by senior technical staff are no longer in the technical domain. Being some of the most highly educated and trained staff in local government, civil engineering professionals have left the sector as their skills were no longer being adequately utilised. This has more than halved the capacity that was in the system 20 years ago.

Consulting engineers are used on an ad hoc basis. With supply chain restrictions on the duration of their appointments, they are unable to build up sufficient understanding of the municipality as a whole to advise on restoring some of the systems and expertise.



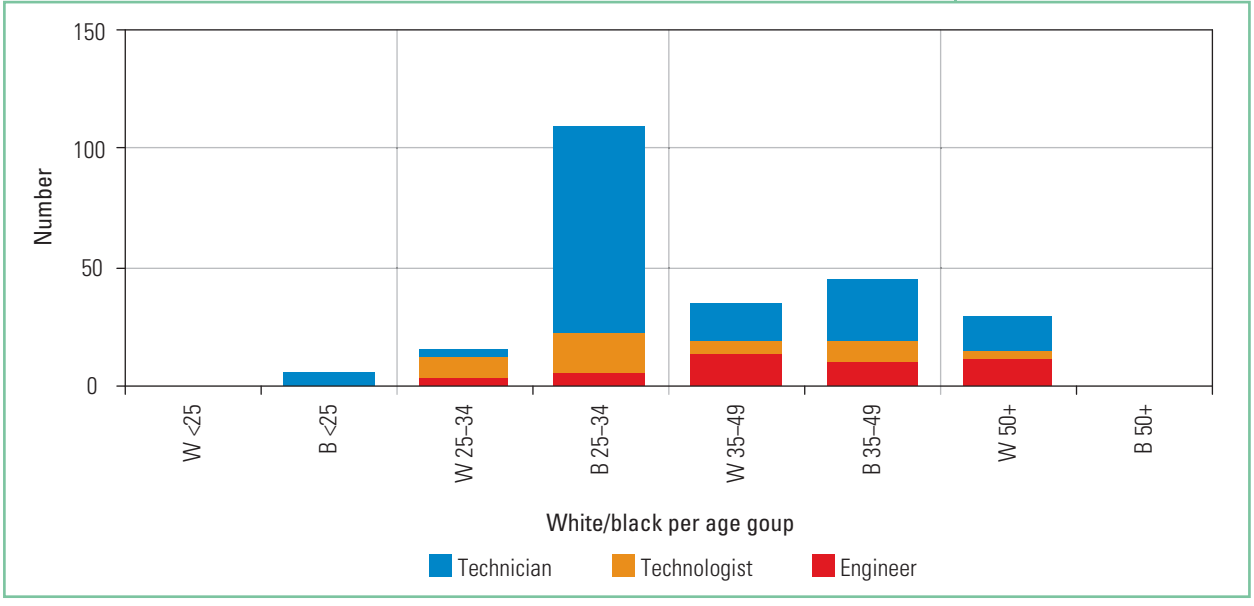
Source: *Numbers & needs*

Figure 3.5 Civil engineering profile in metros – by age, race and qualification, April 2005

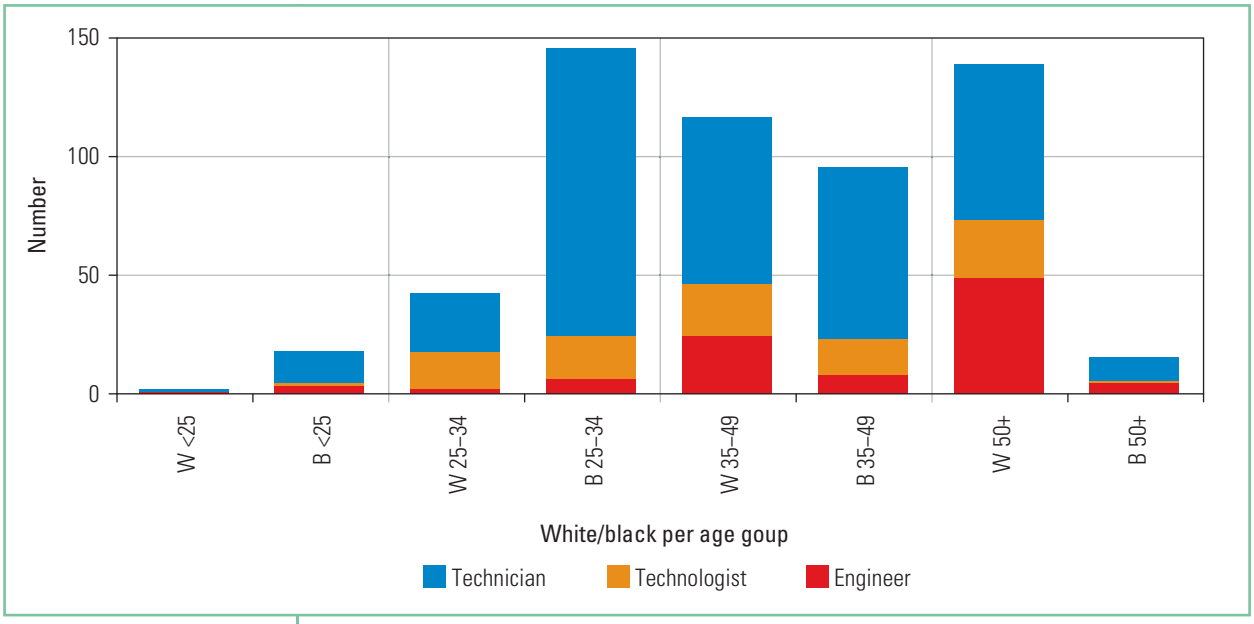
At this stage metros do still have the range of skills shown in Figure 3.5, but as mentioned above, numbers are dropping and the frustration levels of those who are able to make a contribution, but are not adequately utilised, are ever increasing.

The selection of staff is often not based on skill or experience, but rather on equity and costing criteria, which compromises technical departments severely. In all but the largest municipalities there are few engineers or staff with significant experience. Where there are experienced staff they have generally been marginalised and are sitting waiting to retire. As such, few are involved in making strategic decisions. Decisions are either deferred, are not made at all or, where they are made, are often inappropriate.

Figure 3.6 Civil engineering profile in district municipalities – by age, race and qualification, April 2005



Source: *Numbers & needs*



Source: *Numbers & needs*

Figure 3.7 Civil engineering profile in local municipalities – by age, race and qualification, April 2005

Figures 3.6 and 3.7 show the large group of young technicians who have been employed in local government. Whilst there is no problem with employing these young people, their qualifications and level of experience have not prepared them to deal with the complex challenges that they will face in local government today. Working in a vacuum, often on their own, they have no guidance and can therefore make little or no professional progress or offer direction to their municipalities.

Says Paul Kgole, past president of the South African Black Technical and Allied Careers Organisation (SABTACO):

> *It is very wrong for any reason whatsoever to put young inexperienced black Engineers to the test of looking after Municipalities, which have very intricate infrastructure problems including monitoring and controlling highly experienced and sometimes very sly consultants, without any backup plan.*
>
> *Government should therefore formalize the twinning of experienced white Engineers with young qualified inexperienced black Engineers to create a mentorship programme, which offers massive skills transfer aimed at providing the much needed service delivery in South Africa …*

The SAICE-SABTACO ENERGYS programme did just that and proved to be very successful.

Professor Hubert Dreyfus, considered to be the world's leading analyst on post-modern philosophy,[8] explains the stresses under which these young people find themselves. Being placed in positions beyond their level of experience it is necessary for them to assess more situations than can be named or precisely defined, so they cannot refer to lists of possible situations and what to do or look for in each case. They must therefore decide for themselves in each situation what plan or perspective to adopt without being sure that it will turn out right.

Given this uncertainty, coping becomes frightening rather than merely exhausting. As a junior, if the rules do not work,

… rather than feeling remorse for his mistakes, he can rationalize that he hadn't been given adequate rules. But, since at this stage [more senior stage], the result depends on the learner's choice of perspective, the learner feels responsible for his or her choice. Often, the choices lead to confusion and failure …[9]

3.8.1 The technical services director

The current tendency to appoint a non-technical and often young person as the technical services director flies in the face of good business practice.

It is well accepted that a medical problem would require medical advice, a legal problem would require legal advice, mining engineering requires a mining engineer, chemical engineering requires a chemical engineer but strangely it is not realised that municipal infrastructure is the realm of the municipal engineer. Perhaps it is because municipal engineering does not appear to have the same complexity and mystique as that associated with the other professions. However, it requires the same amount of training and is comparably complex.

Municipal engineering is a subset of civil engineering which covers many disciplines including structures, water, sanitation, roads, rail, harbours, waste, geotechnics and construction. Thus it is not readily understood that municipal infrastructure is civil engineering infrastructure and requires the requisite skills and experience. The 'delivery' promised by politicians in the new democracy can only be achieved by the civil engineering profession.

The harsh reality is that failure in infrastructure delivery and O&M can have catastrophic effects on the health and safety of our people. There is a direct correlation between rising medical costs and the deterioration of civil engineering infrastructure.

As explained in Chapter 2, the City Engineer's Department of the past would develop alternative solutions for council to consider. These would be approved based on a presentation given by one or more senior engineering staff. With technical staff now buried low down in the structures, motivations must be communicated to the technical director, who must then explain the solution and motivation to the infrastructure councillor who must then explain it to the executive committee and finally in council.

This 'telephone chain' can become so convoluted, unconvincing, or consciously changed en route to council that the solution may be disregarded or the solution selected may not be that which was recommended in the first place.

3.9 PROCESSES

The large number of vacancies as outlined above, the loss of institutional knowledge and the appointment of many inexperienced or non-technical staff have impacted severely on the tried and tested processes that had stood the test of time.

3.9.1 Planning

As outlined above, detailed planning is now handled by the private sector. The need for forward and master planning has not been understood and therefore this planning has fallen by the wayside.

In terms of the Municipal Demarcation Board definition, municipal planning means:

The compilation and implementation of an integrated development plan (IDP) in terms of Chapter 5 of the Municipal Systems Act 32 of 2000 and the regulations of this Act. Municipal planning includes the preparation of spatial development frameworks, as a sectoral plan forming part of the integrated development plan …

Municipal infrastructure is civil engineering infrastructure and requires the requisite skills and experience

(a) Forward planning and the integrated development plan

'Forward planning' is now mostly the panic that hits officialdom towards the end of each year, when they realise that the MIG year-end on 31 March is looming. Mechanisms introduced by MIG to force consistent performance throughout the year have met with limited success.

Few municipalities have contemplated spatial development plans in recent times, hence there is no framework within which to plan. Having realised the need for better planning, the concept of the integrated development plan (IDP) was introduced. It is intended that the IDP should incorporate decisions related to municipal budgets, land management, infrastructure development, local economic development and institutional transformation, in a consultative, systematic and strategic manner. However, as outlined, this process has been removed from technical departments and is being handled by a separate structure.

The combined effect of inexperienced decision makers and officials and no experienced technical staff working with communities is that IDPs are generally impractical 'wish lists', as little or no provision is made for expanding bulk infrastructure for future growth, or for looking at growth and development strategies, life cycle costing, etc.

This result can perhaps be understood after perusing an official IDP document,[10] which makes regular reference to the fact that an

… IDP approach excluding planning techniques …

can be adopted by smaller municipalities and that their assessments may

… rely on guesswork …

This hardly seems to be the correct way to brief municipalities, particularly those with limited planning experience. Grants are clearly needed to ensure that professionals support the process.

National and provincial sector departments, at a loss as to the support required of them, have now initiated discipline-specific planning processes, such as the WSDP (Water Sector Development Plan) and the ITP (Integrated Transport Plan). In the past, such issues would have been considered as part of the master and forward planning exercises.

Sadly, few of these plans now 'talk to each other', either within the municipality or across the three tiers of government.

(b) Master planning

Few municipalities have done recent master planning exercises. As a result, few can agree, or disagree, when developments under their jurisdiction are suggested by either public sector departments (such as the Department of Housing and the Department of Environnmental Affairs and Tourism) or by private sector companies (such as mining and other industries and property developers).

The sustainability of municipalities can only be ensured by comprehensive planning to ensure that capacity and income are adequate to support future growth.

3.9.2 Budgeting

As explained earlier, there are three main income streams, namely:

- Income from consumers
- MIG and other grants

Canada – planning challenges

Effective land use planning requires adequate staff, experience, financial resources, and tools. With the elimination of the regional planning commissions in 1995, many communities lost their associated land use planning resources. In many cases, these resources have not been replaced

Higher ground: municipal land use planning, Alberta 2007

The Equitable Share

MIG expenditure is clearly ring fenced in accordance with MIG terms and conditions. Where there is additional funding for capital development, funds tend to be allocated on a ward-by-ward basis rather than against priority developments that may contribute more significantly to service provision and long-term sustainability.

The Equitable Share, though allocated to operate and maintain infrastructure for those who cannot afford to pay, is an unconditional grant given to each municipality based on its indigent population. Budgets are determined according to the Equitable Share allocation. This grant, though allocated to each service department when it is received, is often transferred to the central treasury account for other uses.

Service departments complain of losing millions of rands initially allocated to them since these funds are necessary to cover general staffing and administration costs, leaving service departments out of pocket and unable to carry out their O&M duties.

The MFMA (Local Government: Municipal Finance Management Act, 2003 (Act 56 of 2003)) guidelines on increased expenditure are enforced as law by chief financial officers (CFOs). Where a municipality has vastly increased its infrastructure in the preceding year as a result of MIG development, or when prices have increased significantly (for example, the cost of chlorine used for disinfection going up by 33% or electricity by 10%) operating costs would have increased significantly more than the 5% to 6% increase recommended by National Treasury.

The CFO is generally not too sympathetic when technical departments complain that they cannot manage, citing his or her need to comply with the MFMA, GAMAP (Generally Accepted Municipal Accounting Practice) or GAAP (Generally Accepted Accounting Practice). However, technical departments must also comply with the National Water Act, 1998 (Act 36 of 1998), National Environmental Management Act, 1998 (Act 107 of 1998, NEMA), etc. Budgeting needs to take all financial and technical legislation into account.

Success story – roads completed in Emfuleni

The Cradock Road project in Emfuleni was successfully completed with the help of ENERGYS project managers.

Before

After

The MFMA does not allow funds to be carried from one year to the next, which means that it is no longer possible to create an emergency or reserve fund. Should a major breakdown occur, repair funds must be taken from an existing budget at the expense of one or more items or activities originally catered for in the budget.

Another major frustration in respect of budgets is that of being held to expenditure per line item. Changing priorities cannot be readily accommodated. For instance, where there have not been funds in the vehicle budget to effect repairs, but there has been funding in the staff budget, staff have been given permission to work overtime so that two groups of staff can share one vehicle. In the end, overtime costs far exceed the costs of repairing the vehicle. Flexibility is required for optimum expenditure.

3.9.3 Approving building, town planning and development plans

Town planning schemes and building control systems seem to be a thing of the past, particularly in many smaller municipalities. Town planners are no longer employed and as a result many have left the industry. Building inspectors are aging and few have been trained to take their place.

A backlog report prepared by a town planner commissioned to handle outstanding work in a centre with no town planning capacity captures the challenge. It read:

> *The estimated backlog in the processing of town planning applications is in excess of 230 applications of various types. This includes rezonings, township establishments, site development plans, consolidations, subdivisions, special consent uses, written permissions, etc.*
>
> *At this stage a town planner takes approximately 5 hours to evaluate and write a report on one rezoning application, should they have **all** the required information in hand.*
>
> *An application for township establishment can take up to 5 days to complete – depending on the information available and the nature of the comments …*
>
> *If an average of 12 reports can be done monthly by an additional person, the existing backlog in rezonings alone will take 12 months to eliminate. That does not even begin to address the backlog in any other applications or site development plans, or the processing of any new applications …*

Urgent attention needs to be paid to rebuilding these departments to address not only financial viability but the health and well-being of all suburbs.

3.9.4 Drawings, designs, records and reference material

(a) Drawings

In times past most municipalities from about grade 6 and upwards had organised drawing offices and records, as well as GIS systems of some sort. Sadly, asset information and drawings have been destroyed over the years owing to a lack of understanding of the importance of retaining such data.

Indeed, drawings have been found dumped in basements, damp store rooms at the treatment works, etc, rendering them worthless. This loss slows down planning and

design and makes both functions significantly more expensive as field work is necessary to recreate the lost data.

Annual reports on the current status, which previously had to be submitted to the **dplg** (Department of Provincial and Local Government), ensured that such data was managed. However, the advent of IDPs has meant that submissions are generally only forward looking and do not require municipalities to keep a log of their historical data.

(b) Designs

Only a handful of municipalities carry out their own designs. For the major part this function has been outsourced. Unfortunately this means that few municipalities consider it necessary to appoint engineers with design experience. As a result many technical staff are inadequately equipped to assess the suitability of designs proposed by service providers.

(c) Records and reference material

Few libraries remain intact, and design codes and standards have disappeared. Hence many young people entering municipal service at present have no reference material for producing their own small designs, drawing up contract documents or checking submissions received.

3.9.5 Project management and quality control

After 1994, as already outlined, development demands have greatly increased, sources of funding have reduced and line departments are no longer the decision makers with respect to what developments should take place; the IDP process now sets priorities. In terms of basic services MIG provides the funding. In order to accelerate MIG development it was decided to set up dedicated PMUs that access MIG funding from **dplg** against projects outlined in the IDP.

Housing in Nigeria[11]

South Africa is not the only country facing housing challenges. This is a worldwide phenomenon, neatly articulated in an article describing Nigeria's housing challenges.

Nigeria is the largest country in Africa with the largest concentration of black people in the world: a land area of almost one million square kilometers supporting a population of well over 125 million.

Urbanisation continues unabated and the challenge to prevent the development of slums is immense. The World Health Organization maintains that it is the home and not the clinic that is the key to a better health delivery system. The vast majority of Nigerians however live in crowded conditions in defective physical dwellings, sometimes located in areas that do not provide adequate defences against disease and other health hazards.

After trying many policies, including limiting migration to the cities, limiting land ownership, blocking development and, as a last resort, slum clearance and back-to-the-land schemes, they came to an interesting conclusion:

Slums and irregular settlements grow not only because the people who live in them are poor but because of overregulation, the sluggishness of government to provide adequate and affordable land, and failure to harness the energies and resources of the poor in the right direction. The creation of dual and parallel urban systems – the 'formal' and 'informal', the 'legal' and 'illegal', should give way to an appropriate mix and range of tenure systems and standards within the same city, providing scope for incremental improvement over time as resources improve.

Initially it was thought that 70 well-capacitated units would be adequate to handle all projects nationwide. However, it was found that this 'district' approach did not adequately address the needs of individual municipalities and therefore project management units (PMUs) have been established in many local municipalities.

The PMU reports directly to the municipal manager (MM), rather than to line managers. It was thought that this would cut short the lengthy process of having to resubmit each project to council once funds were available. Some municipalities have not adopted this short-cut process, which means that the project cycle is as long as before, but with no input from the line department who will ultimately be responsible for operating or maintaining the asset.

The model as currently structured is proving to be problematic in that the percentage allocated for project management is inadequate to employ experienced project managers in the case of small MIG budgets, resulting in inexperienced or non-technical staff being employed. Without experience or understanding of the products or services being delivered, appropriateness of solutions, quality and financial control is compromised.

Materials testing, inspecting of foundations, checking alignments, checking monthly quantities, etc all seem to be activities of the past. Amazingly, one MM under pressure from contractors whose inferior quality work had been rejected by an ENERGYS engineer complained that the senior was inflexible and had overstepped the mark by checking on the contactor's work!

Where municipalities have been uncomfortable with their service providers and have asked the seniors to check on quality, numerous projects have been condemned and many incomplete projects have been discovered, abandoned as a result of funds not having been adequately managed.

Another problem resulting from the removal of projects from the appropriate line department is that often an IDP project is put out to tender without the knowledge of the line department. In some cases the project is not even required; in others the solution flies in the face of the long-term plans of the line department; and, finally, development has been undertaken where there is insufficient bulk supply to service the new community.

3.9.6 Housing

The need to accelerate housing development is abundantly clear. In the urban areas millions of people live in appalling conditions. According to the Department of Housing, the estimated backlog in February 2007 was 2,4 million units. It was stated that in the rural areas people are generally not homeless, but live in traditional structures, many of which are not suitable to receive formal infrastructure, including in-house water or sanitation, or even formal roads, as settlements have developed in a scattered manner not conducive to developing a road network. Thus there is a challenge in both the urban and rural context to develop formal housing.

The Department of Housing, with their Breaking New Ground project is driving housing development, using their provincial structures as well as working directly with all levels of local government. However, problems abound and are discussed in 3.9.6 (a) to (f).

(a) Land availability

Although announcements are made about major developments, ownership of the land has not been resolved and projects are put on hold for months and, in some cases, years whilst this is addressed.

(b) Bulk planning

There is little or no coordination with municipalities to ensure that there are sufficient bulk services to accommodate the envisaged growth.

(c) Financial viability

Little regard is given to the additional burden on O&M resulting from the introduction of large indigent populations who wil be drawing on formal infrastructure. As outlined earlier, the Equitable Share rarely stays in the O&M budgets of service departments.

(d) Coordination and standards

There is little coordination among housing developers, local government and bulk suppliers, such as Eskom and the water boards. Municipalities complain that townships are developed at a level of service different from their standards, which thwarts their long-term plans. Water supplies are inadequate and at times electricity is not catered for in the new homestead, although the shack on the same plot is officially connected to the electricity grid! Conflicts of interest in terms of targets being chased by different departments exacerbate the problem.

(e) Quality control

The extent of the work being carried out is such that there are insufficient people with the experience and authority to inspect regularly and demand quality service or finishes from contractors. Consequently, projects are often months overdue with staff starting work very late each day or being absent for weeks.

(f) Transfer and registration

Few people understand or are in place to handle the transfer of the new houses to the final owners. As a result, rates accounts are not issued and, worse still, nor are service bills.

Randfontein Local Municipality (RLM) evaluates the fire fighting network

A project that caught the attention of the ENERGYS monitoring and evaluation team involved assessing the status of municipal fire fighting infrastructure, with specific attention to the hydrants located on streets and associated pipework. Concerns had been raised about the condition of the network after a recent fire. In addition, the network would have to be in tip-top condition for the 2010 Soccer World Cup.

Vincent Mabuda, a rural water graduate, was set the task of evaluating the network. His main aim was to determine the general fire fighting readiness of hydrants, their visibility and the distances separating them, necessary colour markings (for example, red for hydrants, green with yellow bands for water supply valves) and corresponding locations on street infrastructure drawings.

His objective was to compile a sample assessment for each representative land use area encountered and possible solutions to enable the RLM to better budget for reactive and eventually also proactive maintenance of the street-situated fire fighting installations. The network required attention and as a result of his research funds were set aside for the maintenance required.

Vincent also consulted with the West Rand District Municipality fire brigade operating in the RLM area and gathered from the discussions that there were typically a few critical (that is, fire-sensitive) areas within each municipality (such as schools, hospitals, retirement homes, certain factories and sports grounds) where hydrant readiness and location had to comply with the fire fighting regulations at all times.

3.9.7 Construction

Few municipalities have construction teams, and those that do, complain of aging fleets, equipment and ever reducing staff levels. Most projects are now put out to tender, and suffer the associated supply chain delays and lack of quality control that will be explored in 3.10.10.

3.9.8 Operations and maintenance

The need for efficient O&M is not understood. Limited funds are budgeted and the number of staff attending to the well-being of infrastructure has decreased dramatically.

A recent survey conducted by SAICE on artisans and semi-skilled workers found that vacancies existed for more than 1 000 plumbers and 1 500 electricians nationwide. Although this may not be as a result of new local government structures, but rather of the general skills shortage, it nevertheless impacts negatively on efficient O&M.

(a) Planned upgrades

With little attention being given to O&M, few annual assessments take place. As a result, few (if any) recommendations are made on capacity increases, or replacing ailing equipment. The power crisis faced by the country is a good example of this, as is the increasing gridlock seen on the roads of many of South Africa's towns and cities.

(b) Routine or preventative maintenance

Without assessments, little budgeting or planning takes place. The number of technicians, superintendents, operators, artisans and general workers employed has also been reduced. As a result routine or preventative maintenance is limited.

(c) Emergencies – response to failures

Stores are depleted, vehicles broken and experienced staff no longer employed. Consequently response to failures in all but the major centres is poor. The most alarming incidences are long-term sewage spillages, long breaks in service provision, roads breaking up and municipal property becoming prematurely dilapidated.

Success story – valve refurbished

In Emfuleni a major existing isolating valve was refurbished with the help of ENERGYS engineers.

Located

Removed and repaired

On its way back to offer many more years of service

(d) Operations

The reduction in staff also means that day-to-day operations are not adequately handled resulting in poor quality water, unacceptable effluent quality, waste accumulating in the streets, etc. The neglect of infrastructure will now require huge investment to restore the status quo.

In the USA, the Infrastructure Report Card[12] report lamented that the cost to restore infrastructure to acceptable conditions was prohibitive in many places, due to inadequate or no regular or preventative maintenance over an extended period.

New York City,[13] when forced to cut their maintenance budget during their lean period, estimated that it would result in an increase in their capital budget of $400 million per annum once the unmaintained infrastructure had become unserviceable.

Countries around the world lament the lack of planning and poor infrastructure due to poor or no maintenance. (See insets below and on p 96.)

The SAICE Infrastructure Report Card[14] issued in November 2006 rated municipal roads and water in rural areas as a **D-** and sanitation as **E** (the rating ranged from **A** to **F** for failed). Urban infrastructure fared slightly better, ranging from **C-** for sanitation to **C+** for water. The Report Card cited lack of investment and skills as the major bottlenecks.

Studies carried out in just two substantial local municipalities in August 2006 showed that over three billion was required to restore failing or failed infrastructure. This value has since increased!

The consequences of this complete system breakdown are outlined in more detail in Chapter 4.

3.9.9 Purchases

The purchasing responsibility has been moved from individual technical departments to central services and is managed by supply chain managers. The 'remote control' and lack of technical direction that are now characteristic of the supply chain process result in serious procurement delays, as well as inappropriate purchases. A further consequence of these delays is the escalation of material prices. Said one frustrated engineer:

Without quick responses and access to funds, operations are now hamstrung.

We are not alone …

Indonesia – averting an infrastructure crisis[15]

Poor infrastructure is hurting growth. Investment in infrastructure must increase before Indonesia can achieve the 6% growth rate needed to create jobs. Power outages are imminent in Java, while outer regions already suffer regular black-outs. Road congestion has increased and is pushing up costs for exporters. Maintenance of existing roads is neglected: almost half the district roads are in poor or bad condition, leading to increases in transport costs and lower prices for farm produce. The poor have the worst access to services. They have limited choice of services and they pay more to providers. Tariff increases are politically difficult, but required to revamp infrastructure investment.

The Philippines – deteriorating roads[16]

In Asia, the implications of the lack of maintenance are severe. It means that the enormous investments in capital assets that a country has made in its rural road network are going to waste where roads are deteriorating faster than they are being rehabilitated. In the Philippines, for example, it is estimated that the annual loss in national capital assets is twice the budget that is required to maintain these assets.

We are not alone …

Peru – reducing capacity to deliver and maintain infrastructure[17]

The biggest challenge to municipal governments in Peru and elsewhere is the development and maintenance of urban infrastructure and the provision of urban services … Local administrations tend to be characterised by apparent incompetence, high turnover, no merit basis selection of professionals (an incoming mayor traditionally changes a big part of the municipal personnel) and salaries are not competitive. Throughout the 1990s different laws and executive decrees were little by little cutting into the competences and resources of municipalities.

Australia – local government and the infrastructure crisis[18]

A particularly colourful quote comes from an assessment of the backlog in infrastructure renewal. In New South Wales it is estimated that $6 billion is required to refurbish and $1 billion a year will be needed for the next 15 years to replace existing, largely neglected assets. Says the quote:

Like roos in the headlights, we are captivated by the tremendous need for new infrastructure. But as funds are diverted into the latest projects, the backlog of maintenance and renewals keeps growing.

3.9.10 The general climate

Most technical staff, except a few isolated technical directors, regardless of race or gender, are frustrated to the point of giving up, as their skills are not being adequately used. They are all too aware that many decisions being made, whether they relate to the level of service, choice of service provider, or allocation or re-allocation of the budget, will impact negatively on the solutions and long-term sustainability. Morale is at an all-time low and needs to be addressed as a matter of urgency.

3.10 GOVERNANCE AND DECISION MAKING

Today's local government has reverted to the philosophy of early local government where structures were set up specifically to address the interests of the communities being served.

The new approach of collaboration among central government, local government and communities is embodied in the ideology of the 'Third Way', a political programme seen in many centre-left governments in the West since the late 1990s. This approach aims to renew social democracy by including civil society as a partner in managing the economy.[19]

To ensure involvement from grass roots an elaborate hierarchy of community-based workers and ward councillors is responsible for working with communities in order to feed their needs to council, and council has the duty of ensuring that their needs are met.

Transparency is key. Decisions are made by full-time politicians on behalf of their constituents, rather than by volunteers and technical officials. Plans, proposals and reports thus move backwards and forwards from officials to politicians to communities and back again, until solutions are decided upon.

Governance has attained currency at the expense of government, or control by central bodies, in answer to the need for individuals and institutions to manage their common affairs. This has turned local government upside down.

Sadly, as with many other changes, the structures, roles, responsibilities and processes per municipality were not designed in advance of the change. A number of years of efficient local government have been lost whilst the structures, appointments and approaches to the new landscape have been developed. Unfortunately some municipalities are not up to speed yet.

The major changes that have affected delivery are discussed in 3.10.1 to 3.10.12 below.

3.10.1 Executive role of council

The executive role given to council or members of council has taken much responsibility away from senior officials. Some of the confusing terminology in the Local Government: Municipal Systems Act, 2000 (Act 32 of 2000) relating to finance and infrastructure is given below:

> ***Section 4 – Rights and duties of municipal councils***
> *(1) (c) finance the affairs of the municipality by –*
> *(i) charging fees for services; and*
> *(ii) imposing surcharges on fees, rates on property and, to the extent authorised by national legislation other taxes, levies and duties.*
> *(2) (g) give members of the local community equitable access to the municipal services to which they are entitled;*
> *(h) promote and undertake development in the municipality;*

The verbs used in these instances do not imply that council should oversee or support such activities but that they must actually handle 'finance', 'charging' and 'undertaking' development directly.

This gives councillors the authority to select projects whether practical or not. Technical staff find that instead of having one 'boss' in the form of a line manager, they have many 'bosses' in the form of councillors each of whom is rooting for his or her work to be done.

Research on the effectiveness of the Third Way in New Zealand[19] found that the ideals of the model were not being met. Their report yielded the following comments:

> *One of the most scathing criticisms of representative democracy is that democracy in the Western world has been reduced to plebiscite. Elections empower and legitimise rulers who govern in an undemocratic, top-down fashion.*

Further comments, which capture some of the South African experience, are as follows:

> *Participatory democracy sees consultation as an end in itself; its danger is that it has a populist focus. The model falls down if citizen participation is low, or if extremist notions put forward by interest groups win the day.*

They go on to caution:

> *In many cases a responsible decision must be made, which may not be in the interests of a majority.*

The new dispensation also finds the CFO in a difficult position when it comes to increasing service fees in line with, for example, inflation if such increases are not initiated or supported by council.

Under Section 51 the MM finds himself in the most difficult position of all, as he is accountable for the municipality's performance but does not have the authority to appoint senior staff or control development or finances. (For a more detailed discussion see 3.10.8(e).) Further, the organisational structure,[20] including the number of staff required for various duties, is a policy decision that must be made by the municipal council, once again undermining the authority of the MM to lead the administration.

The *Financial Mail* covered many horror stories in its well-researched cover story, subtitled 'Political domination in municipal councils is destroying administration and infrastructure' way back in September 2005.[21] A frustrated former MM explained:

> *Politicians … appoint people who are not qualified. The municipal manager must then manage people who have been brought on board without skills and experience – and it is the municipal manager who is then held accountable.*

Considering executive governance in more detail, there are three different models, namely:

- The plenary executive system
- The mayoral executive system
- The collective executive system

(a) Plenary executive system

In this model, which is limited to small municipalities, the council as a whole forms the 'executive' and makes decisions, chaired by the mayor.

(b) Collective executive system – executive committee

Some municipalities have opted for the executive committee system whereby the full council elects the executive committee, which may thus represent several parties. The executive committee then elects a chairperson who becomes the mayor. The executive committee must exercise its powers collectively and decisions cannot be taken by any particular individual (such as the mayor) on the behalf of the executive committee.

(c) Mayoral executive system – the executive mayor and mayoral committee

A significant number of councils in the country have an executive mayor who is elected by the full council. The executive mayor is the political head and as such he

- Has full executive powers
- Takes overall strategic and political responsibility
- Heads the mayoral committee

As with all organisations, leadership is key. South Africa is no different from any other country in this regard, and the following quote applies equally to our mayors:

> *In Canada,[22] any leadership role that a mayor may exercise is dependent largely on the power of the personality and not on powers assigned to this office.*

It is therefore critical that mayors have a good understanding of local government so that they motivate both politicians and officials to work together to help honour their obligations to the municipality.

The mayoral committee functions like a local cabinet, with individual members taking responsibility for different aspects of municipal government. In the previous system, powers could only be exercised by committee and could not be delegated to committee members. The mayoral committee is however not a committee of council; it is set up to support the mayor.

Each member of the mayoral committee chairs a standing committee made up of councillors drawn from all political parties.

The differences among the three systems are depicted in Figure 3.8.

(d) Portfolio committees

Portfolio committees have been established to facilitate working relationships between the political leadership and the senior management of the city manager's team. Each committee is headed by those who were elected to serve on executive committees.

Unfortunately, in most cases, there is little team effort, with politicians considering themselves to effectively be directors, treating senior officials as assistants who should comply with their every instruction, whether appropriate or not.

Technical officials find themselves carrying out duties for politicians – some of the most amazing being organising catering for political meetings, fixing private property and even attending funerals on their behalf.

They are also instructed to roll out many technical solutions that are inappropriate. Said one disillusioned young black technical staff member:

> *If you don't do what the councillor says you lose your job. Our technical expertise counts for nothing. But if something goes wrong because of his wrong decision it is our fault. We cannot win.*

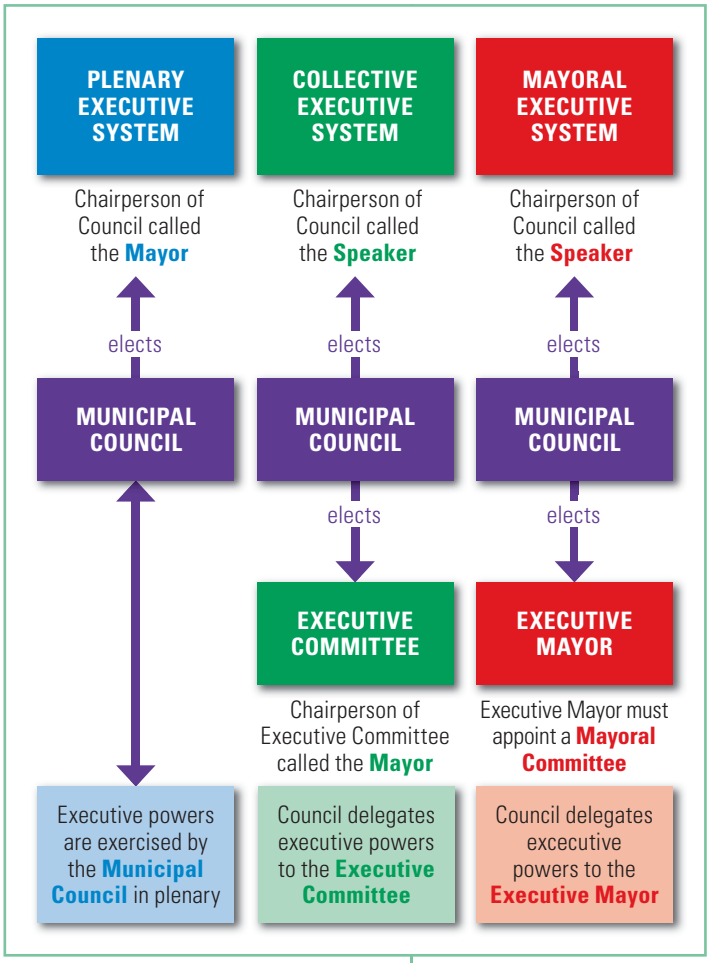


Figure 3.8 The three models of governance in local government

(e) Councillors

Councillors have executive powers and are in full-time employ in large municipalities, or serve part time in small municipalities. In metros and local municipalities, half the councillors are elected through a proportional representation ballot, where voters vote for the party, and the other half are elected as ward councillors by the residents in each ward. In districts, 40% of councillors are elected through a proportional representation ballot and the balance are sent by local municipalities to represent them on the district council.

Clause 160 of the Constitution states that the following functions may not be delegated by a municipal council:

- The passing of by-laws
- The approval of budgets
- The imposition of rates and other taxes, levies and duties
- The raising of loans

The above activities need to be initiated by officials based on direction from council. Where there are few officials or councillors with local government experience, issues such as by-laws, increased rates and levies, and raising of loans go unattended, impacting on the financial viability of the institutions.

Decision making is highly politicised, which means that technical priorities and practicalities often do not feature in the solution, or are disregarded as outlined in 3.8.1, at times

to the long-term detriment of the disadvantaged communities councillors are purported to be serving.

Sadly, many technical staff have given up campaigning for what is right and simply acquiesce to everything their political leader asks of them. This compromises their professional integrity and ethics in terms of the service delivered and long-term sustainability. Performance contracts also hang over their heads like the proverbial Sword of Damocles – if they do not deliver the solutions demanded of them, they will certainly not receive bonuses or have their contracts renewed.

The whole system is now so complex: there are too many chiefs – each with a different agenda – and this will inevitably lead to the ultimate collapse of service delivery unless changes are made to the current model. The *Financial Mail* article referred to above concluded that:[23]

> *… local politicians are pushing out competent officials and replacing them with lackeys who allow councillors to do as they please …*

Sadly, an improvement in this regard has not been widely seen since the 2006 local government elections.

Ward councillors also have influence when it comes to deciding on solutions, even though they may not be employed full time. The developmental model of local government requires councillors to have an intimate knowledge of what their communities require, but all too often councillors are not from the area, and seldom visit their communities. Alternatively they live in the area and demand personal payment from their communities for the 'services' that they render!

Section 29(b) of the Municipal Systems Act, 2000, provides that:

(i) *the local community must be consulted about its developmental needs and priorities*
(ii) *the local community must participate in drafting the IDP*
(iii) *organs of state, including traditional authorities and other role players, should be identified and consulted when the IDP is drafted.*

Much more balanced interaction with communities is essential. When consulting on infrastructure, ward councillors should be accompanied by technical staff who should be trained to handle community liaison and negotiations. Ward councillors should also be painting the overall picture and challenges so that communities can understand the options and make sensible decisions.

After Cabinet's July 2007 *lekgotla*, President Mbeki commented on the slow pace of service delivery and outlined the need for municipalities to explain the challenges and constraints in more detail. In the report[24] he mentioned that:

> *… often when issues were explained at presidential imbizos, the citizens understood the challenges and could themselves identify what should be prioritized …*

3.10.2 Expertise

(a) Introduction of many inexperienced councillors

There is a dramatic change in the composition of council at the end of every five-year local government election cycle. As a result, new councillors, often with little business

experience and limited knowledge of the complexities of local government service delivery, or in extreme cases with limited education, find themselves seated around their first council table with little or no idea of the challenges facing the community and how to develop sustainable solutions.

Expansive bureaucratic systems have been introduced in an attempt to control or limit the risks or lack of performance induced by inexperience, which causes delays in processing.

Decisions on spending also tend to be delayed or not to be taken at all because of the fear of repercussions if the wrong decisions are made.

(b) Lack of authoritative or experienced leadership

Without leadership, passion and control, the lack of discipline and accountability that creeps in hampers service delivery severely. By the middle of 2006, almost half of the MMs in local government were in an acting capacity. Whilst trying valiantly to step into the breech, the authority of these acting leaders is reduced, with council taking over many of the MM's decision making duties.

Typically an MM is empowered to decide on the following:

- Staff appointments
- Choice of materials and equipment
- Choice of service providers
- Selection of community-based labour

However, many councils or individual councillors insist on taking responsibility for these decisions. The resulting delays or inappropriate choices once again impact on service delivery.

A further problem is that many MMs have not previously been CEOs of even small businesses, let alone major ones, and so do not have the experience necessary to lead their organisations. Neither do they have appropriate tertiary qualifications that could have alleviated, to some extent, the lack of experience.

Understanding of and experience in people management, financial management and developing structures, systems and appropriate capacity to ensure efficient delivery of the

Expansive bureaucratic systems have been introduced in an attempt to control or limit the risks or lack of performance induced by inexperience, which causes delays in processing

Pipes need to be under the ground!

Satisfactory completion of projects requires experience in project management and confidence to demand quality service from contractors. Without this control, problems arise …

Where on earth is this pipe going?

Should these be joined?

When will this pipe be connected?

products they are selling, are essential areas in which an aspirant CEO should have acquired experience before assuming any such leadership role.

Sadly, this is not the case, which has resulted in many municipalities descending into weaker financial positions.

An even more vexing problem is that many MMs do not live locally and consequently spend Mondays and Fridays travelling from and to their homes, which greatly reduces the time they are available to carry out their management duties.

(c) Lack of experienced technical staff

Without exception the ENERGYS team has encountered extreme staff shortages, or inexperienced staff trying to carry loads far beyond their capabilities. Furthermore, the load carried by the existing staff is becoming untenable.

Where there are experienced people, they are seldom in leadership positions because of equity criteria applied to senior posts, or they are in an acting capacity – once again limiting their authority and confidence to lead or drive. In many instances there are no technical staff whatsoever to lead sustainable service delivery.

Staff roam in and out as they feel inclined and do very little work causing extreme frustration among those who are working. Young African managers are particularly frustrated at not being able to discipline many of their subordinates who flout their comrade relationships or political seniority to buck the system.

This lack of discipline was also found by the early Project Consolidate Service Delivery Facilitators when first offering support. Explains the September 2006 report:[25]

> *The corporate culture and unacceptably lax discipline was such that some senior managers would come to work smelling of alcohol, arrive late and sometimes not bother to come to work at all!*

Without strong leadership or knowing what is expected of one in the workplace, there is no pressure on young staff to work hard, or progress as a result of increasing competence or improved performance, and little is achieved – much to the frustration of service providers. The following quote captures the feelings of those working in the system:

> *We are frustrated by the zero interest and responsibility we see in the municipalities we service. It is amazing how often documentation can disappear in the hands of the officialdom, to our utmost frustration. We submit information timeously and often put ourselves under huge pressure to achieve unrealistic deadlines. This phenomenon impacts on the progress of projects, because nothing moves without the paperwork having been done.*

This state of affairs is extremely demoralising to service providers, especially when their fee accounts remain lost in the system for months despite numerous resubmissions. Many have vowed that they will no longer serve the public sector – capacity the country can ill afford to sacrifice.

The large contingent of young technical staff have inadequate experience to determine whether solutions or suggestions from consultants are appropriate and many costly white elephants, such a pumps stations where they are not required, and water-borne sewage where there is no water supply, have been developed. The problem is exacerbated where the consultant is also a young professional with limited experience.

Those officials who actually accept responsibility and do work hard, are demoralised by the non-performance of their colleagues and either fall into the same mode, or resign. The closing remark in this section is taken from a European Commission report:[26]

More value should be attached to professional staff and their advice and recommendations

More value should be attached to professional staff and their advice and recommendations

(d) Opportunities for corruption and promotion of personal interests

Finally, there is the issue of corruption of officials and politicians. There are also those in full-time public sector employ who run private businesses, such as professional practices and construction companies, procuring work from other local or district authorities or, worse still, within their own municipalities. Their attention during office hours is diverted and little work gets done. This must **not** be allowed to continue.

Sadly, all these traits impact on service delivery. The 'I'm all right Jack' approach seems to be widely felt in public services worldwide and is particularly prevalent in the younger generation. In the USA,

> *… young workers are developing in a different cultural climate than their predecessors, and have the complex task of learning to negotiate the often competing demands of excellence, ethics, and earnings.*
>
> *Often the young professionals know the right thing to do, but instead cross that line to further their careers by bending the rules or engaging in morally questionable behavior. They look for big money instead of big satisfaction.*

These were the findings of a major study carried out by Harvard Graduate School of Education in their GoodWork Project.

Findings were similar in South Africa. Honesty International tested thousands of South African employees and found that four out of ten South African employees lack integrity.

Our education system at all levels needs to address ethics, codes of conduct, values and responsibility, and in fact rekindle our much revered culture of Ubuntu, or 'a person is a person through other persons'.

Bishop Desmond Tutu[27] described Ubuntu in 1994 saying:

> *It embraces hospitality, caring about others, being willing to go the extra mile for one another … my humanity is caught up inextricably in yours. When I dehumanise you I inexorably dehumanise myself. The solitary human being is a contradiction in terms, and therefore you seek to work for the common good because your humanity comes into its own community in belonging.*

In today's profit-driven and materialistic society we would do well to rekindle these values.

President Mbeki[28] himself, in his 2005 Heritage speech at Taung in North West Province, lamented that:

> *There has not been a campaign to ensure that ubuntu becomes synonymous with being South African. We have a responsibility to use the positive attributes of ubuntu to build a nonracial, nonsexist and united South Africa.*

Legislation affecting local government

Specific local government legislation
- Constitution of the Republic of South Africa
- Local Government: Municipal Systems Act, 2000 (Act 32 of 2000), as amended by Act 44 of 2003
- Local Government: Municipal Structures Act, 1998 (Act 117 of 1998), as amended by Act 58 of 1999, Act 33 of 2000, Act 20 of 2002 and Act 1 of 2003
- Local Government: Municipal Finance Management Act, 2003 (Act 56 of 2003)
- Local Government Municipal Demarcation Act, 1998 (Act 27 of 1998)
- Municipal Electoral Act, 2000 (Act 27 of 2000)
- Organised Local Government Act, 1997 (Act 52 of 1997)
- Intergovernmental Relations Framework Act, 2005 (Act 13 of 2005)
- Local Government Transition Act, 1993 (Act 209 of 1993), as amended by Act 34 of 1994, Act 61 of 1995, and Act 89 of 1995
- Local Government Cross-boundary Municipalities Act, 2000 (Act 29 of 2000)

Water
- Water Services Act, 1997 (Act 108 of 1997), as amended by Act 30 of 2004
- National Water Act, 1998 (Act 36 of 1998), as amended by Act 45 of 1999

Energy
- Electricity Act, 1987 (Act 41 of 1987), as amended by Act 58 of 1989, Act 46 of 1994 and Act 60 of 1995
- Electricity Regulation Act, 2006 (Act 4 of 2006)

Roads
- National Land Transport Transition Act, 2000 (Act 22 of 2000)
- National Road Traffic Act, 1996 (Act 93 of 1996), as amended by Act 8 of 1998, Act 21 of 1999 and Act 20 of 2003
- Urban Transport Act, 1977 (Act 78 of 1977)
- The South African National Road Agency and National Roads Act, 1998 (Act 7 of 1998)

Solid waste and environment
- National Environmental Management Act, 1998 (Act 107 of 1998), as amended by Act 56 of 2002, Act 46 of 2003 and Act 8 of 2004
- Environment Conservation Act, 1989 (Act 73 of 1989), as amended by Act 52 of 1994 and Act 50 of 2003
- National Heritage Resources Act, 1999 (Act 25 of 1999)

Housing
- Housing Act, 1997 (Act 107 of 1997), as amended by Act 28 of 1999 and Act 4 of 2001
- Housing Development Schemes for Retired Persons Act, 1988 (Act 65 of 1988), as amended by Act 20 of 1998
- Rental Housing Act, 1999 (Act 50 of 1999)
- Housing Arrangement Act, 1993 (Act 155 of 1993)
- Residential Landlord and Tenant Act, 1996 (Act 3 of 1997)
- National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977), as amended by Act 49 of 1995

Deeds and land
- Deeds Registries Act, 1937 (Act 47 of 1937), as amended by Act 9 of 2003
- Land Affairs Act, 1987 (Act 101 of 1987)
- Physical Planning Act, 1991 (Act 125 of 1991)
- Land Administration Act, 1995 (Act 2 of 1995)
- Development Facilitation Act, 1995 (Act 67 of 1995)
- Communal Property Associations Act, 1996 (Act 28 of 1996)
- Extension of Security of Tenure Act, 1997 (Act 62 of 1997)
- Local Government: Municipal Property Rates Act, 2004 (Act 6 of 2004)
- Communal Land Rights Act, 2004 (Act 11 of 2004)

Health and safety
- Occupational Health and Safety Act, 1993 (Act 85 of 1993), as amended by Act 181 of 1993
- National Health Act, 2003 (Act 61 of 2003)
- Disaster Management Act, 2002 (Act 57 of 2002)
- Fire Brigade Services Act, 1987 (Act 99 of 1987), as amended by Act 83 of 1990 and Act 134 of 1992

Labour and Broad-Based Black Economic Empowerment (BBBEE)
- Labour Relations Act, 1995 (Act 66 of 1995)
- Basic Conditions of Employment Act, 1997 (Act 75 of 1997), as amended by Act 52 of 2003
- Employment Equity Act, 1998 (Act 55 of 1998)
- Broad Based Black Economic Empowerment Act, 2003 (Act 53 of 2003)

Finance and procurement
- Local Government: Municipal Finance Management Act, 2003 (Act 56 of 2003)
- State Tender Board Act, 1968 (Act 86 of 1968)
- Intergovernmental Fiscal Relations Act, 1997 (Act 97 of 1997), as amended by Act 29 of 1999
- Public Finance Management Act, 1999 (Act 1 of 1999), as amended by Act 29 of 1999
- Division of Revenue Act(s)
- Preferential Procurement Policy Framework Act, 2000 (Act 5 of 2000)
- Financial and Fiscal Commission Act, 1997 (Act 99 of 1997)

Skills development
- South African Qualifications Authority Act, 1995 (Act 58 of 1995)
- Skills Development Act, 1998 (Act 97 of 1998), as amended by Act 31 of 2003
- Skills Development Levies Act, 1999 (Act 9 of 1999)
- Adult Basic Education and Training Bill (Government Gazette 21461 of 7 August 2002)

Professional councils
- Construction Industry Development Board Act, 2000 (Act 38 of 2000)
- Council for the Built Environment Act, 2000 (Act 43 of 2000)
- Built Environment Councils Acts, 2000 (Acts 44–49 of 2000)

Regulations
- Municipal Supply Chain Management Regulations (Government Gazette 27636 of 30 May 2005)
- Municipal Investment and Municipal PPP Regulations (Government Gazette 27431 of 1 April 2005)

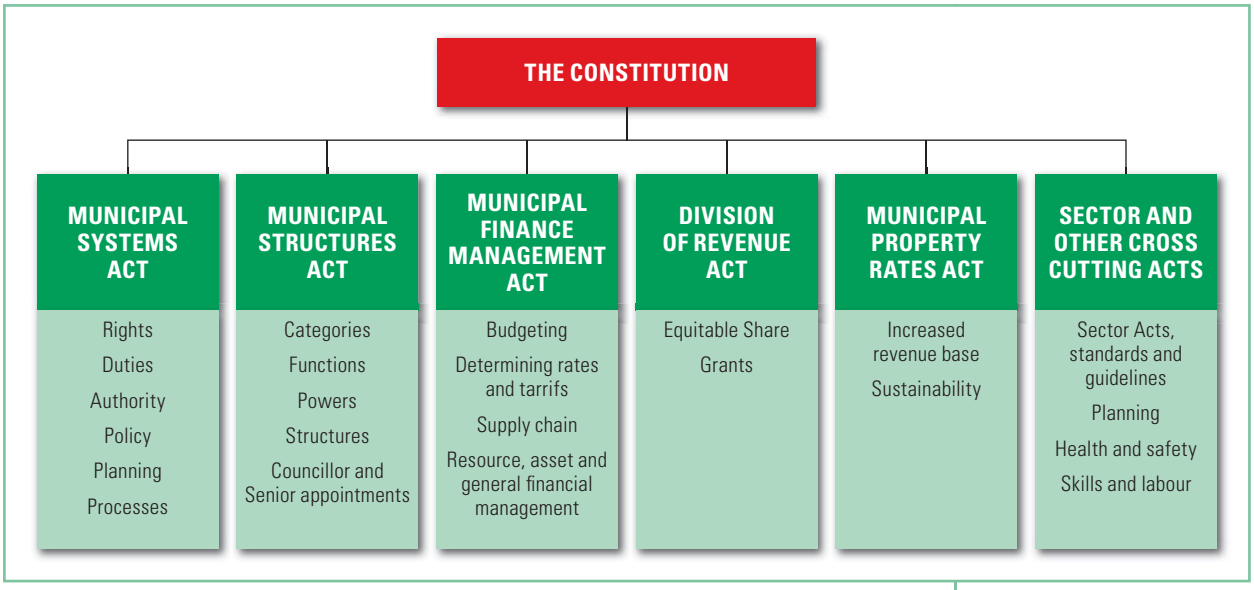


Figure 3.9 Legislation affecting local government

3.10.3 Legislation

Specific legislation addressing the new models of local government have been developed. The guiding documents are shown in Figure 3.9. The 'sector and other cross cutting acts' referred to in the figure, which impact on local government and the infrastructure sectors, are overwhelming. A subset of the myriads of Acts that affect decisions is given in the inset on p 104.

Many of the above Acts and regulations affect service delivery and O&M, and their consequences will be highlighted throughout the following sections. Approvals that have to be obtained from numerous departments for numerous mundane developments and the issuing of records of decision also slow down development. Says one frustrated developer:

> *A major problem is our Department of Agricultural and Environmental Affairs, in tandem with our Wildlife Bodies. Between them, development is regarded as a threat to the environment, to be stopped, rather than to be harmonised with the environment to the benefit of mankind. The problem is not the legislation, it lies in the application of the legislation, which is the human factor.*

Issues such as the siting of borrowpits, repairing faulty pumps in a sewer line, reconstructing existing assets and laying water mains in existing road reserves all require approval, which can take anything from two to six months or more to obtain.

These activities are generally short term and should be controlled by guidelines, a code of practice or even regulations. Site activities could be logged on a website with the controlling department and the regulations, monitored by inspectors, could simply call for sites to be restored to their former condition within a specified period or face a stiff fine. For example, waiting for permission to spill sewage whilst repairing a pump can cause more harm than just getting on with it, since allowing a sewage spill for an afternoon during a repair exercise could save days or even weeks of sewage spills during the approval process resulting from system blockages due to a faulty pump.

Even the National Water Act, 1998 (Act 36 of 1998) is affecting operations and particularly maintenance in unexpected ways. The fact that water courses are now the sole responsibility of the Department of Water Affairs and Forestry (DWAF) means that farmers can no longer clear out culverts or subways on their land when they notice that they are blocked, resulting in flood waters taking alternative courses and causing great damage.

Similarly, the Working for Water programme, whilst rooting out alien vegetation, is leaving areas denuded, causing greater run off. Where alien trees are felled along water courses they are often found to cause damage as they are swept away by flood waters, wreaking havoc in their path.

Health and safety challenges are no different. The Occupational Health and Safety Act, 1993 (Act 85 of 1993) requires that:

- Community-based labour be given extensive safety training and be issued with safety equipment, even if they are only going to work for a week, contradicting the aims and objectives of the Expanded Public Works Programme (EPWP)
- Government must approve all excavations, making legal maintenance impractical

Clearly, much of the above legislation was developed in isolation. This lack of integration has resulted in cause and effect not being considered holistically.

South Africa is not the only country experiencing this problem. It is widespread, as is so beautifully articulated in the US bestseller, *Reinventing government:*[29]

> *We become so obsessed with dictating how things should be done – regulating the process, controlling the inputs – that we ignore the outcomes, the results!*
>
> *Every rule was originally laid down with the best intentions. But the cumulative effect is gridlock. Every group's prerogatives are protected. Unable to do what they know is right, fearful of punishment if they are found ignoring the rules many public employees simply give up. They forget their agency mission and settle for following the rules. They write memos upon memos, in the time-honored tradition known as 'covering your ass'. The price we pay is staggering. Rule-driven government may prevent some corruption, but at a price of monumental waste. Who can put a price tag on the bureaucracies that grow ever larger, because they are so locked up by rules and line items that they cannot do anything new without adding more people and more resources.*

The Gore administration spent considerable effort looking at their systems and concluded:

> *The current [control] approach is hollow.*[30]

They went on to say:

> *While management controls must be cost-effective, so should the review of these controls. FMFIA*[31] *and A-123*[32] *have been criticized because they are seen as hollow, inflexible procedures. While many people interviewed consider management controls as important tools to safeguard the government's assets and resources, FMFIA generally is perceived as a labor-intensive, paperwork-focused reporting requirement with little positive results. It treats management controls as a separate, staff-run program, not an integral part of line management.*

3.10.4 Duration of appointment

This is the era of limited-term contracts. Contracts ranging between three and five years are given not only to senior officials, but also to council members who are replaced after each election. Whilst this allows municipalities to introduce fresh blood, institutional knowledge is not being built up and each appointee sets him- or herself a few short-term goals to deliver, to the detriment of long-term sustainability.

3.10.5 Consultative decision making

The White Paper on Local Government (9 March 1998) defines developmental local government as:

> *… committed to working with citizens and groups within the community to find sustainable ways to meet their social, economic and material needs and to improve their quality of lives.*

The three important new Acts relating to local government listed in the insert above, namely

- The Municipal Demarcation Act of 1998
- The Municipal Structures Act of 1998
- The Municipal Systems Act of 2000

have effectively enabled South Africa to transform from its previous supply-driven, top-down approach to a holistic, demand-responsive approach to service delivery. It is envisaged that the municipality and its citizens will work towards the common purpose of sustainable community development.

Thus ward councillors are tasked with understanding community needs, ultimately feeding their inputs into the IDP process. Table 3.3[33] outlines the differences between the

Success story – a bridge across the river … at last!

Rains always presented communities in this region with a major access problem since the Njekeni stream became impassable. A brand-new bridge has now solved their problem and the engineering team were very proud of their work.

Table 3.3 The top-down versus the bottom-up approach

SUPPLY- OR PRODUCT-CENTRED DEVELOPMENT	DEMAND- OR PEOPLE-CENTRED DEVELOPMENT
1. The development product or project is predetermined, usually by experts, and then 'sold' or imposed from the top down to the benefiting community.	1. The development project emerges from within the community (with external facilitation taking place, at most).
2. 'Us/them' language is used to differentiate between the project developers and the benefiting community.	2. 'We' language indicates an inclusive approach to development and a sharing of the responsibilities of project development by the project facilitators and the community.
3. The community is involved, but normally only consulted in a top-down manner.	3. The community owns and drives the process, with external support where necessary.
4. The pre-occupation is with delivering a product and not with facilitating a process.	4. The development product is part of a process that enhances the lives of the people in the community.
5. The project provides for assumed deficiencies in the benefiting community.	5. The project seeks to identify and build on the competencies of the benefiting community.
6. There is a dependence on external expertise.	6. The emphasis is on developing and using local expertise.
7. The project can require indefinite external support if it is to be sustained after the developers have left.	7. The benefiting community has been consulted and has considered how it will sustain the process after external developers have left.
8. The project managers often 'manipulate' the community into agreement through promises that are seldom met. Disillusionment is common.	8. External experts act as facilitators only in a community-driven development process. Project goals are set by the community and their attainment is determined by the community with, when necessary, support from outside agencies.
9. Developers often profit more from the project than the benefiting community.	9. The major profit from the development accrues to the benefiting community.
10. Development can be delivered in a shorter time, but may prove to be unsustainable.	10. Development processes may take longer, but invariably prove to be more sustainable in the longer term.

Source: Adopted from *People-centered development*

top-down and the demand-responsive approach. However, to ensure that the best overall long-term solutions are decided on, the success of this new approach depends on:

- A well-informed client or community
- Skilful liaison with communities
- Mature decision-makng

Unfortunately, as with all changes, in trying to right wrongs of the past, the pendulum often swings too far to the other extreme.

3.10.6 Technical solutions and level of service

As described previously, politicians and ward councillors dictate which projects should be developed and also prescribe the level of service. In many instances the solutions on which they insist are unsustainable and their communities are soon once again without services, as the services fail.

Whilst community needs must be taken into account a balance needs to be struck between community aspirations and practical, long-term solutions. Trust and respect need to be built in relation to the roles, skills and responsibilities of all players, including communities, politicians and technical staff.

3.10.7 The advent of shared or central services

Not only are technical project approvals a problem, but systems in place to control administrative processes have all but brought departments to a standstill.

As legislation demands more complex procedures and controls than in the past, dedicated posts and departments have been constituted for human resources, purchasing, budgeting and many other functions, taking decisions away from technical departments and placing them in shared or central administrative services. These shared services centres have become a source of extreme frustration in most municipalities.

The authors of *The reinventor's fieldbook*[34] describe the problem as follows:

> *Handing control over day-to-day practices to central agencies – civil service commissions, budget offices, and treasury departments – takes power away from the operational managers, the very people who are supposed to implement policies and produce results.*

It seems that we have the tail wagging the dog!

3.10.8 Human resources

The human resource (HR) process, including decision making, has been totally removed from individual technical departments. As a result the new employee is generally not selected by those who will be employing or managing him or her. This disconnect between the employer and those handling the process results in a number of difficulties as outlined in (a) to (h) below.

(a) Delays

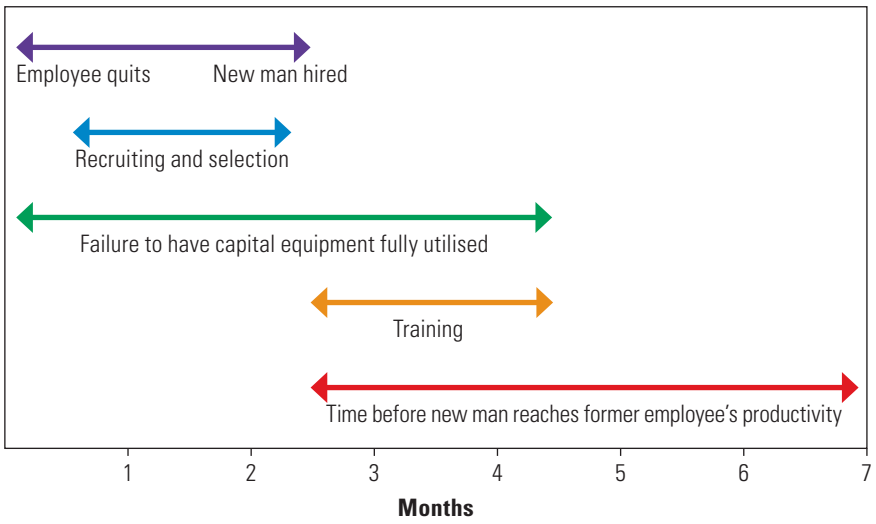
There is no urgency to attend to the needs of any particular department. Furthermore, many new performance measures, capacity investigations, handling of complex workplace skills plans, SETA claims and scheduling of training programmes mean that few in HR have time available to dedicate to the advertisement, selection, interview and appointment processes.

Figure 3.10 shows a typical employment cycle – cited in the *Management of Personnel Quarterly,* 1971 (Summer). Although the 'new man' was hired on average two-and-a-half months after the initial resignation, the article lamented the loss of productivity experienced, complaining of a six to seven-month period before the new incumbent was able to carry the full load.

South African local government would be delighted if the appointment delay was only six to seven months let alone the time to reach full productivity!

When a post is vacated, it is first necessary to confirm that the post may be filled – a long process that requires detailed motivation and many signatures. Once confirmed, advertisements are drawn up and published with lengthy closing dates and scrutiny periods. As a result, the first interviews generally take place only four to six months after the previous incumbent's resignation.

All too often the applicants do not suit the needs or profiles required by the municipality and posts must be re-advertised. At times, due to an inadequate spread of publications selected for advertising, no replies are received, which also requires re-advertisement. Thus existing staff find themselves acting for many months – if not years – whilst the appointment process runs its course, to the detriment of both positions for which they are responsible.



Source: *Management of Personnel Quarterly*, Summer, 1971

Figure 3.10 The employment cycle

(b) Technical knowledge

Without understanding the field that the prospective recruit will be entering, those conducting the interview are unable to determine whether the applicant is suitable or not. In one or two instances where an ENERGYS engineer was asked to attend final interviews it was found that few – if any – of the candidates who were on the short list could answer even basic technical questions! In an extreme case candidates interviewed for the position of Director of Water and Sanitation had no knowledge of *E. coli* and associated treatment!

(c) Experience

Few understand the need for technical staff to have appropriate experience. Provided they mention a few technical words in their CVs, they are considered suitable. Few municipalities require only one or two civil engineering staff, but rather teams of such staff. For long-term sustainability these teams should be composed of junior, production and senior staff.

Senior staff must have the expertise to select and drive sound projects, manage production staff and train the growing tide of junior staff queuing up for employment in the sector. Without this training, long-term skills growth cannot take place.

Take, as an analogy, the game of cricket. Having watched the 2007 Cricket World Cup in the Caribbean (see Figure 3.11), few would argue the fact that you can learn how to be a world class cricket player from following the rather complex tea towel description of cricket:

You have two sides, one out in the field and one in.

Each man that's in the side that's in goes out, and when he's out he comes in and the next man goes in until he's out.

When they are all out, the side that's out comes in and the side that's been in goes out and tries to get those coming in, out. Sometimes you get men still in and not out.

When a man goes out to go in, the men who are out try to get him out, and when he is out he goes in and the next man in goes out and goes in.

There are two men called umpires who stay out all the time and they decide when the men who are in are out.

When both sides have been in and all the men have been out, and both sides have been out twice after all the men have been in, including those who are not out, that is the end of the game.

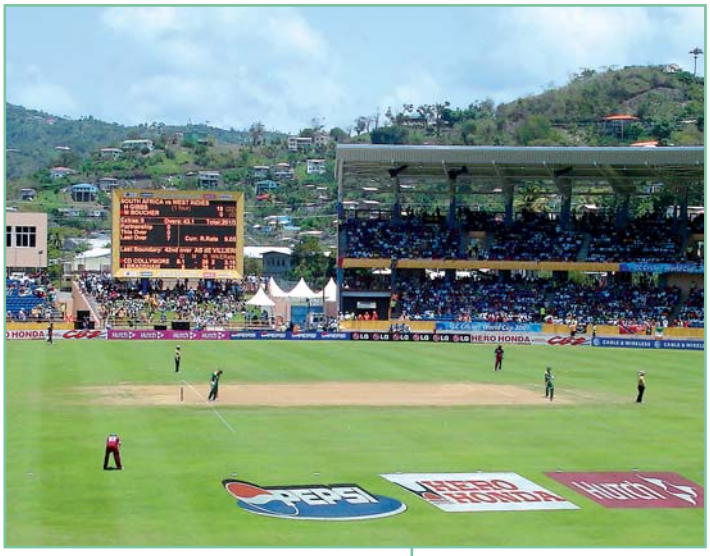


Figure 3.11 South Africa facing the West Indies at the ICC World Cup, Grenada

Practically speaking, cricket instruction usually commences at a tender age under the guidance of a master and the game is learnt by practising on the field! (See Figure 3.12.) Without having experienced the movement of the ball on a wet pitch and learning how to handle it, without learning to read the field in order to find gaps, without learning how to defend the wicket and stay in and without having practised for hours on end to hit the wicket or catch the ball, early dismissal of the opposition and the winning big scores would not be achieved.

The efficiency of relay fielding can only be achieved by superb teamwork. Finally, the game strategy must be sound. The ability to read conditions and the strengths and weaknesses of the opposition only comes with years of on-the-field experience.

Cricket is no different from any other activity that requires an outcome. Investigation, strategy, planning and efficient implementation by a skilled (practised) team is the only route to a winning solution.

In today's world of information, communication and technology (ICT), society has become armchair specialists in all fields. Patients take screeds of internet printouts when visiting their doctors to ensure his diagnosis is correct and sports fans have a lot to say about the errors made by their teams, but few armchair experts could actually face a ball bowled by Ntini, convert a try, return a serve from any Wimbledon tennis player or get the soccer ball near the goal posts in a penalty shoot out! Equally, arm chair engineering is not possible. The permutations and combinations of parameters associated with the simplest of engineering decisions requires years of experience gained by working in teams with those who have encountered and learnt how to solve similar challenges in the past.

Figure 3.12 School children exhibiting their cricket prowess during the lunch break at the ICC World Cup, Grenada

A suite of job specifications with commensurate qualifications, technical expertise and experience has been customised with the help of Buffalo City and the Gauteng Department of Local Government, as part of the ENERGYS

Success story – treatment works refurbished in Ga-Segonyana

The efficiency of new aerators and the renewal of all mechanical and electrical equipment at the Ga-Segonyana waste treatment plant has increased capacity from 0,5 Ml/day to 4,0 Ml/day, an expansion required to cope with the rapid increase in urbanisation.

project to guide municipalities in their future selections of new appointees. (Part III outlines numbers and qualities that should be sought and training regimes that should be adopted in this regard.)

(d) Responsibility

Engineering projects have start and end dates, with associated penalties for delays. Penalties were introduced by the private sector since their new assets are generally designed to generate income, and late completion would reduce the new owner's long-term income and profitablity. In the public sector, the development of assets is no different since service fees can be raised or the municipality can earn the peace of mind from having delivered a much needed service to an indigent community. Thus engineering professionals have become accustomed to working long hours to ensure that projects run smoothly at all times and deadlines are met.

Few non-technical or inexperienced staff have any sense of this urgency or commitment to or ownership of their projects. The applicant's level of responsibility needs to be tested when appointing senior staff and needs to be developed as a matter of urgency in junior technical staff.

(e) Political appointments

A major problem is that many senior officials are political appointees and their technical capacity and work ethics seldom play any role in their selection.

The following anomalies occur among sections 51, 56 and 57 of the Municipal Structures Act, 1998 (Act 117 of 1998):

- Section 51 holds the municipal manager accountable for the overall performance of the administration
- Section 56 states that the municipal council must appoint managers directly accountable to the municipal manager
- Section 57 states that a person to be appointed as the municipal manager of a municipality, and a person to be appointed as a manager directly accountable to the municipal manager, may be appointed to that position only in terms of a written employment contract with the municipality
- Subsection 2(c) states that the performance contract of a manager directly accountable to the municipal manager, should be entered into with the municipal manager

These clauses are conflicting and do not give the MM the authority over his senior staff. He did not select them, but must enter into an agreement with them – a certain challenge when it comes to accountability!

Knowing that they have been selected by council rather than the MM, the allegiance of senior staff in many instances is not to the MM. They are able to go over the MM's head and cannot be disciplined by the MM for non-performance since such discipline is often frowned upon by the council which initially selected them.

An urgent review of the Municipal Structures Act is required to disentangle political leadership from administration and delivery.

(f) Employment equity

The discussion on appointments would not be complete if mention was not made of employment equity. Many of the above strengths required in key technical staff are ignored in the interests of achieving equity targets per department. In many instances these short-term political gains jeopardise long-term goals. Those who suffer most as a result of these selections are the poor as service delivery is severely hampered due to the reduced ability to deliver sound services.

(g) Job hopping

A further problem with employment equity is that, as a rule, staff so selected do not remain in the position for long since they are on the hunt for more senior or better paying positions – companies pay top dollar in the interests of transformation.

This tendency results in a situation of sustained vacuums as replacements must be found, which takes time (as outlined above), only for the cycle to be repeated again within a few months or at most a year!

(h) Lack of systems and procedures

Frustration with HR departments is not limited to the employment process, but extends to the lack of systems, policies and procedures. Lack of attendance registers, leave forms, sick leave reporting procedures, etc makes it difficult to check absenteeism and take disciplinary action where necessary.

3.10.9 Finance

The finance branch has extended its control to all areas of budgeting and expenditure. As demands beyond infrastructure delivery have grown, staff numbers have increased, without the commensurate increase in income. Furthermore, difficulty with collections and losses have reduced municipalities' ability to balance the books.

As a result, service departments often find large portions of their budget being reassigned to keep their municipalities alive, once again impacting on service delivery and O&M.

In several instances technical staff have been retrenched to reduce costs whilst in many municipalities the appointment of several staff to address compliance issues, such as supply chain and performance management, means that funds are not available to employ technical staff.

3.10.10 Appointing suppliers and service providers

The advent of the supply chain department has all but halted project development in many municipalities.

There is no distinction between bids (to supply standard and easily specifiable goods, such as stationery, furniture and computers) and tenders (to supply complex engineering infrastructure). All processes associated with the appointing of service providers are now

handled by central services, far removed from the department requiring the commodity or service. The context of the requirements is not understood and generally those in supply chain have little or no technical knowledge or, for that matter, buying office experience.

(a) Purchases

Instead of managing their own purchases within the confines of a budget, technical departments need to motivate to supply chain for each and every item required, even for recurrent purchases such as those required by stores for ongoing O&M.

Supply chain will ultimately choose the product based on price or supplier bias, not necessarily matching the specification exactly, and may even veto purchases in the name of savings or budget restrictions.

This problem is not limited to municipalities but exists in supply chain controlled departments as a whole. The writer even came across a mine which came to a standstill when supply chain decided that enough conveyor belting had been purchased for the year!

Purchases may also be delayed in the name of trying to negotiate the best price whereas often the cost of losses due to the failure far exceed the small savings on holding out for the best price.

(b) Service providers

The appointment of professional service providers has been dissected to the extent that little continuity, or benefit from institutional knowledge is possible.

Competitive bidding is a requirement at every stage of a project, from the definition of the scope, feasibility studies, planning and design through to developing and awarding construction tenders. The following hurdles are associated with initiating, awarding and ensuring that a sound project is delivered:

- Defining the scope
- Issuing the tender
- Evaluating the tender
- Adjudicating the tender
- Awarding the tender
- Monitoring
- Payments
- Acceptance testing and sign off

(i) Defining the scope

If not handled in house, in times past a consultant would prepare the scope of works on spec in the hope that the company would be appointed once the project was issued.

Few municipalities have the technical capacity to develop project scopes and most are not in a position to engage consultants on spec to draft terms of reference for other consultants. Even this exercise must be put out to tender!

Where scopes are written in house by non-technical or inexperienced staff, they rarely adequately capture details of the service required. As a result, inappropriate offers are often made at ludicrous prices – varying from impossibly low to unreasonably high.

(ii) Issuing the tender

Not only are the scopes inadequate, but the terms and conditions are often not relevant or specified at all. Conditions relating to the purchase of computers may well be found in

the tender documents for a new treatment works! Critical clauses covering specifications, retention, or penalties are often omitted giving the municipality little clout in the case of poor performance.

Few supply chain departments understand the professional charge-out guidelines of the Engineering Council of South Africa (ECSA), which cover fees scales versus time and materials costs. Their criteria are often mixed up in one tender. As a result, the service provider will gleefully charge full fees, plus time and materials for attending meetings, office and administration costs, etc – and get away with it!

Supply chain departments are also under the impression that they can decide who may or may not tender. Firms have reported being told that they may not tender unless they combine with companies nominated by the supply chain department and charge specified prices! In one municipality 80% of tenders scrutinised contained cession clauses covering major components of each of the projects. Condoning and indeed encouraging fronting **must** be rooted out.

Where the municipality indeed complies with the supply chain process as laid down by National Treasury and submits the bid document to the bid committee for approval before issuing, delays can still be lengthy because of the size of the committees making it difficult to set meeting dates that all can attend.

(iii) Evaluating the tender

This is the responsibility of the evaluation committee and is another lengthy process, fraught with difficulties. The components that should be measured when adjudicating a tender are:

- Quality or suitability of the offer
- Ability of the service provider
- Level of transformation of the service provider
- Price

All too often Black Economic Empowerment (BEE) credentials or price are the only selection measures used for evaluation.

(iv) Adjudicating the tender

The adjudication committee will consider the recommendations of the evaluation committee in order to determine the most suitable offer. All too often, the ability of the consultant or contractor is not considered. A limited number of small contractors have the expertise, resources and cash flow to handle the projects for which they are tendering. As a result, projects are soon in trouble.

Furthermore, the pricing is generally so low that projects cannot actually be built at the prices tendered. In one instance only one carriageway of a dual carriageway road could actually be built for the tender price and the contractor disappeared before it could be demanded that he deliver the complete solution.

Consultants also seem to view the new supply chain management regulations as requiring cut-throat prices. (Discounts of 40% are the norm with 60% or more not being uncommon.) The result is that little planning and design time is spent on developing the most efficient solution, and limited site supervision takes place. This when emerging contractors require more hand-holding than before!

As a result, quality suffers and projects are rarely completed on time or within budget. The maxim in the quote from John Ruskin (see inset) should not be ignored – it seems that

The lowest tenderer

It's unwise to pay too much, but it's worse to pay too little.

When you pay too much you lose a little money – that is all.

When you pay too little you sometimes lose everything because the thing you bought was incapable of doing the thing it was bought for.

The common law of business prohibits paying a little and getting a lot – it cannot be done.

If you deal with the lowest tenderer it is well to add something for the risk you run and if you do that, you will have enough to pay for something better

John Ruskin (1819–1900), English philosopher

the problem of 'goedkoop is duurkoop' has been around for a long time. When will we ever learn?

Quality has suffered to such an extent as a result of bidding for consulting work that a frustrated Seetella Makhetha, a SAICE executive board member, exclaimed:

> *It may be beneficial to the country to enact legislation to prevent the discounting of professional fees. Engineers who discount their fees heavily cannot devote the same amount of resources to do the job adequately and are undermining the future of the country.*

Without adequate technical expertise those serving on supply chain committees are not in a position to make the correct choice of service providers and can be forgiven when they handle infrastructure tenders in the same way as they do supplies. It is however the technical department that is responsible for the end product and not the supply chain, which leaves scope for corruption with regard to the selection of service providers.

A radical change in approach needs to be put in place to address this disconnect.

(v) Awarding the tender

Having decided on the service provider, there are often long delays in issuing the letter of appointment. The urgency to get projects off the ground, or to complete MIG projects timeously, is not felt by the supply chain department but technical officials are powerless to expedite the process.

(vi) Monitoring

In-house technical staff or consultants are responsible for on-site monitoring of contractor progress. Both quality of work and progress should be monitored.

The quantities constructed each month should be measured by the contractor and

Success story – access improved for Mgwebi village

The steep road to Mgwebi took a long time to travel and was hard on passengers and vehicles alike. A new concrete road has vastly improved the journey and was designed specifically to endure this rugged environment.

Before

After

submitted with his monthly claim. The party responsible for monitoring must then check the actual work on site, verify the claim and submit it to the financial department for payment.

All too often claims are signed off without any verification or visits to site. This happens for a number of reasons, such as no technical staff with capacity to handle the process; no vehicles for getting to site; or, sadly, officials or consultants being bribed by contractors to sign off inflated claims.

(vii) Payments

One of the frustrating stumbling blocks within municipalities is the long delay and late payment of suppliers and service providers. This problem arises where there is no capacity in the financial office, or where financial staff with little knowledge of technical invoices based on construction costing are nervous to commit to the large sums being claimed.

Furthermore, the construction process is not understood and all too often the full retention figure is taken off the first invoice, leaving the service provider cash strapped as he battles to make the paymaster understand the error.

(viii) Acceptance testing and sign off

The handover phase also presents a problem in terms of capacity and experience. The final product should be tested before the completion certificate is signed off. Water pressures, valve closures, drainage, levels, alignment, finishes, etc all need to be checked before projects can be signed off.

A retention figure should be held to allow for attending to small defects found within the first few months of operation or use, that is, the maintenance period.

All too often no inspections take place and inferior or non-existent projects are fully paid out. In several instances the ENERGYS engineers have come across projects that have been paid for in full to find only foundations, or a few excavations, or the first delivery of construction material to site!

(c) Supply chain management in general

Supply chain frustrations should not come as a surprise. In devolving power to local government many countries have:

> *… given municipalities more responsibilities … [but have also] … restricted the authorities' discretion over their own expenditure …*[35]

because central government support is given on condition of compliance with many centrally developed controls. It is important that a balance be struck between government's need to ensure control and the local need to deliver.

3.10.11 Information technology

One of the most disconcerting discoveries for the author, who spent years in technical IT, has been the realisation that excellent systems which were in place in the 1980s have not been kept up to date. As systems have crashed, or maintenance contracts have expired, or operators have left, systems have been abandoned. Consequently, today few municipal technical departments have functioning systems of any sort.

Where departments have now resolved to get up to date, they have been held back once more by central services who believe that the selection and operation of technical systems also fall in their domain, but that they are not a high priority.

Without the data models that can be built up in CAD and GIS systems, planning and handling of O&M call outs and future budgeting are almost impossible.

3.10.12 The overall effect

In 1993 Goldsmith[36] suggested that there were four models of local government:

- The client/patronage model, which was the pattern in 19th century America. Community leaders and local government were expected to produce favours in return for votes. This system offered ample opportunity for abuse
- The economic model, prevalent in Canada and Australia, where it is the task of local government to promote growth and develop communities in competition with each other
- The welfare state, in which the state is responsible for the delivery of welfare state services, mostly to the standards set by central government. This model has led to entrenchment of officials and accusations of bureaucratic paternalism
- The enabling model, which moves away from direct production to enable a range of goods and services for consumers, and involves communities at grass roots

Whilst the last model describes what we are aiming for, the ills of the first and third models are plaguing us today, as seen throughout this chapter. Officials are demoralised and are leaving the public sector, service delivery is not taking place, systems are failing, and the communities for whom this new model was designed are the poorer. Balance and innovative approaches are urgently needed to effect change. (Attention will be given to these in Chapters 5 and 6.)

3.11 TRAINING

The advent of the Sector Education and Training Authorities (SETAs) has placed much emphasis on formal training courses. Little or no distinction has been drawn between formal training and workplace training. Public sector staff spend inordinate hours in training courses, but commensurate improvement in efficiency, expertise or decision making is not evident. This is so for two reasons: staff are not career ready and there is a lack of experienced personnel who can provide guidance to newcomers.

3.11.1 Staff are not career ready

Many young graduates are not career ready. Vygotsky,[37] a respected learning theorist on whose work much good practice in teaching is based, suggests that there are two levels of development:

- The development of primitive mental functions, such as simple perceptions, simple (natural) memory and involuntary (passive) attention
- The development of higher mental (cognitive) functions, such as logical memory

Important issues in developing cognitive functions are:

- The foundational psychological functions (awareness and mastery of one's mental activities)
- Learning to write (the algebra of speech)
- The role of scientific (subject matter) concepts
- The role of peers, the teacher and the learner

Complex skills that are learned build on prior learning.[38] Many of our young graduates had attended inadequate schools and were thus inadequately equipped to benefit fully

from their tertiary studies. Due to language difficulties, they were unable to grasp several concepts. Due to poor numeracy they battled with application in certain fields. Due to inadequate tertiary institutions they may not have had any laboratory experience. As such they graduate with minimum marks and need much support in the workplace. Figure 3.13 describes the building blocks in the career of a civil engineering professional. If any of the blocks are missing or are ill formed, the graduate will not make it to the top of the pyramid.

In South Africa today it appears that many of the stimuli that contributed to the development of engineering professionals of the past have not been present in the upbringing and education of the young generation. Until such time as society, schooling and tertiary education address these issues it rests with the profession to address the gaps during the workplace training phase before comprehensive professional training can proceed at an acceptable rate.[39]

This is indeed a daunting task!

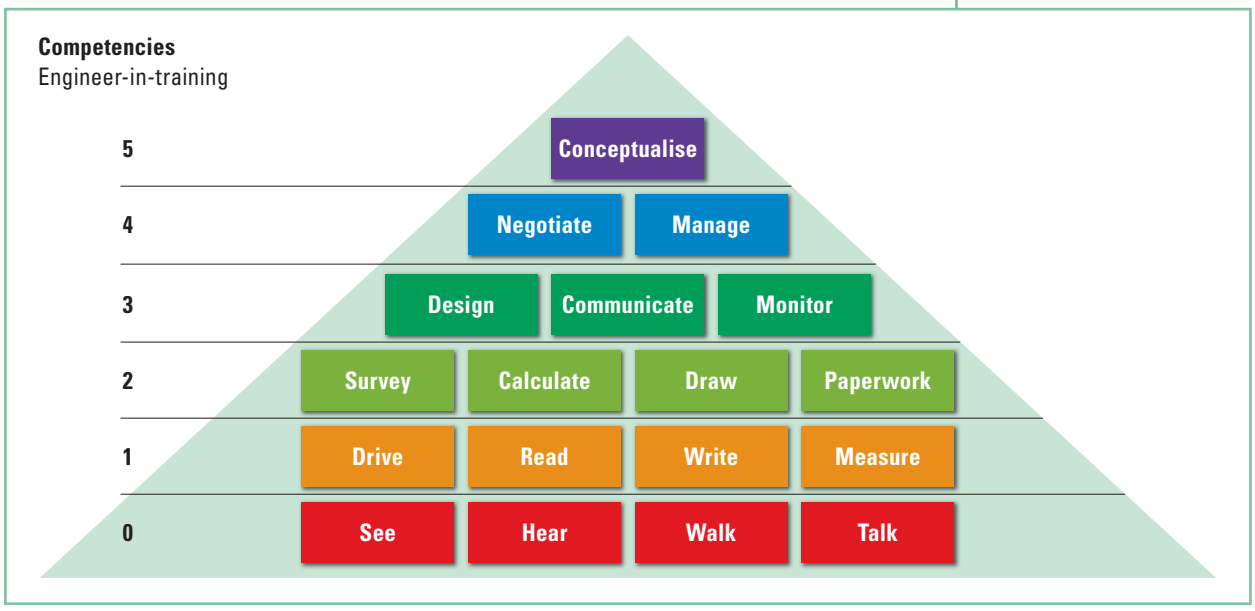
3.11.2 Guided experience is the best teacher

The only way to become proficient in the workplace is to gain practical experience under the guidance of a seasoned professional. In their research on the failure of the dotcom bubble, Professors Leonard and Swap[40] concluded that the young whizz kids who were at the forefront of technology simply did not have sufficient experience to build successful businesses. Figure 3.14 captures the different methods of learning, with sitting in lectures being the least effective, to guided experience being the most effective.

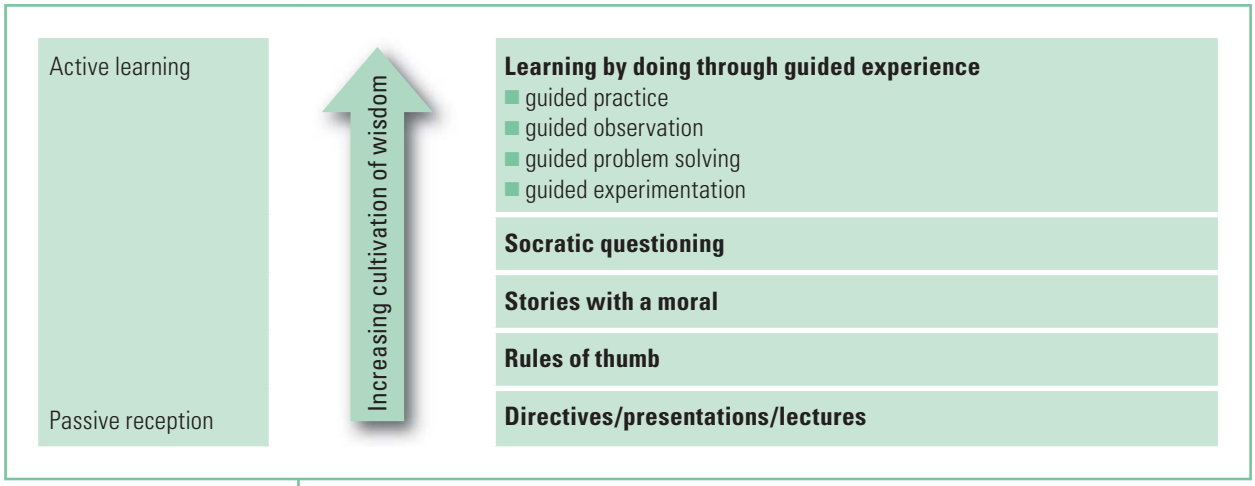
According to Skinner, another learning theorist, the development of professional skills cannot be left to chance but requires comprehensive formal instruction, preferably on a one-on-one basis.[41]

Unfortunately, in local government if there are experienced senior staff, they are run off their feet and do not have time to slow down and train graduates, let alone spend more time helping those who are not career ready build their missing blocks. Where there are no senior

Figure 3.13 The development of the engineering professional in training



Source: Christian Schumann



Source: *Deep smarts*

Figure 3.14 Modes of knowledge transfer

staff, no training can take place. Therefore, although many young technical professionals may be found in local government they are not able to make a significant contribution to sustainable service delivery, due to a lack of adequate supervision and hence training. This finding is not limited to the work of ENERGYS but has been witnessed in many programmes.

An insightful quote from a 2005 report stated as follows:[42]

> *Capacity building interventions should not be 'one size fits all' … but tailored to address individual needs … individual on-the-job training should be continued to embed knowledge.*

CONCLUSIONS

This chapter certainly leaves one feeling depressed. Local government appears to be the playground of opportunists. There are vacuums where formal structures once existed and overbearing structures and policies where previously there was relative freedom of selection and decision making. Service delivery, and worst of all, the poor, are the ones to suffer.

Engineering is a complex science. Engineering services cannot be effectively conceived, designed or delivered without experienced engineers. Effective engineering decisions cannot be made without experienced engineers. Engineering processes and systems cannot be developed or managed effectively without experienced engineers. Young engineering personnel cannot be trained effectively without experienced engineers.

One can only take heart from the experiences in Britain in the 1970s.[43] At this time, the dream of amalgamation and the efficiencies of economies of scale were being followed. Many small local authorities were merged to form corporate structures, policy was divorced from implementation and politicians were expected to set targets for their officials and to monitor their implementation.

> *However, politicians largely ignored their strategic responsibilities and got involved in bread and butter issues.*

Such was the chaos and empire building that most of the authorities who instituted large-scale restructuring largely abandoned it a few years later. In more recent times

it has been found that by decentralising further, setting up local offices, having local budgets and being responsive to local needs, communities have been revived. South Africa has only recently embarked on the earlier British model and urgently needs to look critically at the current structures, powers and functions in order to start effecting meaningful change to deliver sustainable solutions. This may very well require adopting some of the approaches of the past, which served the established communities very well. Says P S Reddy:[44]

> *The pendulum will continue to swing. At some time in the future it will be realised that a patchwork of competing providers may not be the best way of providing public services … that [new systems] can be just as prone to favouritism and lack of responsiveness as those they replaced … that dignified, consistent and democratically accountable structures may well be more effective vehicles for provision of local services.*

RECOMMENDATIONS

A major campaign to recruit experienced civil engineering personnel should be mounted nationwide. Control should be relaxed and authority returned to those able to make meaningful decisions.

Part III will look at practical solutions to the concerning vacuums we currently experience in leadership, skills and service delivery.

There are vacuums where formal structures once existed and overbearing structures and policies where previously there was relative freedom of selection and decision making. Service delivery, and worst of all, the poor, are the ones to suffer

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CHAPTER 4

The consequences of reduced engineering capacity

As municipalities pursue the eradication of backlogs in basic services, concerns are emerging over the deterioration of existing infrastructure and the sustainability of the new infrastructure being built.[1]

4.1 SERVICE DELIVERY

Before discussing the consequences of reduced engineering capacity, reduced capital, and reduced operations and maintenance (O&M) expenditure, it is necessary to consider the scope of service delivery.

4.1.1 Municipal infrastructure

In South Africa[2] municipal infrastructure covers:

- Water supply
- Sanitation
- Roads, street lighting and stormwater drainage
- Solid waste disposal
- Electricity supply
- Community facilities and administration buildings

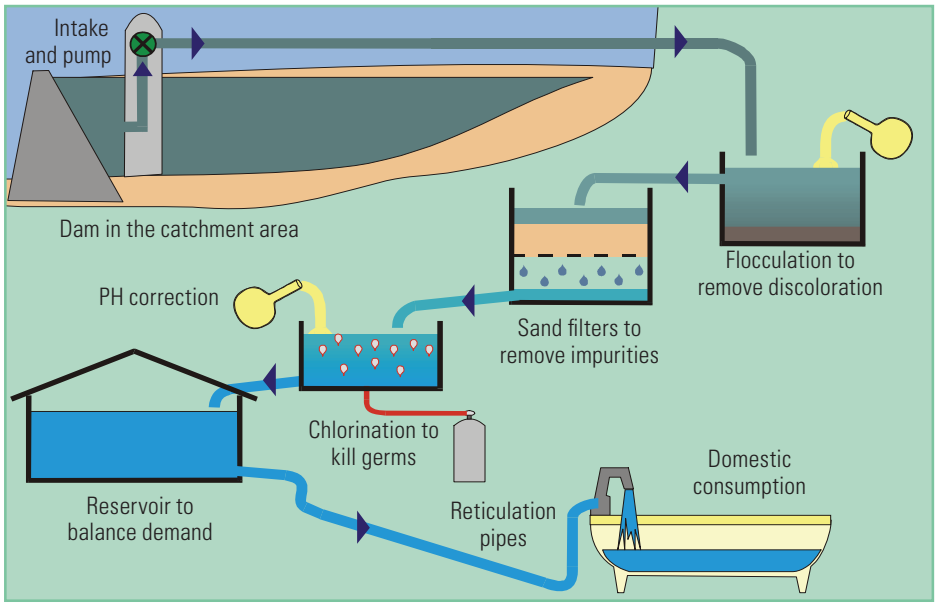


Figure 4.1 Water supply process, including bulk supply required to service end user

Considering this infrastructure in more detail it typically includes the pipes, pumping installations and ancillary control equipment, reservoirs, treatment works, electrical installations and transmission lines, streetlights, fixed electro-mechanical equipment, roads, traffic signs, channels, kerbing, stormwater catch pits, municipal buildings, equipment in parks, sports fields and facilities and even information and direction signs, to mention but a few. These items qualify to appear in the municipal asset register of immovable assets.

Of importance too is access to or the supply of bulk infrastructure, which is essential for sustainable service delivery. Bulk infrastructure includes dams, boreholes, treatment works, reservoirs, ring roads, power stations and high-voltage lines, all of which are necessary to ensure that there is adequate capacity to meet all end user requirements. Figure 4.1 shows a simplistic supply process for domestic water consumption. By adding more and more households without increasing the bulk water supply (in this case dictated by the size of the dam), pressure will drop and taps could even run dry.

Success story – housing in Mogale

When the ENERGYS team joined Mogale, one of biggest backlogs was in respect of housing. Many projects had been mooted, but the many challenges faced when developing housing beset these projects, including planning, provision of bulk infrastructure, availability and transfer of land, and availability and releasing of funding.

During 2006/2007 financial year, a great deal of preliminary and planning effort, under the leadership of an ENERGYS engineer, went into getting a number of flagship housing projects to the implementation stage. These projects included:

- The Kagiso-Azaadville node development project, undertaken as an integral part of the financial charter with the banking fraternity. This project will deliver between 6 000 and 9 000 housing units from 2007 to 2010, at a cost of between R700 million and R1 billion
- The Munsieville urban renewal project, which will provide an additional 2 500 housing units between 2007 and 2009
- A housing development comprising some 740 housing units in Sinqobile in Kagiso. This project will be completed in 2007
- Two projects in Rietvallei (Ext 3 and Ext 5) that will provide a total of 1 145 housing units. These projects will also be completed in 2007. The sites already have toilet structures and these have to be incorporated into the new dwellings

A number of other housing projects are in the planning phase and will be implemented from 2008, resulting in a housing stock increase of 23 000 units over a seven-year period. An important feature of these projects is that comprehensive forward planning will ensure that bulk and local services will be in place prior to construction of housing. Occupation of the units will be seamless, which will ensure that there is no vandalism of the assets or illegal occupations. The result is that professional, technical and political integrity will prevail.

4.1.2 Municipal services

Municipal services, on the other hand, are the commodities provided by the municipality for the use or enjoyment of residents and other consumers, in accordance with their needs.

Services include not only the measurable physical commodities, such as water and energy, but also the intangible commodities, such as workspace, transportation and light. Services even include safety, leisure, recreation, urban design and layout, hygiene, wellness and dignity.

Thus defined, it is recognised that levels of services are often qualitative, as opposed to the quantitative parameters used when measuring the backlogs in water, energy and housing. Thus interpreted, the constitutional requirement, section 152(b), which calls for:

… the provision of services to communities in a sustainable manner …

implies that residents shall have access to quality services. In other words, we need to deliver quality services to residents, failing which the constitutional obligation of local government cannot be honoured.

4.1.3 Infrastructure and services management

Infrastructure and services management would include operational planning, the issuance of O&M directives, resources management, optimisation of resources, operational procedures, budget control and quality control.

Although infrastructure may have been installed, if these components are neglected or are missing altogether, consumers will still not be receiving adequate services.

Sadly, in the rush to address the backlog in basic services, the fundamental responsibility of municipalities has been neglected in that few are now able to render ongoing services to all consumers. Whilst there may be initial euphoria at receiving a house, the dream of living in dignity will not be realised if:

- It is without water, sanitation or electricity
- It is without access to schools, job opportunities or products due to impassable roads
- Refuse is not removed due to lack of manpower or vehicles
- Health and safety is threatened due to poor quality water, sewage spills, flooding, etc

The trend of employing inexperienced technical or non-technical management results in little or no direction, and offers little or no quality control. This has given rise to many problems which require urgent attention, including:

- Loss of institutional knowledge
- Lack of planning or town planning control
- Uncoordinated housing developments
- Lack of budget for technical activities other than from the municipal infrastructure grant (MIG)
- Decisions generally not being made
- Projects not being issued to consultants to initiate or manage
- Inability to manage service providers
- MIG funds not being spent
- O&M not taking place

Several of these were covered in the previous chapter. The balance will be covered in more detail below.

4.2 LOSS OF INSTITUTIONAL KNOWLEDGE

Chapter 3 dealt extensively with the loss of data, technical history and experienced civil engineering staff since the late eighties. This dearth of knowledge and experience has resulted in many planning and O&M problems. For instance, when inspecting sewer pipes, precautions should be taken in case of hazardous gases. Where this is known only to those who have left the municipality, there is a real danger that new staff, who have never been involved in pipe inspections, could be overcome by gas, or worse, lose their lives.

Documenting of underground fire hydrant positions is another area that requires urgent attention as new employees simply do not know where the hydrants are. As a result, buildings have been razed to the ground before the hydrant could be located!

To recover from the above situation it is essential that:

- Records are rebuilt, by trying to locate existing data and interviewing employees who have retired
- Existing infrastructure is located and recorded where data gaps exist
- Data for all new projects is handed over to municipalities on completion, in a predetermined format for inclusion in a GIS, the asset register and O&M systems

4.3 UNCOORDINATED HOUSING DEVELOPMENTS

At present, there is little coordination between municipalities and the departments responsible for rolling out housing projects funded by the Department of Housing (DOH). The DOH has targets in respect of the number of houses that must be delivered. Whilst infrastructure per house is usually covered by DOH funding, municipalities are often not consulted on the type of solution being delivered.

As with MIG, these projects should fall under the municipal manager (MM) and funds should be given to each municipality to appoint consultants, advisors or additional in-house staff to project manage these developments to the appropriate municipal standards. The increased O&M costs must attract commensurate income from the new owners, or from government in the case of indigents.

In drawing a comparison with the Gautrain project, some housing projects at the height of rollout will be spending about a fifth of the daily figure that will be spent on Gautrain. The Gautrain custodian, Gautrans, has some 70 technical staff to advise and direct the large team appointed by the Concessionaire during the design and construction phase. In addition, the Independent Certifier is composed of a large professional team who review and certify all work. Few municipalities have any technical staff representing their interests or checking work carried out, and most are extremely concerned about quality and the impact that the lack thereof will have on the long-term viability of projects.

4.4 NEW WORKS

4.4.1 Quality control of service providers

National Treasury has expressed the desire to get a 'bang for [its] bucks'. Assessing a number of projects at the outset of the ENERGYS project, the engineers confirmed that the department was indeed getting a 'bang for its bucks' but it was not quite what they had in mind. The 'bang' related more to money going up in smoke than value for money! This is due largely to the rush to spend MIG funds, inadequate designs, project management unit (PMU) and consulting staff not carrying out site supervision, and inadequate service providers being appointed.

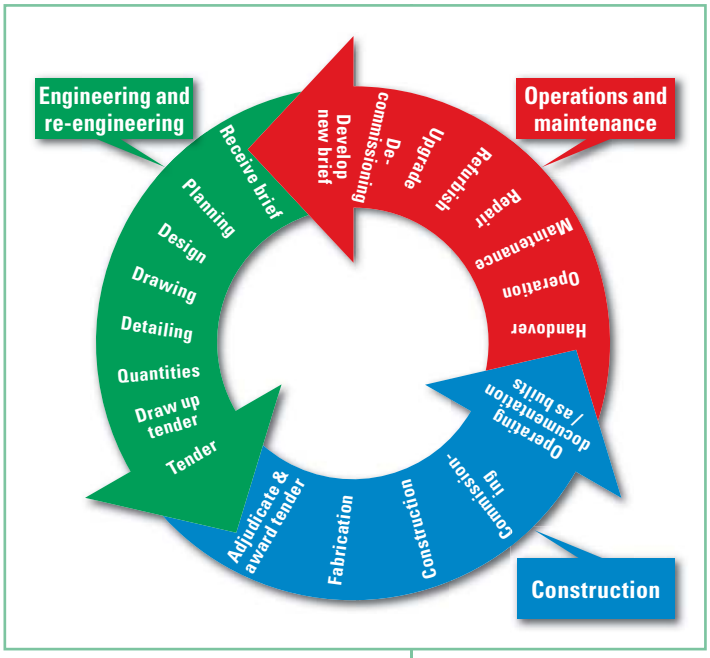
4.4.2 Qualifications and experience

The types of qualification and levels of experience must be considered to understand the problem. Becoming a registered engineering professional is a lengthy process.

(a) Engineers

A basic engineering degree takes four years, but owing to the complexity and volume of work, only a small percentage of students complete this course in four years. The majority take five years. In view of recognising the volume and complexity of content, the official duration of the basic degree has been extended to five years in many countries.

After qualifying the engineer is expected to work for three to four years before he or she can be considered for registration as a professional engineer with the Engineering Council of South Africa (ECSA). This workplace training phase can take many years if the graduate has inadequate workplace coaching and is not exposed to the full project cycle. (See Figure 4.2.)



Source: *Numbers & needs*

Figure 4.2 The project cycle

Having registered the engineer is then able to practise on his or her own, but this registration is still considered inadequate by the international community, who call for a minimum of seven years' experience before registration will be recognised and accepted by the Engineer's Mobility Forum (EMF) countries. The extremely detailed theoretical training of engineers (see Figure 4.3 on p 130) equips experienced engineers to handle the most complex of tasks.

(b) Technicians

The technician qualifies with a national diploma after two years' theoretical training (see Figure 4.3 on p 130) at a university of technology and one year's experience in the workplace. The theoretical component is designed to allow the technician to play a support role in a professional team where his duties will be defined by an experienced technologist (see (c) below) or engineer.

Professional registration as a technician requires a minimum of three years' post-graduate workplace experience under the supervision of an experienced registered professional.

Unfortunately, many young technicians and further education and training (FET) graduates with little or no supervised experience are setting themselves up as consultants and contractors. The complexity of the engineering process is such that without the required mix of the academic and workplace skills, projects are sure to fail.

(c) Technologists

A qualified technician who wants to specialise in a field of his choosing, for instance water and sanitation, or roads and transport, or structures, can register for a BTech degree upon completion of two years' workplace experience as a technician. The BTech course is structured so that students can either study full time over one year, or over two years while working full time and attending just a few lectures per week, or by taking study leave and attending four or six blocks per annum. Upon completion of the BTech course, the technologist is expected to gain

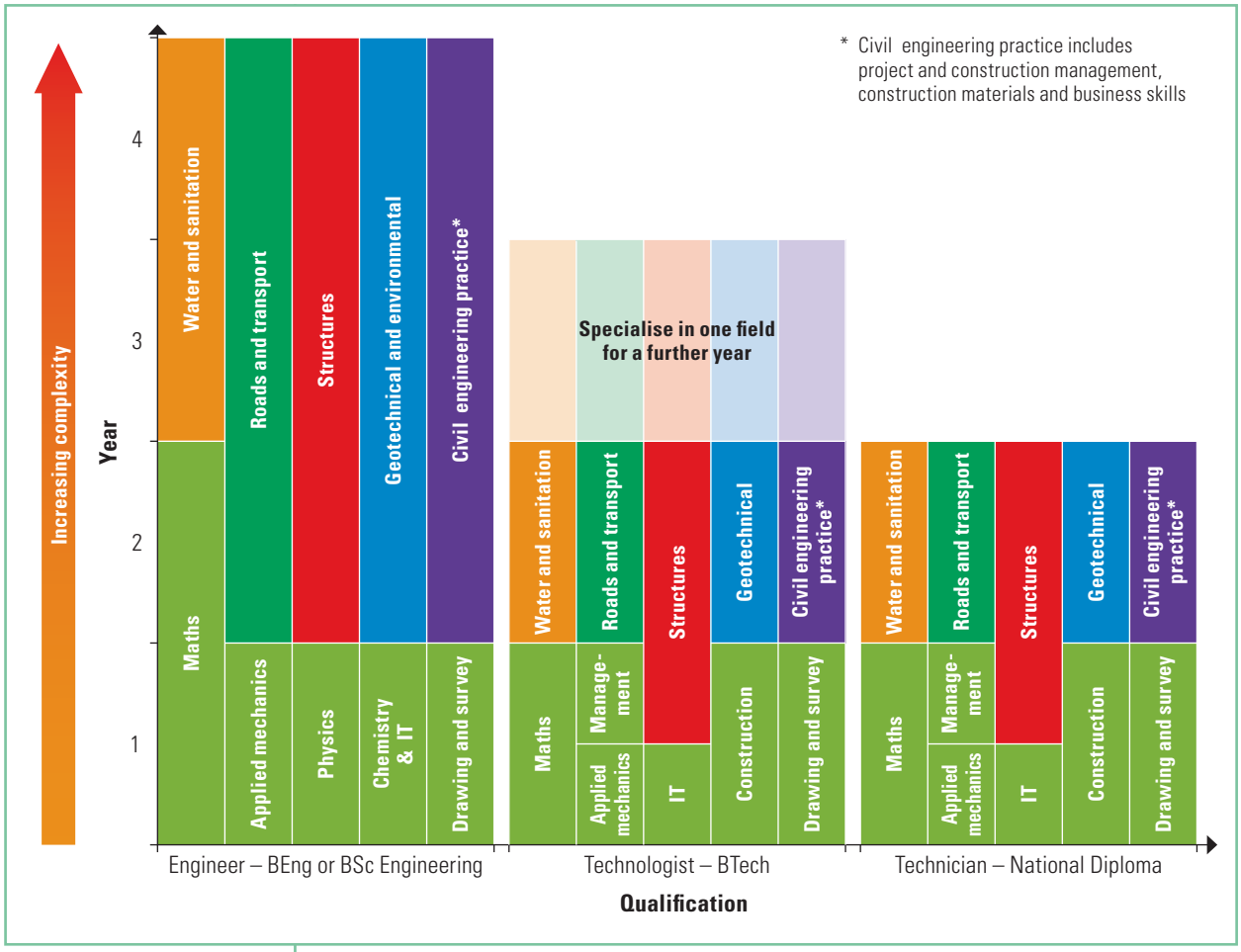


Figure 4.3 Theoretical content of civil engineering qualifications

at least three years' workplace experience before he can register as a professional technologist. Having specialised in his chosen field of study, the technologist is capable of handling complex work in this field or broadly defined tasks in other disciplines within civil engineering.

4.4.3 Professional registration in the engineering profession

The Engineering Professions Act 2000 (Act 46 of 2000), clearly defines who may or may not take responsibility for engineering work. Section 18(3) states that:

> *A person may practice in a consulting capacity in the category in which he or she is registered.*

Section 18(4) proceeds to explain that:

> *A person who is registered in the category of candidate must perform work in the engineering profession only under the supervision and control of a professional.*

Ignoring the above in making appointments has cost local government dearly as will be seen in the next sections.

4.4.4 Consultants

Of major concern has been the number of projects for which there are inadequate and, at times, no designs, drawings, geotechnical investigations, material tests, environmental impact assessments and approvals from the Department of Environmental Affairs and Tourism (DEAT), clearances from the Department of Water Affairs and Forestry (DWAF), etc.

On investigation it has been found that a limited number of small consultants employ or appoint registered engineering professionals, have experience in the field for which they are appointed, or are members of recognised bodies such as SAACE or SABTACO. In the case of structures, few consultants were found to have obtained a signature from a structural engineer, who is responsible for structures in terms of the Occupational Health and Safety Act and the National Building Regulations. The result has been many failures or potential failures for which remedial action is now being taken. Design failures occur across the globe as can be seen from the UK experience in Figure 4.4. In South Africa it is the frequency with which failures occur that is cause for great concern.

Experiences of inadequate consulting that need to be rooted out have been submitted by many parties, including conscientious emerging consultants and contractors. Such practices promote unfair competition and as such they are particularly harmful to *bona fide* emerging companies since they impact on these companies' ability to grow.

Whilst one may point fingers at opportunists who offer their services for projects that fall outside the scope of their abilities, one must also look at the supply chain process and the level of understanding of in-house staff who award projects. As has been outlined, in many cases there is only a sketchy scope of works, designs and prices are not critically reviewed and progress is not monitored.

This type of 'quick and dirty' approach, which omits critical steps such as planning, design and giving consideration to the use of local labour, has been widely adopted in the rush to spend MIG funds before the annual March deadline.

Many other 'standard' solutions, such as low-level bridges, oxidation ponds, irrigation schemes and pipe networks, have been copied from drawings of existing projects without any understanding of the design parameters associated with the existing projects.

Two thousand years ago the public understood the parable of the foolish man who built his house on sand versus the wise man who built his house on rock. However, in the 21st century this principle has been lost. 'Standard' structures have been constructed on sandy material and are in danger of being swept away by the first heavy rains. Also, variations in spans, hydrological and geological conditions per site are not taken into account, which often renders such solutions unsafe.

In a significant portion of the 70 or more municipalities in which the ENERGYS teams have been involved, at least one project has posed a problem because of poor or no design, but in

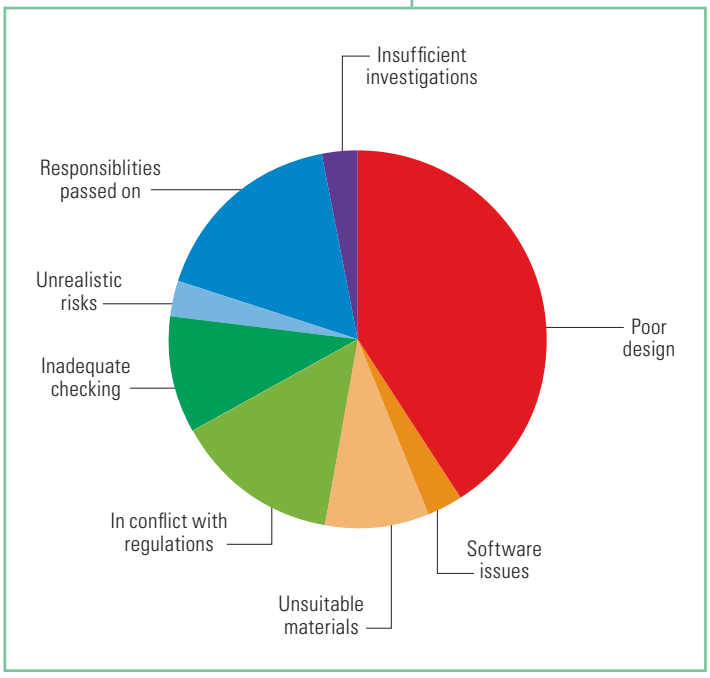


Figure 4.4 Causes of structural failures due to weaknesses in the design phase in the UK

Source: *The Structural Engineer*

Figure 4.5 Inadequately lined pit

many cases several jobs have had to be stopped or redesigned.

It seems impossible that there are no designs or drawings, but in the case of gravel road construction, for instance, contractors have been shown where the start and end points of a road should be and then left to their own devices to bulldoze a path through the veld or bush! With no drainage, base or gravelling details, the final product is nothing more than a wide path which, after the first summer rains, becomes a wide, muddy, impassable path! (See inset.)

Other typical problems encountered include:

- Inadequate water and sanitation designs causing early failure of the systems. A range of problems have been identified, such as:
  - Perforated pipes being laid in sandy conditions without being surrounded by geotextiles – they block within weeks of being laid
  - Pipes being laid directly below the surface with no bedding or cover – they are broken after the first vehicle drives across them (See Figure 4.6.)
  - Pipes being laid at an inadequate gradient – they block very quickly
  - Pipes being too shallow or too deep to connect to the houses that they are serving
  - Long lengths of water pipes being laid without air valves – chronic water hammer soon has the pipes lifting out of the ground
  - Outfalls being inadequately anchored and popping up after heavy rains or tides soon after handover
  - Manholes being spaced at 300 to 500 metres, making cleaning and maintenance very difficult
  - Manholes being inadequately sized for a 'man' to enter for inspection

The problem of poorly designed roads

The 'new' road shown here was constructed in 2005. On completion it was possible to travel at 80 km/h. However, due to no specifications, poor material selection and no drainage it was in a state of disrepair within 12 months, as can be seen from these photos taken early in 2006. The community has reverted to using the original route (shown on the left of the picture on the right), which though also in poor condition offers a more comfortable ride!

- Irrigation networks being installed where the water table varies greatly and requires an impractical amount of pumping when low levels are reached
- Water networks being designed without pumps when the supply is at a lower elevation – hence taps are dry at all households above the reservoir level
- Water-borne sewerage networks being installed where there are no water supplies to connect to toilets
- Boreholes being sunk in areas of high radioactivity, which renders the water unusable – this is common in certain granites and shales as a result of the presence of radon and of course in areas with uranium deposits

Figure 4.6 Pipe laid too close to the surface

- Road design problems, including:
  - Roads being graded without any design specifications or drawings – they are often too steep and erode quickly
  - Roads being designed without any drains
  - Any available material being used for gravelling. The use of clay material in many instances has rendered new roads impassable after the first heavy rains
  - Roads not being sited in the correct place in relation to contour plans and river crossings (sometimes as a result of communities making demands on the contractor after he has moved onto site – see Figure 4.7)
  - Road design not matching the budget hence projects cannot be completed
  - Road signs being inadequately positioned, sized or placed
- Inadequate solid waste sites being chosen or inadequate preparation, which results in:
  - Contamination of ground water
  - Collapse of the site
  - Excessive heat generation and the risk of fire, etc

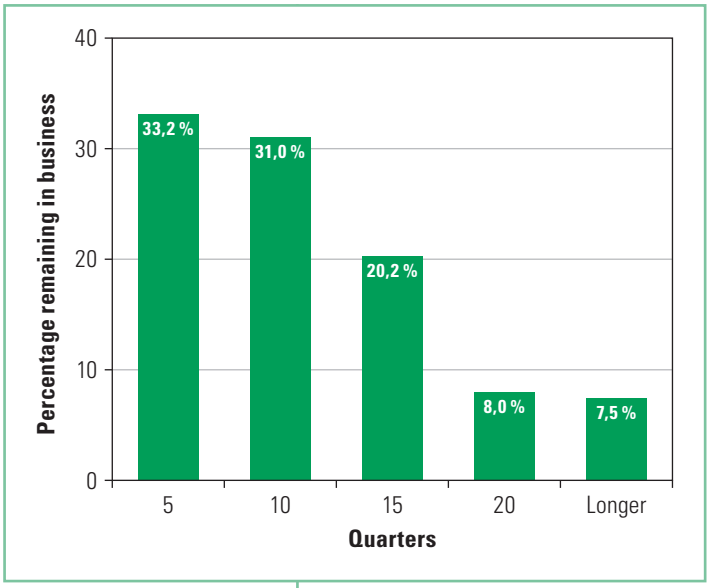
Figure 4.7 Householder fences off the road to prevent traffic from passing and requests that a new road be graded some distance away

An informed client is key to ensuring that adequate scopes of works are developed and practical and sustainable designs are executed. This requires oversight by experienced engineering professionals.

It is essential that companies are appointed based on experience in the field, the size and complexity of the project and the expertise of the principals.

4.4.5 Contractors

A research project carried out by the South African Federation of Civil Engineering Contractors (SAFCEC) in 2002 showed that 65% of emerging



Source: SAFCEC

Figure 4.8 Life span of civil engineering contractors, 1996–2002

contractors had not survived beyond 18 months in business and only 8% were still in business after five years. (See Figure 4.8.)

Interviewing the owners of today's long-established contractors it was found that most of these companies were started by professional engineers who had had a minimum of ten years' experience working for one of the major contracting companies prior to starting their own businesses.

The Construction Industry Development Board (CIDB) was established to provide control mechanisms in respect of appointing contractors with requisite experience and expertise to handle public funds and to offer support in all aspects of service provision. The CIDB website[3] offers a wealth of knowledge, toolkits and guidance on planning and delivering infrastructure. (There is an urgent need to implement similar support and control mechanisms for the appointment of consultants.)

Unfortunately the public sector and, in particular, local government is not yet geared up to meet the requirements of the CIDB, and unregistered contractors continue to be appointed. Many such contractors do not know of, or understand, conditions of contracts, codes of practice, norms and standards or the various Acts with which they must comply.

Contracting practices that are of major concern include:

- Poor quality of workmanship including:
  - Failure of brickwork and concrete work
  - Inadequate compaction
  - Inferior material selection
  - Non-adherence to specifications

Success story – students participate in Women's Build

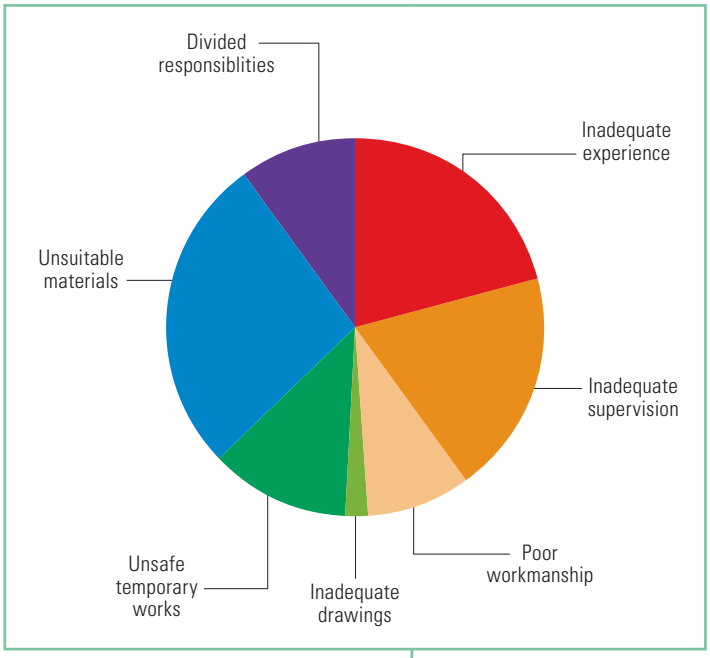
From the 14 to 18 August 2006 female students in Gauteng participated in 'Women's Build' 2006. The students learnt a lot and commented as follows:

During the course of the five days of the project I learned that building is not all about having completed the job, but also thinking about the people [who] will be using the structure on a daily basis.

I would recommend that the NHBRC [National Home Builders Registration Council] insist on contractors keeping plans on site. This will enable anyone coming to inspect the buildings to check that the contractors are doing the right thing – building quality houses.

– Carolyn Maphanda, Randfontein LM

- Slow progress due to poor discipline resulting in labour working only sporadically or very slowly
- Not attending site meetings
- Few projects having site offices or any drawings on site for inspection by consulting engineers or municipal project management staff
- Slow progress due to cash flow limitations, and restricted access to materials, equipment and experienced artisans
- Poorly managed or no material yards or stores resulting in losses and the inability to complete projects
- Unwillingness to take instructions to attend to problems that must be remedied
- Lack of safety equipment



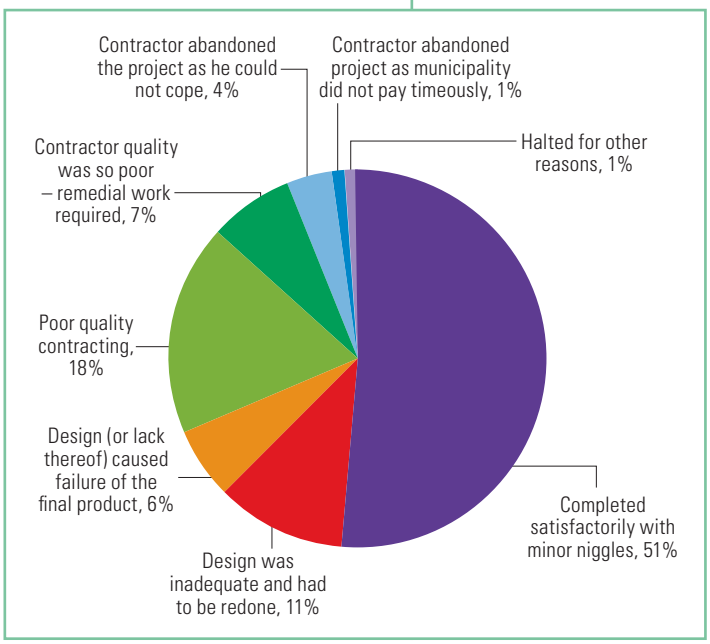
Source: *The Structural Engineer*

Figure 4.9 Causes of structural engineering construction failures in the UK

Using inexperienced contractors has in many cases resulted in fruitless expenditure of tax payers' money. In some cases workmanship and progress have been so poor that contracts had to be cancelled. Projects thus end up being very costly since replacement contractors must be found to complete the work and, in addition, often have to demolish what had previously been paid for and 'completed'.

Research in the UK yielded a range of causes for construction failures (see Figure 4.9). A questionnaire sent to municipalities early in 2007 yielded the results given in Figure 4.10. Only 51% of projects were completed satisfactorily. In 17% of projects significant additional expenditure was required for remedial work that had to be undertaken because of poor consulting or contracting, or because contractors had abandoned projects. Whilst many of the problems seem similar to those identified in the UK, it is the quantum of poor performance that is of extreme concern. Since only 51% of projects are completed satisfactorily vast sums of money are being lost or wasted which could rather have contributed to further development.

Figure 4.10 Project assessments in responding municipalities, 2007



Furthermore, inexperienced contractors place a huge burden on consultants or municipal engineering staff who are responsible for their performance. Where an inexperienced principal or, worse still, when an unqualified principal with no technical background, no bank account and no driving license is appointed, the supervising engineer becomes preoccupied with spoon-feeding and monitoring to the point of practically running the contracting business instead of attending to his own duties. This spoon-feeding and close monitoring carry no compensation,

which impacts significantly on the income potential of consultants, or workload of municipal staff, not to mention their frustration levels. Where an inexperienced contractor is monitored by an inexperienced consultant or municipal employee, even worse problems ensue.

When analysing problem projects, it was found that:

- Few letters of appointments were in place or signed
- Many consultants could not produce monthly site measurements indicating actual work done
- Very few payment certificates had supporting documentation for work carried out by others, for example materials delivered to site or laboratory testing

Success story – civic centre completed in Bushbuckridge

When the ENERGYS team commenced work in Bushbuckridge in March 2006 the development of the civic centre was way behind schedule, due to among other things inadequate contractor supervision, cost overruns because of inadequate soil investigations and the need to carry out vastly extended earthworks, and payment delays. Under direction of the ENERGYS engineer, the cash flow issue was addressed and supervision was put in place to ensure ongoing development. The staff of Bushbuckridge have finally been able to move out of the very cramped conditions in Mkuhlulu to occupy their spacious new offices.

Slow progress in early 2006

Progress with council chamber

Civic centre nearing completion

Council chamber officially opened by the Executive Mayor on 31 August 2007

- Many certificates submitted were signed off and paid without site inspections to confirm compliance
- Contractors acceded to community demands to move or omit many critical elements, such as stormwater or side throw-out drains. The worst instance of community interference was the re-siting of a bridge to suit a householder. As a result there was insufficient material and budget to cover the increased length of the bridge.

Clearly, experienced engineers are needed to adjudicate solutions and monitor progress on site to ensure that the current phenomenon of fruitless expenditure is reversed.

As site work is valuable experience for students and young graduates, large-scale deployment of these young people paired with seniors is critical for accelerated, but quality, service delivery. Without daily checks on work done, enforcing quality, or ringing the alarm bells early on when problems are identified, the delays and poor quality service delivery described will continue.

In municipalities where seniors have taught students and graduates what to check for daily, what tests to carry out, what results to expect, and how to measure quantities for purposes of checking monthly claims, work has progressed smoothly. Such projects have generally been completed on time and within budget, or the contractors have been replaced early on, to allow more capable companies to handle projects efficiently.

Another vexing problem is the tendency of inexperienced contractors to befriend ward councillors and community-based liaison officers who then pressurise technical staff into accepting inferior work, modified designs, or agree to make inflated payments.

4.5 OPERATIONS AND MAINTENANCE

The drive to deliver basic infrastructure has been conducted largely at the expense of O&M.

The shortage of technical staff has meant that where staff are available their energies have been devoted to MIG expenditure. Any funding available for infrastructure has gone towards counter-funding, that is top-up funding where MIG is inadequate for service delivery above basic service levels.

The result is that without performing activities described in Table 4.1 on p 138 backlogs are being created rather than addressed as plant becomes dysfunctional and expensive assets are prematurely reaching the end of their useful life. This the country cannot afford. Several issues requiring attention are discussed below.

4.5.1 Operations

The restriction of a 6% year-on-year increase on operational budgets presents a problem when supplies and materials (particularly imported goods) increase beyond these levels each year. A contingency amount needs to be set aside for unexpected breakdowns and purchasing supplies that have increased beyond 6%. Such increases may result from changes in supply costs, but in very wet years, for example, heavier dousing and therefore more chemicals are required than in dry years. Municipalities cannot for instance afford to be without chlorine for the last month of the financial year due to rigid application of the MFMA.

Water and effluent quality in particular are a major problem. Poor quality generally relates to poor operations or maintenance. Problems with *E. coli* contamination, excessive sediment/solids, etc have been reported in several municipalities.

Municipalities should be employing suitably qualified people to ensure that adequate testing and treatment take place and appropriate chemicals are always available.

Table 4.1 Maintenance activities

Water	Sanitation	Roads, stormwater and bridges
Pipes, connections and meters ■ Fix or replace fractured, burst, leaking or old pipes ■ Removes rust and scale from pipes and fittings ■ Pressure test and sterilise mains after repair ■ Attend to complaints re low pressure ■ Install or remove connections and meters ■ Repair or replace faulty meters ■ Install and record new connections	**Pipes and manholes** ■ Clean, rod and flush pipes to clear or reduce blockages ■ Repair, upgrade and replace damaged or old pipes ■ Construct manholes, inspection chambers, silt traps, pipe bridges and syphons ■ Locate and maintain manholes and manhole covers ■ Install and record new connections	**Stormwater pipes, channels & culverts** ■ Clean, rod and flush pipes to clear or reduce blockages ■ Repair, upgrade or replace damaged or old pipes ■ Locate and maintain manholes and manhole covers ■ Desilt and clean catchpits, kerb inlets and channels
Water tankers ■ Dispatch water tanker drivers to delivery points ■ Ensure water tankers are operational	**Spillages and ingress** ■ Locate drainage infringements, sewage spills and seepage ■ Disinfect polluted areas after clearing blockages or spills ■ Measure night flows to detect leakages and ingress	**Address ponding** ■ Clear and reshape drainage ditches to remove stagnant water
Boreholes and hand pumps ■ Recalibrate, reline or repair pumps and motors ■ Fix or replace broken or faulty hand pumps	**Dry sanitation (consumer to pay)** ■ Clean soakaways ■ Empty conservancy, septic tanks and VIPs when full ■ Maintain and dispatch vacuum tankers	**Flood damage** ■ Reinstate drains, embankments, etc, and revegetate ■ Use stone pitching or gabions where appropriate ■ Repair culvert headwalls and outlets ■ Repair erosion and scour damage to gabions, stone pitching or side drain linings
Pumps, valves and hydrants ■ Monitor pump performance to ensure pumps are operating within pump curve ■ Clean out valve and hydrant chambers and repack glands ■ Maintain or replace faulty pumps, valves, hydrants and fittings ■ Examine and exercise gate valves, air valves and non-return valves on a regular basis ■ Ensure standby pumps and generators are available and functional ■ Adjust pumping to reservoirs according to demand	**Pumps and valves** ■ Monitor pump performance to ensure pumps are operating within pump curve ■ Clean out silt traps and rags from pump station screens ■ Maintain or replace faulty pumps and valves ■ Examine and exercise gate valves, air valves and non-return valves on a regular basis ■ Ensure standby pumps and generators are available and functional	**Gravel roads** ■ Operate, maintain and reinstate borrow pits ■ Clear and open all side drains and culverts ■ Check subgrade – recompact, stabilise, regravel and reshape, as appropriate
		Surfaced roads ■ Repair potholes, seal cracks, and patch ■ Maintain verges and medians ■ Fog spray and resurface – slurry seal, chip and spray or overlay ■ Layerwork or foundation failures: install subgrade drainage if necessary, mill and reinstate surfacing

Continued on page 140

(a) Enforcement

Until legislation relating to good practice is enforced, municipalities will not budget adequately for operating treatment plants. It is time that DWAF and other departments showed the same determination as their SARS counterparts in enforcing issues of compliance so critical to the health and well-being of communities. Similar control and penalties should be enforced in respect of inadequately managed waste sites.

In Europe compliance is fiercely enforced, to the extent that a Belgian mayor was recently jailed as a result of a fatal accident occurring at night at a poorly lit intersection. It was reasoned that he was ultimately responsible for adequate services and was found to be negligent by not safe-guarding the public. In South Africa enforcement on matters of service delivery would result in budgets being reprioritised to ensure adequate O&M.

4.5.2 Funding for maintenance

Whilst there is the notion that maintenance should be funded from the Equitable Share, this is an unconditional grant and after paying salaries and other overheads there is rarely anything left over for maintenance.

A component of this funding should be ring fenced, or a separate maintenance grant should be set aside, the results of which must be audited to ensure that the funding is indeed used for maintenance. An engineering corps could play a monitoring, evaluation and training role in this regard.

Limited or no maintenance in many areas is contributing to overall backlogs growing at a faster rate than the delivery of new basic services! We shall now look at the impact of limited O&M on the various disciplines in (a) to (e) below.

(a) Sewerage

In terms of distribution, where pipes are not cleared or are broken, blockages occur and sewage bubbles back into houses, or flows into streets, onto beaches and into other water courses.

Success story – students contribute to treatment plant operations in Ugu district municipality

Ugu DM has 19 sewerage and water treatment plants situated throughout its 100 km coastal extent. Eight students placed at Ugu were deployed to not only operate the plants, but to survey, sketch and develop operating procedures. In addition they were tasked to train new operators once they had been appointed as part of the district's HR development programme.

At a treatment works

Taking samples

Testing in the laboratory

Talking of her experience at the treatment works in Ugu, Zotha Cele, a student, says: 'I think it is a great opportunity in terms of in-service training, which does not come easily, and learning the ins and outs of becoming a future civil engineer.'

Continued from page 138

Water	Sanitation	Roads, stormwater and bridges
■ Install pressure reducing valves where high-pressure fluctuations occur ■ Inspect business premises to ensure fire mains are not used for purposes other than fire fighting	**Sewage treatment works** ■ Clean screens, conveyors, walkways, clarifiers, grit traps, motors, pumps and buildings ■ Test and adjust chlorine dosing to ensure disinfection of final effluent ■ Adjust clarifier inflow according to flow volumes to balance throughput ■ Sample and arrange testing of ground water pollution and monitor boreholes ■ Desludge primary and secondary settling tanks ■ Treat sludge in digesters or ponds and dispose of sludge within permit conditions ■ Sample and analyse inflow to determine strength and composition to adjust treatment process ■ Sample and analyse final effluent to determine compliance with permit requirements ■ Maintain standby pumps and generators to ensure that effluent is always treated and environment is not polluted	**Road markings** ■ Maintain speed and access control signage **Concrete and block roads** ■ Spray for weed control ■ Reseal joints **Bridges** ■ Repair bearings and joints – to be done by specialists ■ Maintain handrails and guardrails ■ Repair fill protection around abutments
Water purification works ■ Take samples, test and adjust purification process ■ Add flocculation agent to raw water, mix and settle. Desludge settling tanks and dispose of sludge ■ Clean water by filtration, dissolved air flotation or reverse osmosis ■ Maintain chlorinating plant and chlorinate final effluent to health requirements ■ Collect water in bulk storage for distribution. Maintain health and appearance requirements ■ Empty, scrub, disinfect reservoirs, water tanks, etc every 2 to 3 years		
Dams ■ Regulate release of raw water from storage dam ■ Repair fences and safety signage ■ Mow lawns, cut vegetation and repair roads	**Maturation ponds, sludge lagoons and drying beds** ■ Maintain perimeter fencing around ponds and lagoons – health hazard ■ Maintain safety signage and equipment (life buoys) ■ Remove bullrush growth and vegetation from banks, floating debris and settled solids	**Sidewalks and intersections** ■ Repair sidewalk settlements and surfacing defects ■ Maintain scoops and gutter bridges ■ Repair paving slabs, interlocking blocks and kerbs
Maintenance of structures, buildings and grounds ■ Fix spalling concrete on structures, paint buildings and repair roofs ■ Paint pipework in correct colours to show what is conveyed	**Maintenance of structures, buildings and grounds** ■ Fix spalling concrete on structures, paint buildings and repair roofs ■ Paint pipework in correct colours to show what is conveyed	**Reinstatement** ■ Sign and barricade repairs and replacements or additions ■ Repair road crossings after pipe repairs or cable laying activities

Continued on page 142

Success story – sewage spills addressed in Thulamahashe

Where attention has been given to maintenance, the outcomes have been most gratifying. In Bushbuckridge, where sewage spills were widely reported, DWAF facilitated the supply of Chinese pipes and funding was set aside to attend to the most acute problems. Broken and blocked pipes were replaced. Here we see the improved conditions in a home that had been adversely affected due to the blockage.

Sewage bubbling out in the back garden

Broken pipes being replaced

The back garden now dry and sewage free

The health impact of these occurrences is cause for extreme concern. In many instances sewage has been lying stagnant in streets for weeks if not months. Further, the quality of 'treated' effluent being released from treatment plants into rivers is often way below standard. The extent of these problems poses a far greater health risk than the bucket system that is currently being eradicated.

With regular inspections and cleaning programmes in place such problems would be identified and attended to long before they reach the conditions shown in the Figures 4.11 and 4.12.

(b) Potable water

Most, if not all South African municipalities are experiencing unacceptably high losses of potable water. Broken pipes, leaks and illegal connections are all symptoms that would be picked up if planned maintenance programmes were in place. The need to investigate and develop better control has never been greater, not only to save

Left: *Figure 4.11 Raw sewage lying in the street*

Right: *Figure 4.12 Pipes repaired to stop sewage from bubbling out of a manhole into the street*

Continued from page 140

Water	Sanitation	Roads, stormwater and bridges
■ Mow lawns, cut vegetation and repair roads ■ Repair fences and safety signage ■ Test lifting gear to legal requirements	■ Mow lawns, cut vegetation and repair roads ■ Repair fences and safety signage ■ Test lifting gear to legal requirements	■ Re-erect road signs and street furniture after repairs ■ Paint bollards, kerbing (bullnose and intersections) ■ Place temporary road signs, barriers and lane reflective delineators
Resources ■ Ensure adequate chemicals always available ■ Ensure stock and security of the emergency stores for after-hours repairs ■ Ensure adequate special equipment and parts ■ Ensure adequate plant and materials	**Resources** ■ Ensure adequate chemicals always available ■ Ensure stock and security of the emergency stores for after-hours repairs ■ Ensure adequate special equipment and parts ■ Ensure adequate plant and materials	**Resources** ■ Ensure adequate plant, equipment, materials and staff **Yellow machines** ■ Maintain road construction machinery by undertaking scheduled servicing and preventative maintenance inspections, including component wear by means of oil analysis
Vegetation control ■ Clear vegetation on pipeline tracks, trunk mains routes and at installations	**Vegetation control** ■ Clear sewer servitudes, sewer routes and waste stabilisation ponds of unwanted vegetation	**Vegetation control** ■ Clear vegetation in road reserves to maintain sight distance safety and keep drainage operational ■ Remove vegetation and other materials from stormwater catchpits
Communication ■ Prepare notices re water supply problems and distribute to the press and door to door	**Communication** ■ Prepare notices re sanitation problems and distribute to the press and door to door	**Communication** ■ Prepare notices re roads or stormwater related problems and distribute to the press and door to door

water, but in many instances to prevent roads from being destroyed as a result of waterlogged base layers.

A shocking consequence of no maintenance in some areas is the fact that taps are now dry. In one municipality a contractor was consequently appointed to deliver and sell water to those with no access to water. Selling at R48 per kilolitre, the poorest of the poor now find themselves paying eight to ten times the price charged in the major centres, where people are in a better position to pay for their services. Sadly, as with most irregularities in service delivery, it is the poorest of the poor who suffer most.

A ring-fenced fund needs to be made available for municipalities to initiate water loss control measures. In those municipalities with no technical capacity, a national team, dedicated to water demand and in fact to water cycle management as a whole, should intervene.

Success story – intersection upgraded in Randfontein

In Randfontein a major intersection giving access from the R28 to the industrial area and consisting of concrete paving blocks to accommodate heavy traffic was damaged extensively by severe abrasion caused by wheel/spillage interaction. The ENERGYS team issued and managed the tender and the project was completed in good time with the support of the students who were afforded the opportunity to do topographical survey, take measurements, calculate quantities and learn to apply specifications and contract rules.

Broken paving in intersection

New paving being laid

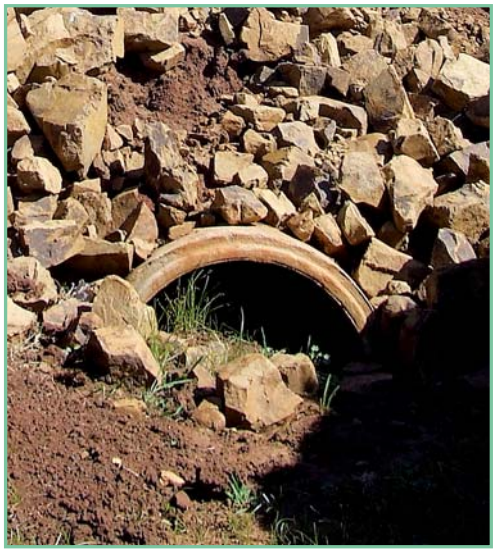
Joint under repair

The completed project

(c) Road maintenance

Road maintenance is emerging as another vexing problem nationwide (See Figure 4.13). For many years little has been budgeted for road maintenance. As a result roads are prematurely reaching the end of their useful lives. One senior lamented that we simply build to 'burn' our assets – in other words, assets are rendered useless soon after completion owing to neglect of basic maintenance. In many cases a well-managed intervention utilising labour from the community is all that is needed to keep drains clear, or grass and weeds from destroying valuable assets. (See Figure 4.14.)

The CEO of the National Roads Agency once explained that a large percentage of the major road repairs necessary after the 2000 and 2004 floods were shown to have resulted from blocked drains and roads that had not been maintained.



Left: *Figure 4.13 A road that had not been maintained for years. Residents had to park their cars at the end of the road*

Right: *Figure 4.14 Drain clearing urgently needed*

The state of many gravel roads in the country is now such that they are unusable, or become impassable for many weeks during the rainy season. As a result, people cannot get to work, children cannot get to school and farmers cannot get their produce to markets. A large percentage of our roads will soon be beyond repair. The Laffer curve, developed in the 1970s, is a great tool for assessing road conditions (see inset on p 145). If repairs are effected timeously, the costs are only a couple of percent per annum on average. If left to reach failure, complete replacement is required, that is, costs of more than 100% of the value of the asset, given that the existing road needs to be ripped up before reconstruction can begin. (Figures (a) and (b) in the inset on p 145 indicate costs and consequences of delayed maintenance.)

Planned maintenance programmes are essential to protect and maintain these very expensive assets; otherwise we are simply wasting the funds invested in them in the first place.

(d) Solid waste

Solid waste is another neglected area in terms of service delivery, and poses major health risks for those living near waste sites.

Few municipalities have staff with experience in managing, maintaining or developing waste sites. Many are unfenced, or are now sited too close to recently inhabited areas. Further, poor management also threatens underground water sources and wildlife, and contributes to air pollution.

There are so many technical issues to be attended to that the trend of moving solid waste from the engineering department to social services is questioned. Issues such as the management of:

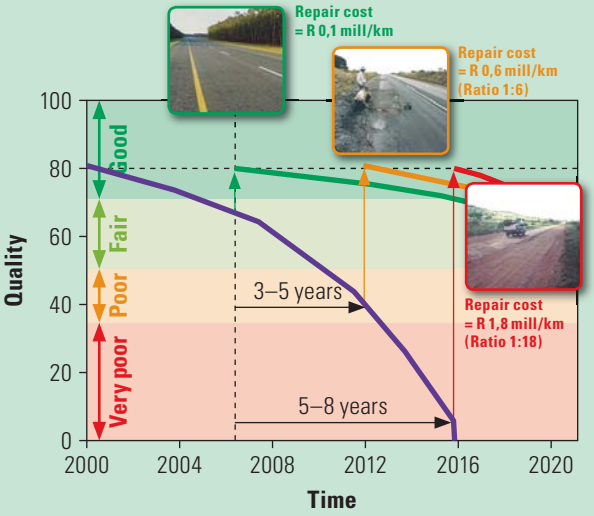
- Groundwater
- Leachate collection and removal requiring underliners, drains, etc
- Daily covering and regular compaction
- Drains and access road maintenance
- Gas levels
- Signage and security, including fencing and surveillance

The Laffer curve[4] – adapted for optimum road maintenance planning

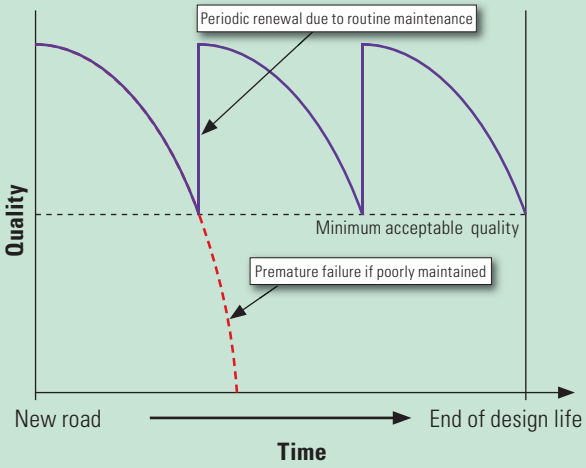
When Laffer, an advisor to the Reagan administration, launched his curve outlining the optimum level of taxation versus income, little did he realise that his concept would be applied to draw distinctions between long-run and short-run scenarios and costs in many disciplines,[5] including mountain rescue, student enrolment and road maintenance.

In the example below, if the road is restored five years after completion minimal cost is incurred. Thereafter, if it is restored every five years, repair costs will remain low. However another three to five years later (that is, initial repairs only take place after ten years), the costs increase six fold; if initial repairs are neglected for an additional five to eight years, the cost is a whopping 18 times the initial repair cost. If minor repairs are attended to as and when they are required, the renewal processes may extend the life of the asset for many years.

As indicated in Figure (b), an absence of adequate routine maintenance will lead to premature failure of the road way before the end of its intended design life.



(a) Cost of maintenance delay[6]



(b) Diagrammatic presentation of routine maintenance (periodic renewal) on a road[7]

■ Capping, rehabilitation, closure and post-closure care require ongoing attention. Indeed, the USA Environment Protection Agency (EPA) considers landfill sites to be:

> *… well-engineered facilities that are located, designed, operated, and monitored to ensure compliance with regulations.*[8]

Significant funds and controls are required to achieve an acceptable standard of waste management. Perhaps a national team should be appointed to oversee the development and control of waste sites in the many low-capacity municipalities.

(e) Buildings

Many buildings stand in tatters and cannot be used owing to lack of planned maintenance that has resulted in total neglect. The biggest enemy of any building is water. Attention needs to be paid to broken window panes, leaking roofs, toilets and taps to ensure that problems of decay are not exacerbated.

Keep the pumps going

When the ENERGYS engineers joined a Gauteng municipality, concern was expressed about the water supply and quality. On investigation it was found that two pumps had failed and were beyond repair due to a lack of maintenance whilst a third was running at very high temperatures. Should the faulty pump fail the municipality would run out of potable water, which it would then have to purchase from another source at R2 million a month. Two new pumps were purchased at a cost R700 000 and the faulty pump was refurbished, thus obviating the expensive alternative.

Lesson learnt – A maintenance team is essential at municipal level and must form an integral part of any successful operation. The one cannot exist without the other!

In many municipalities the importance of maintaining existing buildings and facilities is ignored in favour of more visible construction of new projects.

The condition of municipal buildings and facilities forms an integral component of the quality of life of the community. Apart from the municipal offices (where mayoral committees meet, most employees work, accounts are paid and numerous services are provided to the public), other facilities, such as bus ranks, taxi ranks, museums, markets, libraries, public toilets and community centres, also have to be considered.

Dilapidated and unhealthy buildings and facilities in a decaying environment depress the quality of life, attracts squatters, scavengers, vagrants, etc and can lead to antisocial behaviour.

The backlog of repair and maintenance work required to restore municipal buildings and facilities to minimal acceptable levels continues to grow at an alarming rate.

A universal maxim is that what we fail to repair now is going to cost double next year.

4.5.3 Funding to replace plant and equipment

As a result of little or no attention to O&M over a long period, plant and equipment are also in a poor state.

(a) Plant

Pumps, valves, filters and hydrants are failing, affecting not only water pressure, but also health and safety. Many ENERGYS engineers have had to roll their sleeves up and get busy with fixing pumps, clearing treatment works, dousing, etc! The inset entitled 'Keep the pumps going' emphasises the importance of ongoing plant maintenance.

(b) Fleets

Few municipalities have adequate fleets in working order. O&M and PMU staff cannot get to sites since there are no municipal bakkies, and so quality control goes by the board.

The fleet of waste collection vehicles is also fast diminishing, resulting in solid waste not being cleared from many areas. Much of the toyi-toyiing before the 2006 municipal elections related to poor conditions in existing townships rather than the lack of new service delivery.

The diminishing fleet of 'honey suckers' (vehicles for clearing conservancy tanks and removing night soil) poses an even greater health risk.

(c) 'Yellow machines'

Several billion rands worth of 'yellow machines' are required to restore roads. Whilst it is recognised that the private sector should be called upon to handle components of O&M, the rural nature of thousands of kilometres of roads means that few SMMEs in those areas could ever afford to own the value of equipment required to carry out these functions. Furthermore, supply chain management delays in employing contractors to carry out

repairs after floods, for instance, is such that further damage is caused to roads as a result of subsequent downpours on roads not yet repaired after previous storms.

In one municipality where there is only one grader left, it has been reported that the community follows the operator and threatens him with his life if he dares to take the grader any distance from their community, in case it does not come back to attend to their roads!

A spot survey amongst a small group of municipalities conducted in a couple of days before a reporting deadline found that in just seven municipalities (two DMs and five LMs) 33 graders, 19 TLBs (tractor, loader, backhoe), 28 tipper trucks plus water bowsers, rollers, compactors, etc were needed – at a total cost of some R135 million!

One district alone required R42 million worth of machinery to service 8 200 km of gravel roads. A very concerning extract from a report read:

> *The equipment presently in use dates from the early 1980s, including the eight graders still tottering on their last legs. Since 2001 fifty per cent of the gravel on these roads has been worn away. A huge infrastructure asset is being allowed to go to ruin. In this immense area only one mechanic is left to attend to the aches and pains of these venerable graders, water carts, rollers, caravans, trucks, tractors, etc. Local farmers are holding back on investment because of their concern about getting their produce to the markets over the fast-deteriorating roads, and tourism is suffering …*

The comments, as well as the small sample (see above) would seem to indicate that one or two billion rand needs to be spent on rebuilding construction fleets alone. As these machines are expensive, it is essential that they are well utilised and standing time should be kept to a minimum. Furthermore, quality machines that can be repaired locally should be purchased, rather than cheaper imports for which no parts and service facilities are available.

It is suggested that an expert unit be set up per province or region to own, maintain and schedule the use of equipment by the various local and district municipalities. The major civil engineering contractors have huge fleets with machines that are ten or twenty years old and still performing well. Their performance relates to superb planned maintenance with oil samples being taken every 250 hours to check the metal content. These yield an accurate assessment of internal wear and tear and pointers with regard to imminent maintenance needed to keep the vehicles in tip-top condition.

It is currently possible to hire 'yellow machines', but the cost of transport to remote municipalities is prohibitive, hence better planning and distribution of plant should be handled by civil servant teams of experienced plant operators.

The investment should be extended to upgrade the aging and failing fleets of garbage disposal vehicles, sanitation vehicles and vehicles required by the electricity department for

Figure 4.15 'Yellow machines' failing due to lack of maintenance and limited budgets

maintaining street-lighting (fondly known as cherry pickers), tractors, generators and the many other pieces of equipment required to ensure ongoing O&M.

4.5.4 Increased number of operations and maintenance staff

Clearly, much manpower is needed to operate plant, maintain pipes, pumps, valves, hydrants, roads and solid waste sites. It is essential that sufficient funds be made available for technical and O&M staff with appropriate competencies.

4.5.5 Operations and maintenance in general

As has been seen, maintenance has suffered greatly over the past years. Vehicle replacement and expansion of O&M investment are of paramount importance.

The lack of maintenance is impacting on health, safety, livelihoods and the country's ability to deliver products to local consumers and the international market. Indeed, a multi-national dairy product supplier recently advised an extensive farming community that it was no longer prepared to buy milk from the area since the roads were in such a poor state of repair that the cost of damage to their collection vehicles had become prohibitive. South Africa is currently experiencing milk shortages for various reasons. Such additional bottlenecks to supply cannot be tolerated.

Backlog figures in respect of O&M are urgently required. A ring-fenced support strategy needs to be developed to ensure that specific funds and resources are set aside to ensure that assets which have cost the country billions of rands are not rendered worthless. The authors of *Rural road maintenance*[9] capture the concept of wasted investment in Figure 4.16. In the South African context, this is known as fruitless expenditure, which is an offence! It is time that funds were utilised more effectively on routine maintenance as shown on the optimal pie in the figure. This would ensure maximum life span from infrastructure against minimum expenditure.

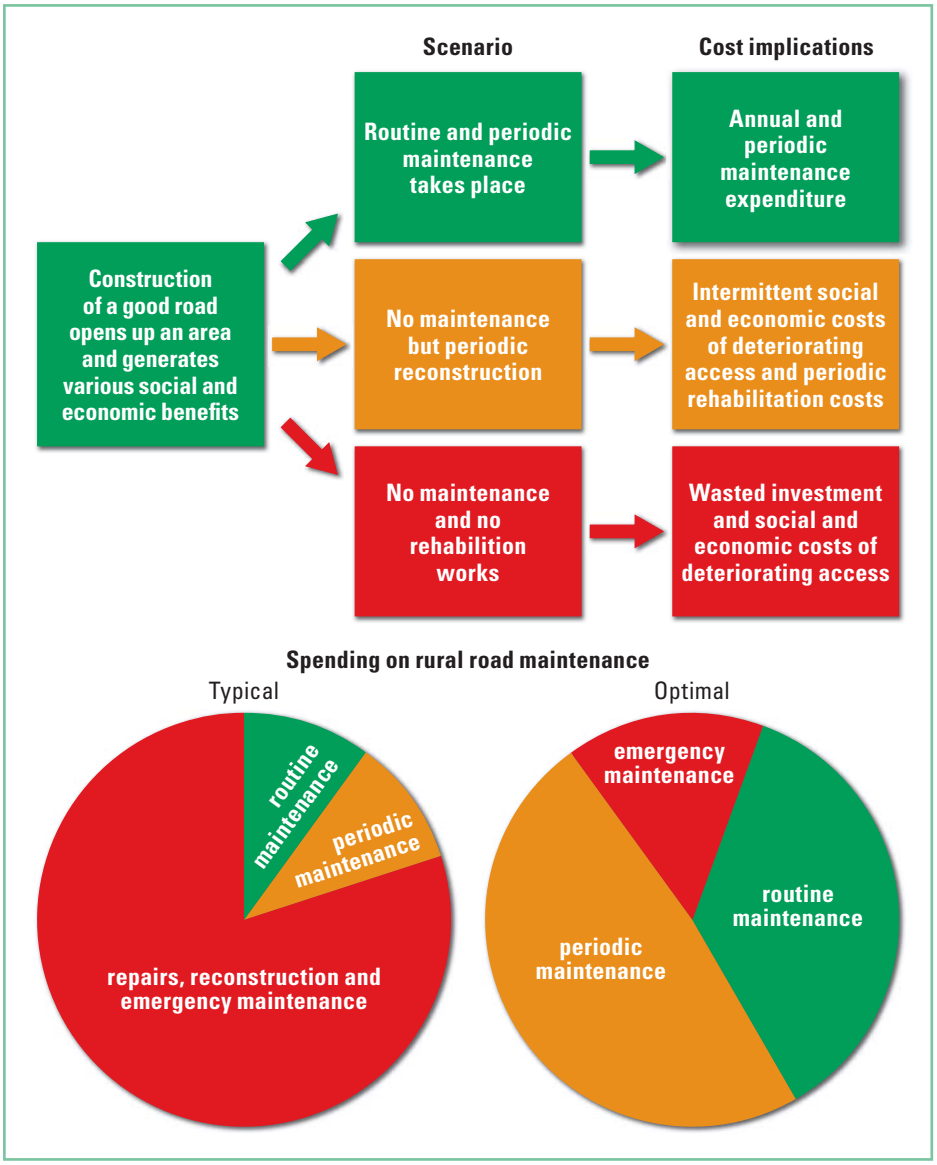
Several municipalities participating in the ENERGYS project are now drawing up reports to indicate the mismatch between requirements and actual funding being made

Success story – contamination addressed in Pearston, Eastern Cape

Pearston in the Blue Crane LM faced a problem of contaminated water supply. In an attempt to resolve the problem, standard procedures were followed to empty the reservoir, clean and disinfect it. After the reservoir had been refilled, it was found that contamination levels were unchanged. At this point it was decided to call on one of the ENERGYS engineers for assistance.

Investigation of the problem revealed that the reservoir situated on a koppie to ensure adequate water pressure was leaking. This leak gave rise to a massive (120 m by 30 m), well-saturated marshland that served as a drinking spot for local roaming animals. It was also determined that a borehole situated 70 m further downhill was the water source for the reservoir and was being fed from the contaminated water. With the leak fixed, the problem was solved.

Small town municipalities in South Africa with similar conditions, that is, a reservoir on a high koppie and a borehole in a lower lying area should regularly check their reservoirs and surrounds for leaks.



Source: *Rural road maintenance*

Figure 4.16 Maintenance scenarios and cost implications

available for maintenance. Their recommendations include replacing pipes, redesigning and upgrading various networks, upgrading or constructing new treatment works, repairing and upgrading pumps, as well as setting funds aside for employing local labour to carry out refurbishment, where appropriate.

The need for a massive national O&M campaign is not limited to South Africa. Following the recent collapse of a bridge in Minneapolis, the American Society of Civil Engineers (ASCE) reiterated the statement they made after issuing the 2005 infrastructure report card, as follows:[10]

> *We need to advocate for public policy action to make our country's infrastructure safer and sustainable for future generations. ASCE estimates that $1.6 trillion is needed over*

a five-year period to bring the nation's infrastructure to a good condition. Funds must be invested and significant steps must be made on the national level, as well as in state legislatures and local communities, to improve our nation's failing infrastructure.

ASCE is working closely with Congress to advance the National Infrastructure Improvement Act, S. 775, which was approved this week by the Senate but still must be passed by the House. This bill would establish a National Commission on Infrastructure to study deficiencies and make improvements to maximize economic growth in the United States.

CONCLUSIONS

Rudy Guiliani, the charismatic mayor of New York explains:[11]

One of the best lessons a leader can communicate to his or her staff is that encountering problems is to be expected. But failing to mention problems, or worse, covering them up should not be tolerated.

Whilst it would be tempting to ignore the challenges outlined in this chapter, none are insurmountable. Overcoming them will require funding, skilled staff and management support to redevelop structures, capacity, processes, systems, asset registers and solid O&M procedures.

'A stitch in time saves nine.' Maintenance cost ratios are no different. Funds spent on maintenance now will save massive expenditure in the future.

It is time that budgeting and spending be reprioritised and realistic organograms developed and populated with labourers, foremen, artisans, operators, superintendents, technicians, technologists and engineers. Equipped with task descriptions, operating procedures, appropriate authority, materials, equipment and adequate supervision, management and monitoring, there is no reason why there should be any difficulty in delivering quality capital assets and O&M. Let us not forget that access to quality services and infrastructure is deemed a **right** of citizens in terms of our Constitution.

RECOMMENDATIONS

Chapter 5 contains a detailed discussion on structures, capacity development and training. The recommendations listed here relate to systems and processes that must be reinstated in terms of capital development and O&M.

- **Deliver housing at local government level**
  Housing development should be managed in exactly the same way as MIG spending with units being set up in local government to address local needs appropriately. Retirees from the architectural, building and QS professions, paired with students and graduates, should be harnessed to man and build such units.
- **Design evaluations**
  An evaluation and advice centre should be set up and manned by experienced municipal engineers to review designs and advise on more appropriate or innovative solutions.
- **Life cycle costing**
  Without considering the overall costs, including construction and O&M, many inappropriate solutions are becoming the norm. Education and awareness in this area are urgently required.

- **Asset registers**
  Until such time as detailed asset registers exist, reflecting the quantum and status of infrastructure, accurate O&M planning and budgeting cannot take place. This is an ideal area in which to involve the many students seeking experiential opportunities.
- **MIG and O&M**
  To prevent new infrastructure from premature failure due to lack of O&M, a portion of the MIG fund should be retained and made available for subsequent O&M. Alternatively, future MIG funds should be reduced or witheld if municipalities do not honour their commitment to maintain MIG-funded infrastructure.
- **O&M budgets and grants**
  Whilst MIG allows for rehabilitation, backlog priorities often take precedence. A specific grant should be made available for once-off rehabilitation of assets, on condition that municipalities maintain the assets thereafter.
- **Increase O&M staff**
  All too often there are no trained O&M staff. Realistic organograms must be developed and filled to rebuild capacity, from labourers all the way up to artisans and superintendents.
- **Rebuild and maintain 'yellow machine' fleets**
  Yellow machine fleets are aging and reducing in numbers as they fail prematurely. A grant to rebuild fleets in remote areas that require high levels of infrastructure maintenance should be considered.
- **Standard operating procedures and workplace training**
  With the loss of institutional knowledge, operating procedures must be recaptured in respect of equipment, processes and departments. Staff need to be introduced to these procedures in the workplace, under supervision until such time as they are proficient.
- **Monitoring and enforcement**
  All too often funds are inappropriately used, at the expense of O&M. Monitoring and enforcement of the various national standards, such as water and effluent quality, are essential to ensure that municipalities honour their O&M obligations.

NOTES

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PART III

THE FUTURE – IDEAS SHARED

Contents

CHAPTER 5

Structures and capacity for the future

5.1 THE CHALLENGES

Human history becomes more and more a race between education and catastrophe.
– H G Wells

From the previous chapters it is clear that there are insufficient skilled technical personnel to operate, manage and develop municipal infrastructure. There is a notion that where there is capacity in a structure, it should be shared with neighbouring municipalities without capacity. This would be equivalent to suggesting that the one and only good maths teacher in a large school, who is already stretched with his or her teaching and marking load, be shared with one or two large schools elsewhere in the district. Consequently, all learners would only have one lesson a week, their work would rarely be marked and so they would not learn from their mistakes, and in the end, few or no learners from any of the schools would actually have gained sufficient knowledge to pass.

The same applies to engineering staff. As we continue to reduce numbers, infrastructure suffers. Unless adequately maintained its quality will decline until it is eventually rendered unusable, increasing the current backlog, rather than reducing it. Each and every asset requires sufficient attention to ensure that it is of value to the municipality lest we reach the state predicted below!

Men came to demand more and more from their institutions – and with greater intransigence. But while aspirations leap ahead, human institutions remained sluggish. Even when forced, it has become almost impossible to induce change into any organisation.

This is a quote from *America in the twenty-third century* by John Gardner, quoted in *The New York Times* of 27 July 1968. Gardner predicted the ultimate collapse of society because of the collapse of its institutions.

Recognising the challenges in local government, the Department of Provincial and Local Government (**dplg**) set these institutions on a 'get well' plan through Project Consolidate that addresses five key performance areas and related challenges, as outlined in Table 5.1.

The first three fall largely at the feet of leaders and infrastructure departments. Historically, systems and structures in place were generally adequate to serve the imperatives of the previous government. There is no reason why these should not be expanded and remodelled where necessary to address the more inclusive focus of government's current expanded goals.

In the local municipalities that are still reasonably successful, the number of civil engineering professionals to inhabitants is found to be slightly more than 1:20 000 and in the case of metros it is 1:13 000, in other words, 5 to 6 and 8 to 10 per 100 000 inhabitants, respectively. This chapter will look at the functions that should be delivered by local government and the structures and approaches necessary to achieve these.

Table 5.1 Key performance areas in local government

Key performance area	Main challenges
Institutional capacity and municipal transformation	■ Core municipal systems not established or implemented ■ Municipal management capacity and capability and high vacancy levels ■ Poor accountability mechanisms ■ Serious challenges in financial management, programme management, engineering and organisational development
Basic service delivery and infrastructure	■ Slow pace and poor quality of services delivered ■ Water and sanitation backlogs emerge as one of the critical challenges ■ Housing backlog cited as a critical issue
Local economic development	■ High levels of poverty owing to unemployment ■ Poor quality LED strategies and scarcity of municipal LED specialists
Financial viability and management	■ Inadequate billing, debt management and credit control systems ■ Poor municipal financial management capacity and systems ■ Low revenue base owing to high number of indigents
Good governance	■ Instability within and between political and administrative domains ■ Poor communication between council and communities ■ Non-functioning of ward committees

Source: dplg

5.2 TOPOLOGY AND POPULATION SERVED

As outlined in Chapter 3, the development of the three-tier local government system appears to be based on the Canadian model, which sees counties set up to provide services to numerous small settlements spread across thousands of kilometres of sparsely populated prairies and the tundra. The latter are largely undeveloped except around isolated mining sites. Many of these settlements consist of only a few households that support a trading post and communication centre – the proverbial one-horse town. Clearly, these settlements cannot afford and do not require dedicated municipalities, engineers and elaborate infrastructure, but do require servicing.

The biggest 25 municipalities in Canada support 19 million of the country's 31 million inhabitants. The other 12 million are spread out in smaller municipalities and settlements, giving a density slightly in excess of one person per square kilometre. In South Africa, our biggest 25 municipalities represent some 23 million of our 47 million people. Thus the average density of the remaining population is 25 people per square kilometre. Only in the Northern Cape with slightly fewer than four people per square kilometre does the density tend towards that seen in rural Canada.

As will be seen later in this Chapter, a municipality with a population of 45 000 to 60 000 (between 10 000 and 14 000 households) requires a full complement of professional staff to take care of infrastructure development and O&M. Of the 283 municipalities in South Africa, only 60 are below this size, the Northern Cape facing the largest challenge with more than 90% of the area covered by small settlements. (See Figure 5.1 and Table 5.2.)

The Western Cape is split into two distinct areas – coastal and inland. The northern areas, covered by the Central Karoo district municipalities, are similar in character to the

Table 5.2 Population density per province

Province	Number of local municipalities per density range			Percentage with fewer than 5 people / sq km
	< 5 people / sq km	5 ≤ X < 25 people / sq km	≥ 25 people / sq km	
Eastern Cape	4	11	23	10%
Free State	4	11	5	20%
Gauteng	0	0	9	0%
KwaZulu-Natal	0	4	45	0%
Limpopo	0	6	20	0%
Mpumalanga	0	5	12	0%
Northern Cape	18	7	2	67%
North West	1	11	8	5%
Western Cape	3	10	12	12%
Total	**30**	**65**	**136**	**13%**

Source: Municipal Demarcation Board

Northern Cape and since they are essentially part of the Karoo, should be grouped with the Northern Cape in terms of the service model. The west of the Eastern Cape and the south of the Free State exhibit similar characteristics, which can clearly be seen on the density map in Figure 5.1.

If one were to ignore the small towns of the Northern Cape and Karoo, there would be 27 small towns requiring district type of support. However, 46 districts have been set up to offer such support! It would seem that in many areas the district model is superfluous.

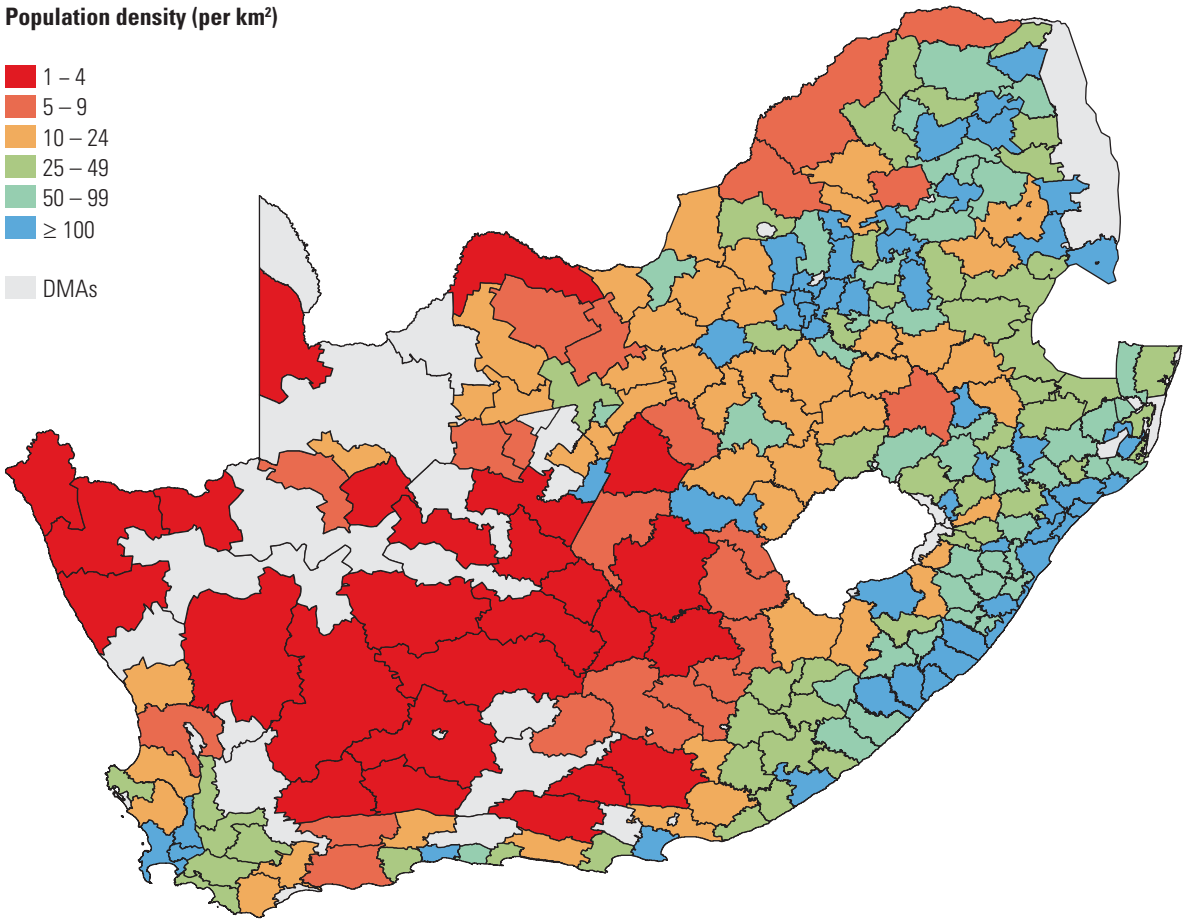
Furthermore, about half the districts are new structures and have not yet built adequate capacity to actually offer the support required. Their vast geographic areas also prevent them from servicing the entire area without setting up regional offices, which become duplications of the local structures in place.

In order to support some of the smaller municipalities in densely populated provinces it may be more effective to absorb the small municipality into a large neighbour.

Formal towns and cities existed in some 140 of the 231 local municipalities. As such, structures with engineering staff and systems were in place. The major effort expended on districts could possibly be better directed at building up local municipalities serving large, usually ex-homeland populations.

Most engineers employed in districts have found little cooperation between district and local municipal structures and have invariably found themselves working in local municipalities to solve problems, build capacity and drive service delivery. This again seems to suggest the need to review the role of the districts.

The idea of districts or regions to plan for a wider area is not new, but in many countries the additional tier has not succeeded. Said one report from southern California:[1]



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 5.1 Population densities per square kilometre in local municipalities and the metros

… efforts to deliver a plan for regional units … have been tried several times and failed to secure willingness …

The idea of building local municipalities into fully functioning, sustainable structures is essential, a view shared by Hildegarde Fast in her paper, *Local government's financial challenges:*[2]

> *In the long term, ours should not be a municipal system of 'two South Africas', the one consisting of municipalities that are relatively functional and fiscally strong, and the other of municipalities that struggle to fulfil their constitutional mandates and depend heavily on on-going subsidies from the centre. At the heart of the long-term vision is the constitutional imperative for all municipalities to govern democratically and deliver services efficiently. This means that the current situation should not be accepted as static, and that the intergovernmental system should encourage all local municipalities to improve their management of resources and to grow their revenue bases.*

The view is also enshrined in the Constitution, section154(1):

The national government and provincial government … must support and strengthen the capacity of municipalities to manage their own affairs.

Mention must however be made of some very effective districts that either provide the water service authority as well as provision functions, or manage the roads for all municipalities in the district, as well as for the province in some instances. These should be converted to delivery agencies independent of political structures or become regional facilities of provincial sector departments, leaving the locals to determine their needs and request support from agencies or provinces.

The expense and efficiency of what is apparently a fourth tier of government is questioned.

This view is also shared by Dr Doreen Atkinson in her deliberations on how to build a supportive state.[3] She contends that:

- *There is no intrinsic reason why district municipalities should be autonomous, elected, democratic bodies*
- *District-level agencies can perform their technical, facilitative and capacity-building functions more effectively without political distractions*
- *[Agencies or provincial field offices] would remove expenditure of District Councillors*

Rather than new provincial boundaries, a new look at mechanisms for growing strong local municipalities should be considered, including a re-look at district functions and effectiveness.

A further complication in terms of stand-alone, viable local municipalities is the trend of water boards to offer to take over water services for local municipalities. It has been found that many of these boards also lack technical capacity and can offer little benefit in terms of operators, artisans and civil engineering staff to operate and manage their services. Rather than take duties away, we need to build capacity in local government.

5.3 SERVICES PROVIDED

South Africa boasts a model constitution and world-class legislation, and has taken the lead role in developing a master plan to combat poverty on the African continent. In doing so, ambitious targets, based on the Millennium Development Goals (MDG), have been set to alleviate, if not eradicate poverty by the year 2014. The goal is to provide housing with at least basic services, transport and access to markets for every South African by 2014.

The principle of conservation of energy is well known. In a closed system, energy cannot increase, but remains constant. The current financial situation in many families is the same. Without income there can be no expenditure and no improvement in their circumstances. Without increased income, neither the MDG, nor national goals can be achieved. Communities need to be encouraged to create and sell more products and need to be exposed to larger markets. The poverty alleviation cycle in Figure 5.2 shows clearly that unless all aspects of infrastructure are in place, the increased income required for growth cannot be achieved. In order to achieve the much dreamt of and debated 6% growth, it is essential to develop infrastructure that addresses all consumer needs. Says the National Framework for LED:[4]

Economic infrastructure investment funding is critical for stimulating municipal economies. The 'E' component of the Municipal Infrastructure Grant (MIG) should be utilised more effectively.

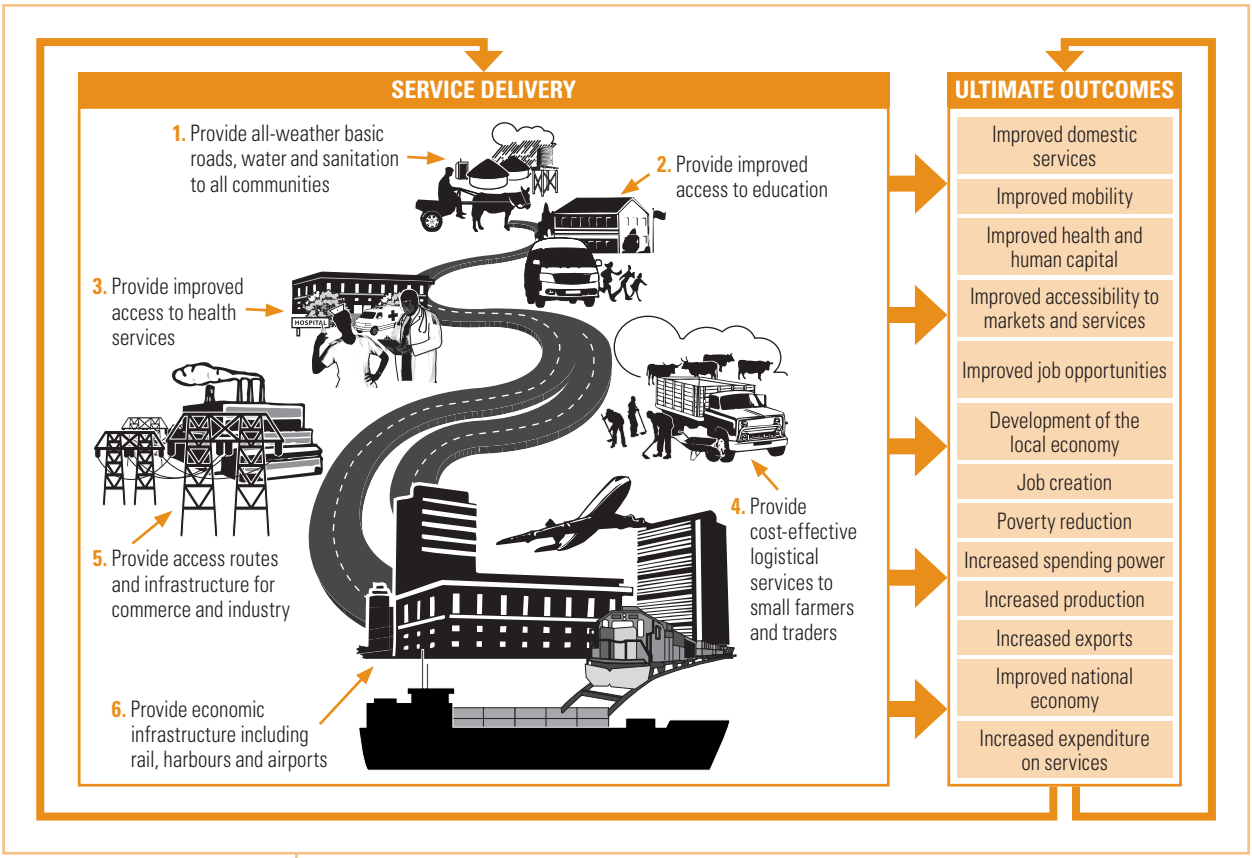


Figure 5.2 Escaping the poverty trap

Municipalities have a major role to play in the country's development. More industries need to be encouraged to invest in our municipalities. Tourism and recreation opportunities need to be increased and the rich and famous need to be encouraged to make South Africa one of their playgrounds, purchasing high-priced properties that come with high-priced rate tags!

Municipalities will not attract these investments – and greatly improve their income – if infrastructure and services are totally inadequate or failing.

In the late 1980s when American local government hit an all-time low, Osborne and Gaebler, in their book *Reinventing government,*[5] identified similar challenges:

> *… we can sit idly by as a vicious cycle unwinds in which the less people depend on government the less they are willing to finance it, the less they finance it, the worse it gets, and the worse it gets the less they depend on it … until the only customers who use public services are those who cannot afford an alternative!*

Hence, now more than ever, it is essential for municipalities to attract and provide services to the full spectrum of consumers (see Figure 5.3), including:

- Basic infrastructure to address poverty alleviation and quality of life (see World Bank inset on p 161)
- Economic infrastructure to attract and support investors and industrial growth
- Rate-earning infrastructure to attract income from affluent consumers

The complexity of having to address the full spectrum places an even greater responsibility and load on technical staff.

South Africa is in a developmental phase and requires experienced staff with long-standing knowledge of their municipalities to handle:

- The growing workload and complexity of work
- Conceptual planning as opposed to detail design to adequately address the developmental needs of local government
- A comprehensive assessment of backlogs, confirmation of actual needs, and preparation of action plans
- High levels of community liaison, which demands much more time of technical staff
- Strategic, long-term planning to address all facets of infrastructure, including the provision of bulk services to support the continuing growth
- Increasing numbers of fledgling BEE consultants and contractors who do not have sufficient experience to work independently on the projects they are awarded, and require hands-on supervision by the senior technical staff in municipalities

The continued practice of chasing and reporting on progress with regard to backlog targets to the exclusion of bulk and economic development is short sighted and dangerous. Basic services are more often than not delayed because of the lack of bulk capacity or the failure of existing bulk systems. In their book *Managing for the long run*[6] (and 'combating short-termism'), the authors caution on ill-conceived acquisitions, disastrous bouts of downsizing and the disdain for long-term investment in people, quality and innovation.

Having studied 40 successful American and Asian organisations, they concluded that those that have survived and done well were dominated by the same theme:

Managing for the long term.

A holistic, long-term approach to local government service delivery must be adopted without delay.

Accessibility – a World Bank view

In general terms, a lack of maintenance is often a major impediment to the achievement of a country's poverty reduction goals. As a result of the lack of access:

- *Many farmers are reluctant to grow a marketable surplus second crop because it cannot be sold or due to the difficulty and expense of transport significantly reduces the returns to labour.*
- *Agricultural productivity is low and there is a lack of innovation because extension information and inputs do not reach the farmers.*
- *School enrolment is low and absenteeism is high (often among teachers as well as children).*
- *Standards of health care are low because clinics are hard to reach and health workers cannot travel easily.*
- *Women's working days are long and arduous, largely owing to the time and effort required to reach water and fuel sources.*

Source: *Rural transport and the village*

Figure 5.3 The optimum approach to service delivery in local government

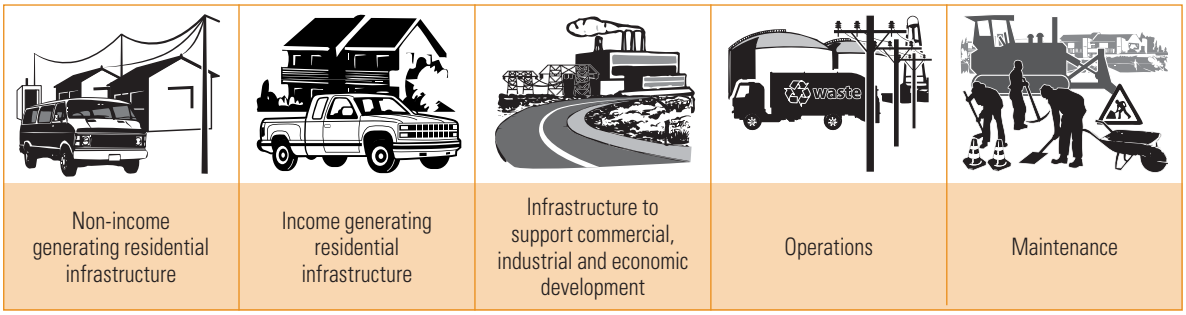


Table 5.3 Municipal powers and functions as defined in the Constitution

Schedule 4 B
Air pollution
Building regulations
Child care facilities
Electricity and gas reticulation
Fire fighting services
Local tourism
Municipal airports
Municipal planning
Municipal health services
Municipal public transport
Municipal public works (internal)
Pontoons, ferries, jetties, etc
Stormwater management
Trading regulations
Water and sanitation services
Schedule 5 B
Beaches and amusement facilities
Billboards and display advertisements
Cemeteries, funeral parlours and crematoria
Cleansing
Control of public nuisances
Control of undertakings that sell liquor
Facilities for animals
Fencing and fences
Licensing of dogs
Licensing and control of food undertakings
Local amenities
Local sports facilities
Markets
Municipal abattoirs
Municipal parks and recreation
Municipal roads
Noise pollution
Pounds
Public places
Refuse removal; solid waste disposal
Street trading
Street lighting
Traffic and parking

In accepting this challenge, municipalities need to be supported by provincial and national structures. Congruent functions assigned to the three tiers of government in the Constitution tend to cause confusion in some areas and need to be addressed.

5.4 THE NUMBER OF CIVIL ENGINEERING STAFF

As was seen in Chapter 2, some 2 500 to 3 000 technical staff developed and supported infrastructure for less than half the population. This suggests that 6 000 or more would now be required to service the entire population.

In Chapter 3, it was seen that the numbers have dropped significantly and presently stand at about 1 300. However, many functions have been transferred to the private sector and technology and systems have advanced, so it is now necessary to consider the current responsibilities per municipality to determine the numbers needed.

5.4.1 Service authorities

In the new dispensation, service authorities per structure were determined per province. In some provinces, the districts were assigned the road and stormwater functions and the local municipalities were given the responsibility for water and sanitation, and in others the roles were reversed. Yet another permutation exists in areas with strong water boards. In these areas neither the district, nor local municipalities are water services authorities (WSA).

Thus it is necessary to look at all the authorities, the service provision responsibilities that have been conferred on each municipality and other activities relating to civil engineering services to determine the number of civil engineering staff required per municipality. Powers and functions in relation to service delivery are shown in Table 5.3. The range of authorities and associated service provision responsibilities related to civil engineering is as follows:

- Abattoirs
- Airports
- Amenities
- Beach facilities
- Billboards
- Cemeteries
- Fencing
- Fire fighting
- Markets
- Municipal works
- Planning
- Pollution
- Pontoons and jetties
- Public transport
- Roads
- Sports facilities
- Stormwater
- Sanitation
- Solid waste
- Traffic engineering
- Water

In the case of water, the authority covers water and sanitation. The above can be broken into two groups, those related to distribution, such as roads, water and sanitation, and those related to individual erven, such as abattoirs and airports. Whilst the civil engineer must provide services in all instances, the main workload in engineering departments is to develop and manage distributed services to all households.

5.4.2 Number of households

Although the common measure of staff is given per 100 000 inhabitants and the rough rule of thumb given in 5.1 relates to population, the end

Table 5.4 Average population per household per province

Province	Average number per household
Eastern Cape	4,26
Free State	3,69
Gauteng	3,36
Kwa-Zulu Natal	4,52
Limpopo	4,39
Mpumalanga	4,23
Northern Cape	4,05
North West	3,92
Western Cape	3,86

Source: Municipal Demarcation Board

consumer in terms of services provided by the engineer is the household. Thus possibly the correct measure to use for determining numbers required is the number of households.

Population per household varies across the country with the lowest average being in Gauteng (3,36 people per household) whilst KwaZulu-Natal records the highest average with 4,52 people per household. (See Table 5.4.)

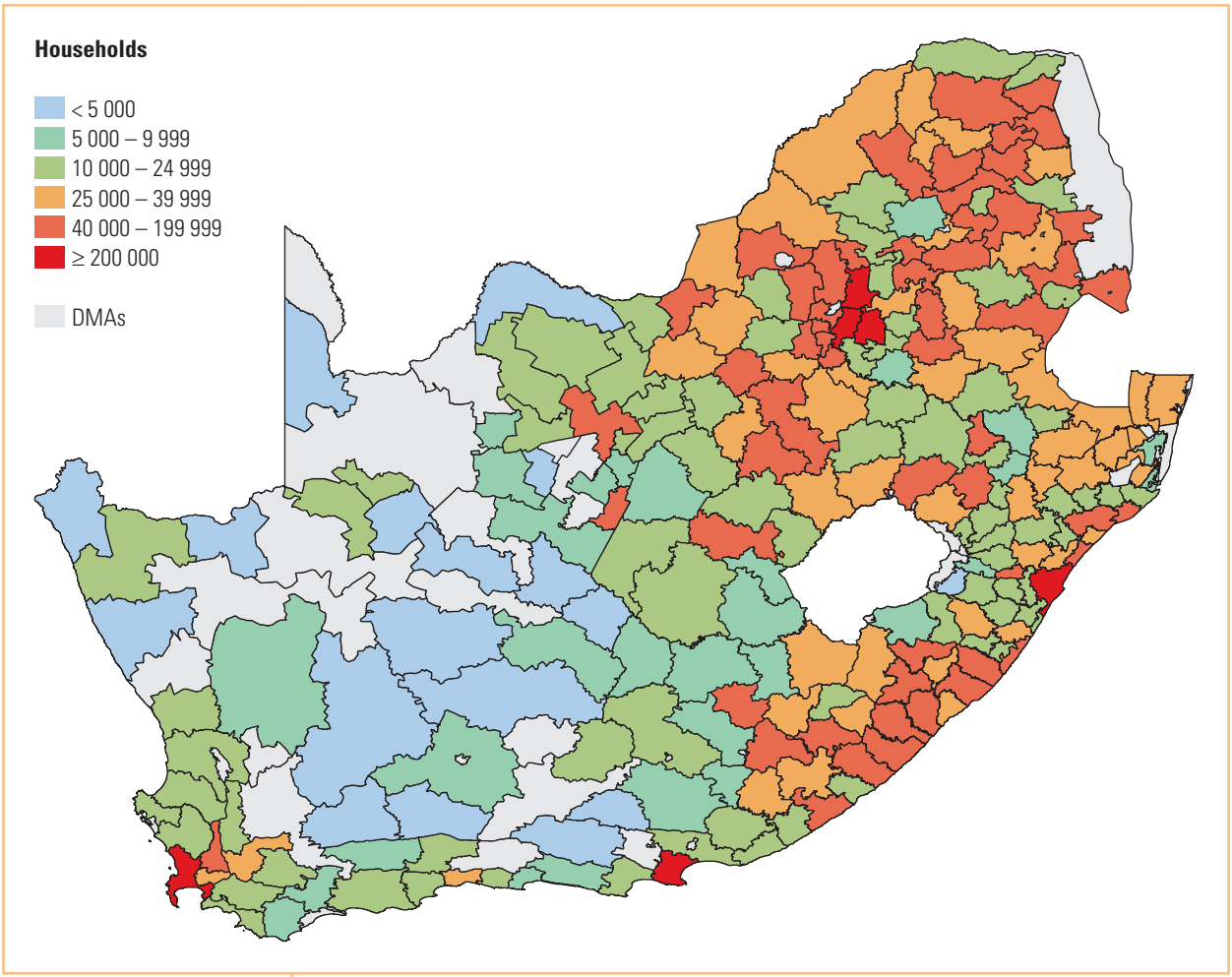
Recent surveys seem to indicate that these official figures are vastly understated and that the people-per-household figure is significantly higher.

The density per household would not affect the number of engineering staff but rather, the size of bulk infrastructure that should be provided and the size of network components, such as the diameter of pipes and size of pumps in the case of water and sanitation, the number of lanes and size of drains in the case of roads and the size of cables in the case of electricity.

Further, the phenomenon of household splitting will give rise to an increased demand for services, even if the population does not change, hence households would be a more appropriate variable to determine the number of technical staff. For instance, whereas the number of individuals increased by 10% from 1996 to 2001, the number of households increased by 24% during the same period[7] requiring significantly increased servicing. It can be seen in Figure 5.4 that more than 50% of all local municipalities consist of 25 000 households and more, a significant responsibility.

5.4.3 Suggested formula for local municipalities and metros

In order to give guidance on the number of civil engineering staff required, a formula has been developed after observation of the performance or lack thereof in a significant portion of South Africa's local municipalities and metros. This should serve as an indication of the minimum number of civil engineering staff required to perform the functions assigned to any particular municipality.



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 5.4 Number of households per local municipality and in the metros

The number of civil professionals required, based on households is designated as $\mathbf{N}_H$ and is calculated as follows:

$$N_H = 1 + ROUND\ (N/5\ 000 * \Sigma_{CEF}/9)$$

Where,

ROUND refers to the rounded value in the brackets. If the decimal value is less than 0,5 the whole number should be adopted. If the decimal value is greater than or equal to 0,5 the next whole number should be adopted

N = number of households, and

Σ_{CEF} = $a + b + c + d + e + f + g + h + i$ (the sum of the civil engineering functions performed in a municipality)

Score 1 for each of '*a*' to '*i*' if the following functions are performed or 0 for each function that is not the responsibility of the municipality

a = planning (every municipality should perform a planning function!)

b = road service provision

c = stormwater service provision

d = sanitation service provision
e = solid waste service provision
f = traffic engineering and transport planning
g = water service authority
h = water service provision
i = has a PMU
If a municipality predominantly supplies dry sanitation and limited water-borne networks, set 'd'=1/2.

Example 1

As an example, a small town with 10 000 households that does not have a PMU and is located in a district that carries the water services authority and provision function would score as follows:
a = 1 – does perform the planning function
b = 1 – is responsible for roads
c = 1 – is responsible for stormwater
d = 0 – is not responsible for sanitation
e = 1 – is responsible for solid waste
f = 1– is responsible for traffic and transport planning
g = 0 – is not a WSA
h = 0 – is not responsible for water
i = 0 – does not have a PMU

$$\text{that is, } \Sigma_{CEF} = 5$$
$$N/5\,000 * \Sigma_{CEF}/9 = (10\,000/5\,000)*5/9$$
$$= 10/9$$

This would round to 1, making the total number of civil staff required = 2.

$$\text{that is, } N_H = 1 + ROUND(10/9)$$

With no water, sanitation or PMU responsibility, the two staff members would be devoted to roads, traffic and solid waste. One would possibly handle the strategic issues and capital projects and the other would manage O&M.

Example 2

If the same small town had a PMU and carried all the authorities, it would require a total of 3 civil engineering staff – the third one picking up the load for water and sanitation, and all three possibly sharing the role for the PMU, as allocations for such a small community would not be substantial.

Example 3

Considering a much bigger town of, say 75 000 households, with the water services authority and provision responsibility, but not the roads and stormwater,
a = 1 – does perform the planning function
b = 0 – is not responsible for roads
c = 0 – is not responsible for stormwater

d = 1– is responsible for sanitation
e = 1 – is responsible for solid waste
f =1 – is responsible for traffic and transport planning
g = 1– is a WSA
h = 1– is responsible for water
i = 1– does have a PMU

$$\Sigma_{CE} = 7$$
$$N/5\,000 * \Sigma_{CEF}/9 = (75\,000/5\,000)*7/9$$
$$= 105/9$$

This would round to 12, making the total number of civil staff required = 13. The 13 members of staff would possibly be made up of a technical director, a deputy, two or three in the PMU, one or two in planning, four or five in water and sanitation and one person dealing with solid waste works and other localised amenities. If the municipality were responsible for all services this would increase to 16 staff – the additional staff being required for roads and stormwater.

5.4.4 Land use factor

The formula given in 5.4.3 relates to households only. However, in larger towns many erven do not relate to households but to a range of other uses, such a business, commercial, industrial, mining, education, tourism, entertainment, sports, health, ecclesiastic, public, and state-owned enterprises. These erven also require servicing. The above figure therefore needs to be multiplied by a land use factor related to the total area that requires servicing in relation to the residential area.

N_L = the number of civil professionals adjusted according to land use and is calculated as follows:

$$N_L = N_H * \frac{\text{area of municipality} - \text{area of farms} - \text{area of public open space}}{\text{area of residential erven}}$$

Where,
farms plus public open space are subtracted in the numerator as neither of these land uses require servicing.

Where land use is almost exclusively agricultural and residential, the above can be simplified to $N_L = N_H$

Example 3 (continued)

Taking as an example the previous town requiring 13 civil engineering staff, a look at their land use areas yields the following:

- Total area of the municipality = 800 km^2
- Area of farms = 400 km^2
- Area of public open space = 160 km^2
- Area of residential erven = 200 km^2

Therefore,

$N_L = N_H$ * (800-400-160)/200
$N_L = N_H$ * (240)/200 = 13*1,2 = 15,6, say 16 civil engineering staff members.

It would probably be found that more capacity is needed in terms of improved access, water and sanitation supply, and fire networks to industry and other consumers.

5.4.5 Urbanisation factor

Over 80% of South Africa's economic activity is concentrated in 15 urban centres. A further demand on engineering capacity is made as a result of urbanisation. This is seen mainly in the large cities, but throughout the country people are moving from rural settings to towns and cities in the hope of finding work and being able to benefit from the improved household, health and education facilities they perceive to be available to city dwellers.

With insufficient low-income housing stock, squatter settlements continue to grow. These are a headache to engineering departments. Not only must they provide some form of rudimentary service in amongst randomly constructed dwellings, but they must also plan and design new areas to eventually accommodate these people. Thus they have to deal with these households twice!

Furthermore, cities require many sophisticated services, such as transport infrastructure, to provide access and mobility for large numbers of people. Increased pollution and many other factors further increase the load.

An adjustment must be made to allow for additional staff that must be employed to cope with this extra workload.

The number of civil professionals adjusted to take account of the extra workload owing to urbanisation is designated as N_U and is calculated as follows:

$$N_U = N_L * (N + N_{INF}) / N$$

Where,

N_L = the number of civil professionals calculated so far based on the number of households and land use

N = number of households

N_{INF} = number of informal households

Example 3 (continued)

Continuing with the example, the town requiring 16 staff is faced with a growing urbanisation challenge. Although officially responsible for 75 000 households, an additional 3 750 are informal households that require a lot more attention. Thus the total number of civil professionals would increase as follows:

$$N_U = 16 * (75\,000 + 3\,750)/75\,000$$
$$N_U = 16{,}8, \text{ say } 17 \text{ civil engineering staff members}$$

The time required for community negotiations, working with other departments, such as provincial and national departments of housing, and with sector departments has found few municipalities equipped to deal with urbanisation as they simply do not have adequate capacity.

At the outset, the basic calculation in Example 3 suggested that 13 civil engineering staff would be required. Given the complexity of issues that need to be dealt with and the ever-growing demand for service delivery, this municipality's targets are more likely to be

met if 17 civil engineering staff, with funding and total support from their municipality, were empowered to normalise the situation.

5.4.6 Other considerations

The formulae given above should be used as a guide only. If a municipality has fewer civil engineering staff than it should have in terms of the calculations, chances are that services are in a poor state and it is time to start looking at organograms, defining job specifications and appointing more technical staff.

If a municipality has more civil engineering staff than calculations show it to require (there are only about 10 municipalaties fortunate enough to fall in this category) the additional staff should not be retrenched. There are many other parameters that demand extra pairs of hands to achieve effective service delivery as outlined in (a) to (g) below.

(a) Design offices

A few municipalities still have the luxury of design offices. Although the private sector now handles this function for most municipalities, large municipalities and most metros still perform design work up to a certain value and should be encouraged to continue doing so, in order to offer training to young professionals.

Where design offices do exist, additional staff will be required to man these. Each municipality requires an employee with design knowledge to adjudicate design submissions, which is why the base equation forces at least one civil professional per municipality. Where civil staff have not had sufficient design experience, the private sector should be harnessed to assist with the adjudication of complex projects.

(b) Area of municipality

The area of a municipality also influences the number of engineering staff required. In a municipality that is small both in area and number of households, all functions can practically be handled from a central office. This may apply to some 65 local municipalities that cover less than 2 000 km^2.

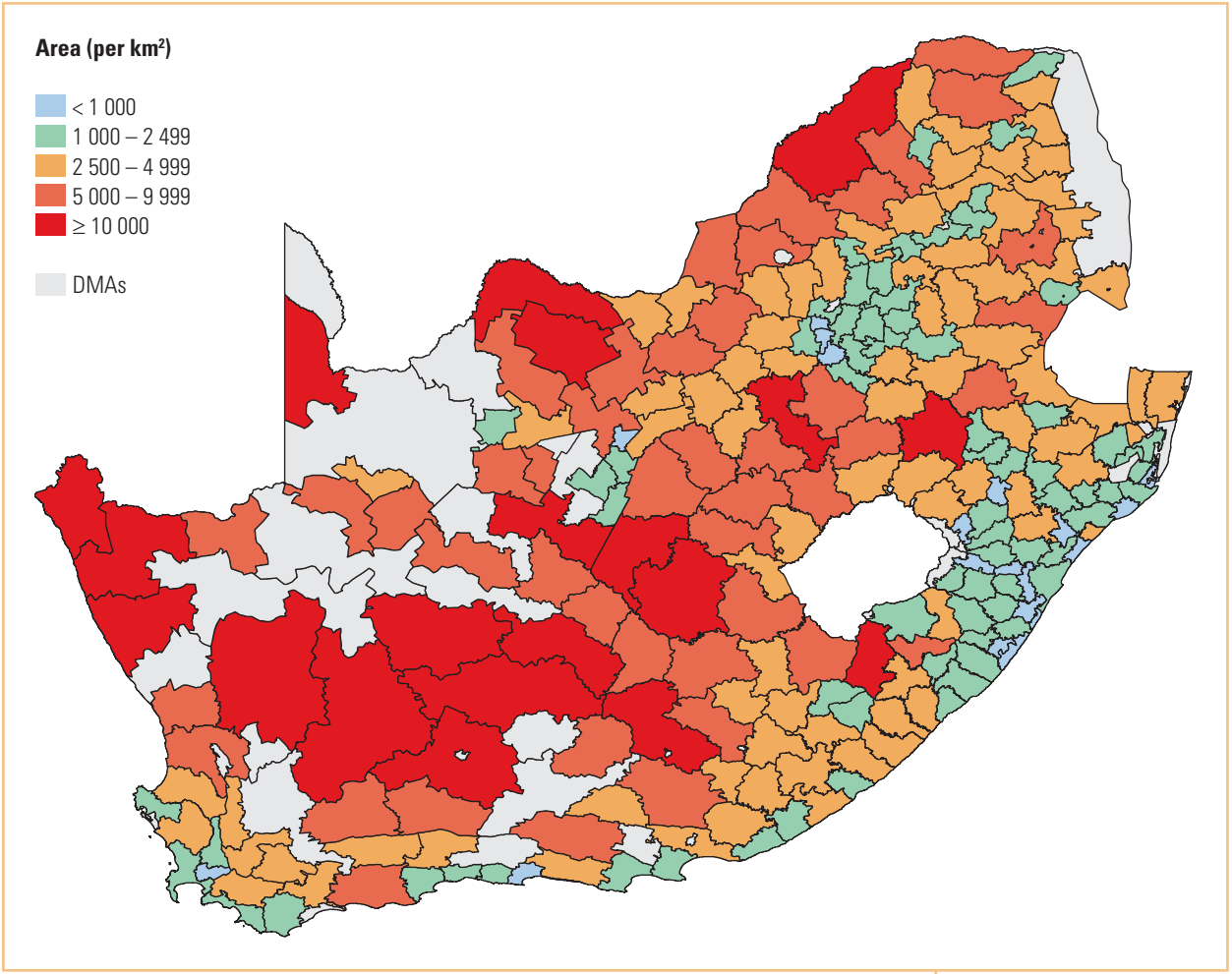
However, when municipalities are very large geographically, or are very densely populated, as is the case in metros and some of the larger towns and cities, depots or service centres offer a more practical way of responding to local needs.

The time spent driving from one region to another is such that little work can be carried out by technical staff based in central offices. There are vast municipalities throughout the hinterland of the country (see Figure 5.5) with twelve district municipalities in excess of 30 000 sq km. In these municipalities it is not unusual for staff to drive 500 km for an afternoon site meeting!

As a rule of thumb, if technical staff need to spend more than a third of their time travelling, it may be more practical to provide additional, dedicated resources in outlying areas. Whilst they may not be fully utilised if dedicated to one area, they could not deliver the required services if sourced from central offices.

Depots or service centres have the added benefit of making municipalities more accessible to the public, who would otherwise have to travel great distances to pay accounts and benefit from other services offered.

In sparsely populated areas, additional staff are essential. However, in districts that boast large locals, the district model appears to be unwieldy since regional offices are set up in the larger towns, which requires a duplication of staff. However, when regional



Source: Municipal Demarcation Board. Map generated by GIMS

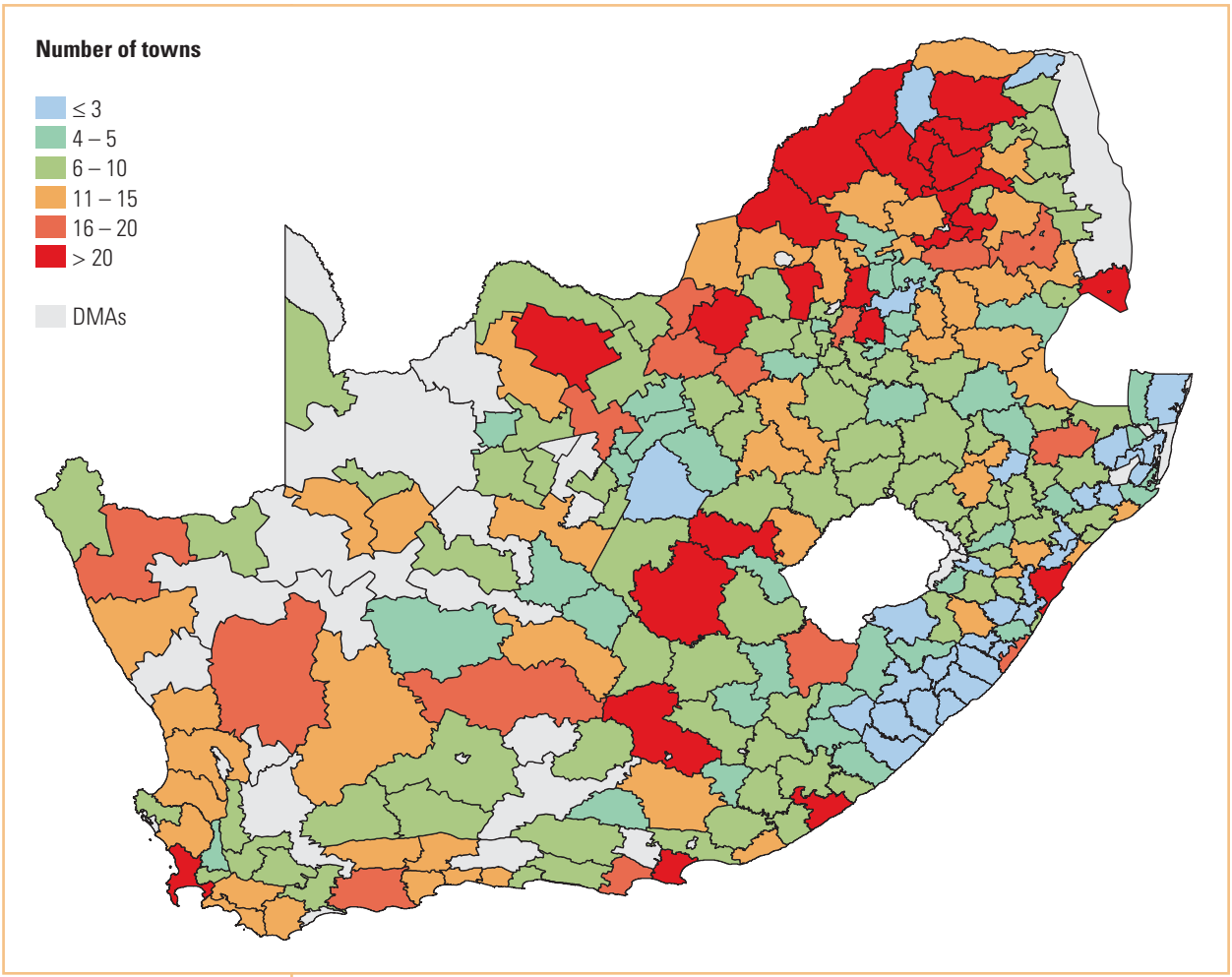
Figure 5.5 Areas per local municipality and in the metros

offices are not set up, local municipalities are often frustrated by the lack of attention given to various services within their boundaries for which they are not authorised or responsible to provide services.

Blanket decisions should not be made when deciding on authorities per province. The geography and demographics of each district should be considered individually, and the larger local municipalities should be funded to grow capacity and take over many of the duties currently assigned to districts. Limpopo is a case in point: district areas are large and only four of the 26 local municipalities have fewer than 25 000 households. Each municipality needs to be built up to handle its own services. The same applies to some districts in other densely populated provinces.

(c) Number of towns and villages

In the sparsely populated provinces a different problem occurs. Each of the towns and villages are so small that there is little or no capacity to handle engineering services. In this instance, districts are faced with the impossible task of handling many settlements, situated great distances apart. From Figure 5.6 it can be seen that metros and around one third of local municipalities are made up of 11 or more previous towns and settlements.



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 5.6 The number of towns merged into local municipalities and the metros

Additional staff need to be appointed to allow them to get to all these centres and ensure ongoing O&M.

(d) Coastal municipalities

The need for civil engineering staff increases in coastal municipalities, where additional responsibilities include coastal protection, breakwater structures, piers and amenities. The handling of sewage disposal and solid waste is complex owing to the impact of the variable water table. Increased O&M is required because the harsh environment causes rusting, concrete spalling and rapid deterioration of many other materials.

An allowance of 5% for large municipalities to 20% for small but busy coastal resorts should be made for additional civil engineering staff.

(e) Topography

In hilly terrain, such as the Valley of a Thousand Hills, planning, delivery and O&M are far more complex and require more attention. Furthermore, where communities are scattered and served by many small schemes rather than by an overall network in the case of water for instance, more support is required in terms of O&M.

(f) Amenities

Municipalities may be responsible for many other amenities not included in the formula, for example cemeteries, municipal airports, sports facilities, parks and recreation areas, and of course all municipalities need to take care of their own facilities, including town halls, community centres, taxi ranks, public toilets and hawker stalls. The number of additional staff required will be dictated by the number of amenities within each municipality.

(g) Size of contracts and SMME involvement

To 'spread the sunshine' (a term given to breaking development work into small contracts to offer job opportunities to as many SMMEs as possible), much more management control and hand-holding is required than would be the case if large jobs were let out to established contractors. Thus additional project managers are required in areas where a significant portion of the work is let out in this way. In chasing backlog targets, it is possibly time to review this approach and package many of the major infrastructure projects into sizeable chunks utilising major contractors in conjunction with SMMEs. This will result in accelerated delivery and slightly reduce the demand for professional skills.

5.4.7 The total number

Municipalities need to assess the additional staff required to handle the local peculiarities as described above and add them to the number determined so far.

The total number of civil engineering professionals designated as N_{CE} will thus be calculated at follows:

$$N_{CE} = N_U + \text{additional staff to address local peculiarities/demands and design needs}$$

This total number should be used as a guideline only. The formula seems to suggest that 5 to 7 civil engineering staff are required per 100 000 members of the population, which is significantly less than the 15 to 20 of the past, but certainly more than the present one to two! Figure 5.7 shows that almost 60% of metros and local municipalities have less than 50% of the civil engineering staff they require. The figures are calculated according to the basic formula, without the localised adjustments that each municipality will calculate on the basis of the degree of urbanisation, land use, size and other local demands. This implies that an even greater number of munipalities employ less than 50% of the staff required.

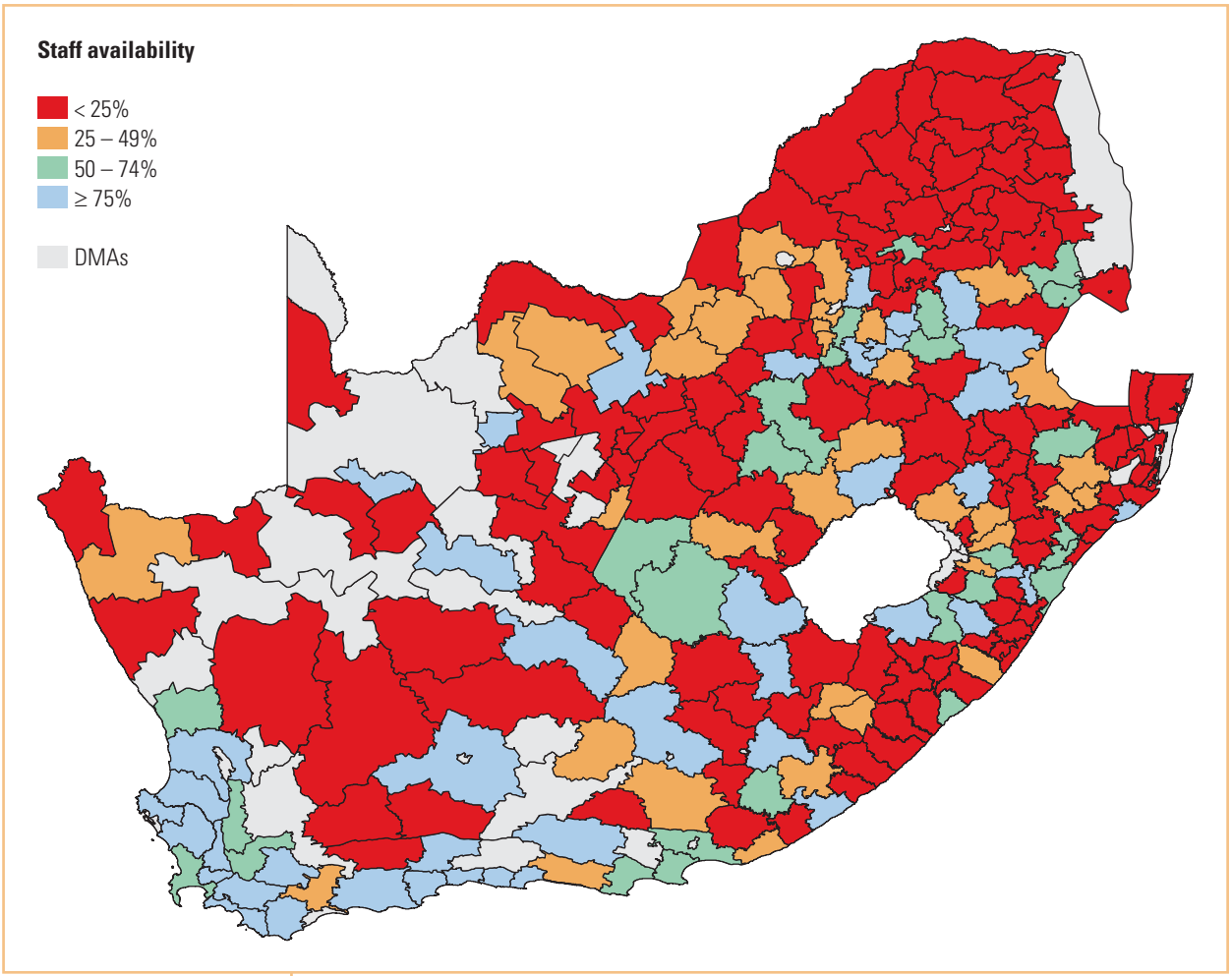
Qualifications and experience have not been captured in the formula and will vary in accordance with the complexity of infrastructure required and the size of the municipality.

Input from municipalities using these guidelines would be much appreciated to fine-tune the formula for ongoing use. Please send comments to **numbersandneeds@ally.co.za**.

In a few cases, municipalities operate efficiently despite low numbers. This usually occurs where remaining senior staff have contracted in service providers with intimate knowledge of local government service provision, and in particular their municipality, to handle the bulk of their workload. Short-term appointment of service providers under the new supply chain conditions may negatively affect these arrangements.

However, in most instances, there are just too few people to deal with the workload!

The new procurement rules are also affecting the extent to which day-to-day operations can be outsourced, since it is necessary to offer work on an annual rotation basis.



Source: Municipal Demarcation Board. Map generated by GIMS

Figure 5.7 Civil engineering staff employed in 2005, as a percentage of the numbers suggested using the basic formula

It is not practical to appoint new service providers to handle various aspects of municipal engineering annually, since no one provider will be able to build up the institutional knowledge required in such a short space of time.

5.5 FUNCTIONS IN ENGINEERING DEPARTMENTS

From the previous chapters it should be clear by now that experience, oversight and control are essential to ensure that municipalities get the best value for money in terms of new developments and that infrastructure is operated and maintained to the optimum.

In offering guidelines on the institutional arrangements that should be in place in a technical department, the October 2006 **dplg** document[8] listed:

- Policy formulation (for example, agreement on service levels)
- Budgeting
- Planning for service provision
- Design and calling for tenders
- Construction, supervision and commissioning of new works
- Operations
- Maintenance, rehabilitation and refurbishment

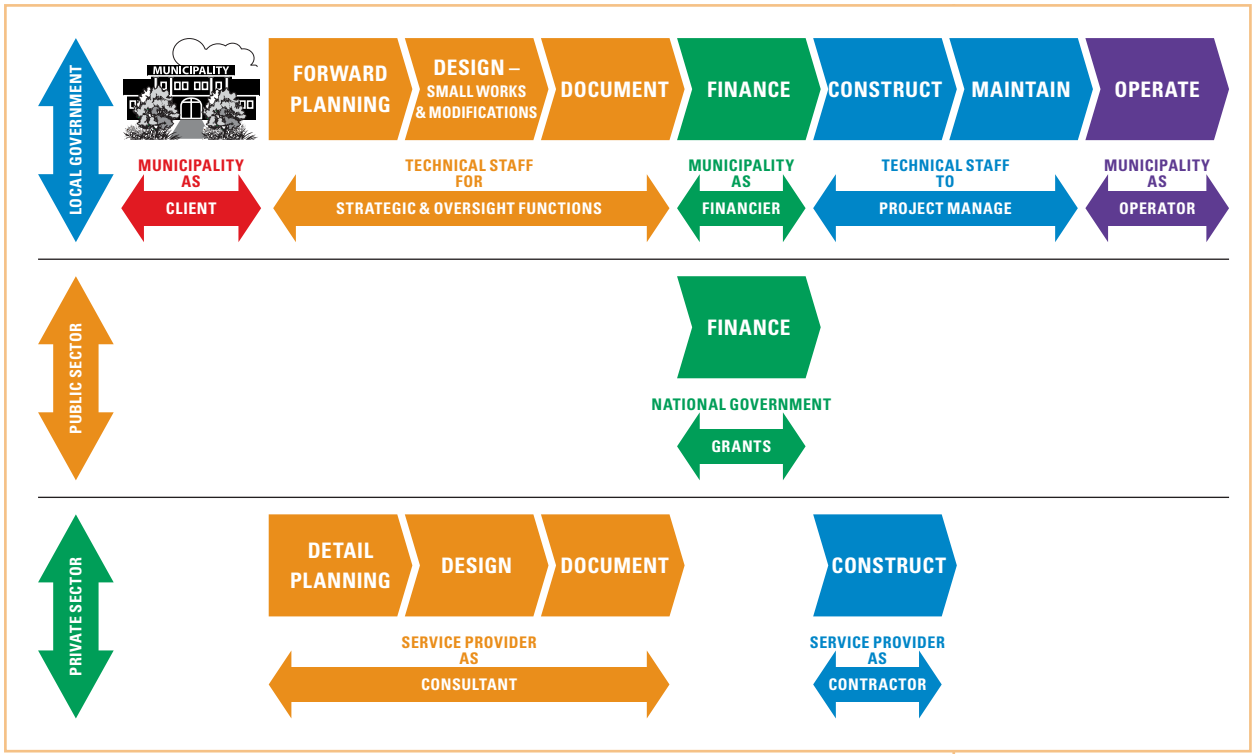


Figure 5.8 Recommended internal staff and functions to be performed or managed

- Trading (that is, meter reading, billing, collection and enforcement)
- Awareness and community involvement

This list reflects very closely the activities, described in Chapter 2, which must be re-established.

Each stage of the project cycle requires knowledgeable input and control, rather than the vacuums that currently exist. (See Figure 5.8.)

As a country, we need to strive towards making municipal engineering a career of choice. There can be nothing more rewarding for an engineer than to turn green field sites and failed systems into state-of-the-art solutions and maintain them in tip-top condition.

In 1961 the entire Wits final year class in civil engineering joined the Johannesburg City Engineers Department – such was the excitement generated by the development of the motorways.

Even today, development opportunities abound in local government. Ideas on how to re-develop the workforce to adequately deliver and manage infrastructure are given in 5.9.2(c) and 5.10 below.

5.6 STRUCTURES

Having calculated the above figures, those with little or no municipal experience may throw their hands up in horror at the number of people required. Indeed, calculating only N_H suggests that some 2 500 civil engineering professionals are required in local government, an increase of 1 200 or more from present figures. The question begs to be asked, how will they be used?

Figure 5.9 shows the typical functional areas that require attention from civil engineering staff in a municipality. Having looked at the authorities above, it is clear

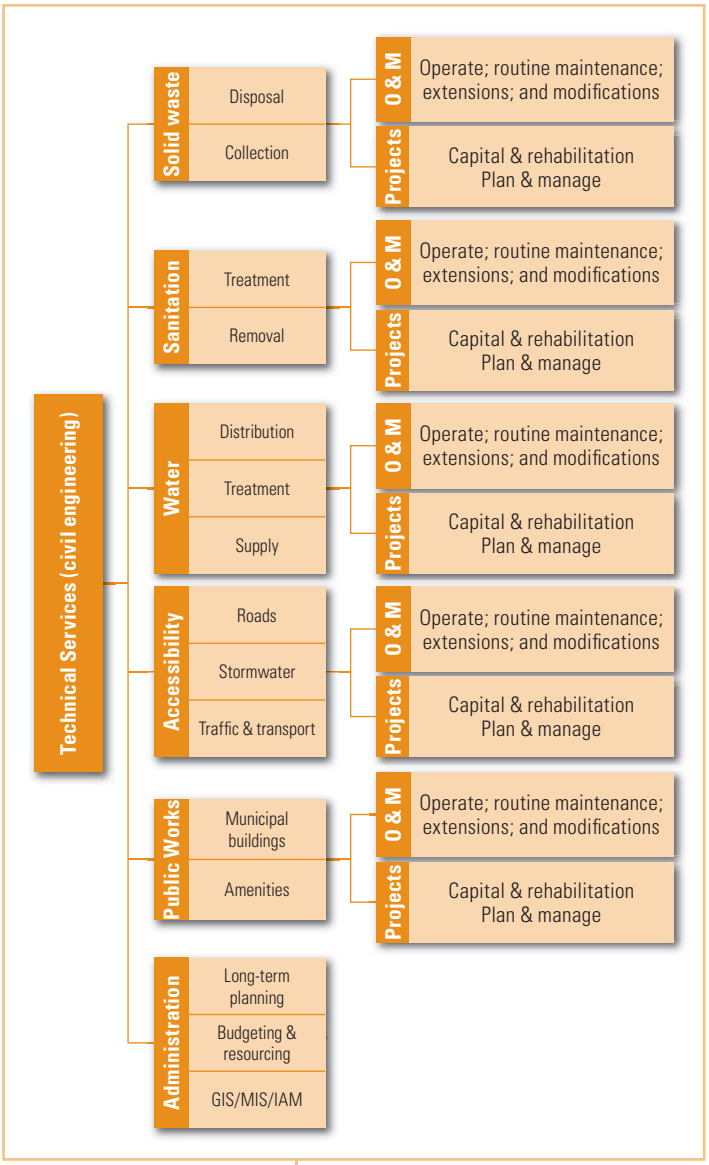


Figure 5.9 Simplistic organogram showing all civil engineering functions to be performed – assuming all functions devolved to the municipality

that a person or, in the case of bigger municipalities, a department, needs to take care of each discipline.

It is totally impossible that a municipality should have no technical staff available to attend to any of these functions. When this occurs, there is no one to concern himself with day-to-day problems that arise, no one to even consider appointing consultants to handle much of the work, and if an astute non-technical manager does realise that he or she should be using consultants, there is no one to determine whether the service provision offers are adequate.

To gain an understanding of how staff would be utilised, a few break points will be discussed in terms of the numbers of households in local municipalities and the metros. Numbers will be suggested.

5.6.1 Fewer than five thousand households (18 municipalities)

When considering the N_H formula it is clear that at least one civil professional is required in each municipality. The shear magnitude of day-to-day problems, such as addressing pipe bursts, breakdowns, service-related requests, complaints and backlogs, requires capacity. There are only two municipalities with fewer than 2 000 households, where perhaps even having one person may not be justifiable. However, the rest have some 2 500 or more households, whose service delivery needs should definitely be managed on a day-to-day basis by one, or in the case of the larger municipalities in this group, two civil engineering staff.

Prince Albert (2 434 households) has not had the luxury of a civil professional and has always used consultants for major projects, and more recently support from the district, as required. However, the ENERGYS project has shown how much they have missed out by adopting this approach. A civil engineering technician with a couple of years' experience was deployed under the watchful eye of a senior engineer who would visit every two weeks and remain in touch via phone and e-mail during the intervening period.

Not only has this young graduate become involved with ongoing inspections of new projects but he has assessed all services and was concerned with the poor condition of the sewerage works and waste site. With help from the ENERGYS engineers he cleaned up both thereby reducing the health risk they had posed. He initiated drain clearing exercises to ensure that the flood damage that had occurred in the past because of blocked drains will not recur and is now busy setting up a building inspectorate.

Success story – low-level bridge repaired in Prince Albert

Lack of maintenance, including blocked drains and culverts, resulted in much destruction in Prince Albert and surrounds during the 2006 floods. An ENERGYS graduate has been supervising the repair work and great progress has been made. Drain clearing routines have now been put in place.

Blocked low-level bridge resulted in slabs being washed away and the remaining support being undercut

Gabions being put in place to protect the bridge

He has also been able to deal with the many small issues with which external service providers could not deal on a day-to-day basis. Thus the savings and earnings he has effected for the municipality more than justify his appointment and conditions continue to improve with his help. He will of course continue to be supported by consultants and the district for major or complex projects.

5.6.2 Five thousand to fewer than ten thousand households (29 municipalities)

The volume of work increases significantly when there are 5 000 households or more in a municipality. Depending on the level of development, at least two civil staff will be required. The split of duties is normally such that one person deals with projects and the other with O&M. An experienced technologist supported by a technician would possibly provide adequate capacity. In municipalities where two towns are equally sized and far apart the two technical staff may each carry project and O&M responsibility in each locality. In very spread-out areas or where there are many small towns, three civil engineering professionals may be needed.

5.6.3 Ten thousand to fewer than twenty five thousand households (80 municipalities)

Here the volume of work increases quite significantly and the number of civil engineering professionals need to increase to four at the lower end, and up to five or six at the upper end. In the smaller municipalities, the technical services director will typically initiate and manage major projects and deal with all policy matters. He (or she – although we have a long way to go with currently only one female technical director in the country) should be an experienced technologist or a technician with an extensive track record in municipal engineering in the smaller municipalities and a registered professional engineer above 20 000 households.

Considering the rest of the civil engineering staff, one person will be responsible for water and sanitation, another for roads, stormwater and traffic and another for the balance of civil engineering activities.

5.6.4 Twenty five thousand to fewer than forty thousand households (48 municipalities)

As municipalities reach 25 000 households, a separate person will be responsible for each discipline. An additional technical person will be required if the municipality has a PMU. The number required per discipline will increase as the size of the municipality increases. The technical services director should be a registered professional engineer with an extensive track record in municipal engineering.

5.6.5 Forty thousand to fewer than two hundred thousand households (56 municipalities)

By 40 000 households at least ten civil engineering professionals will be employed. Management will comprise a technical services director and one or more deputies to manage staff per discipline. The project and O&M functions will be split per discipline since the volume of work in each will require more than one person per discipline. As before, additional staff will be required to man the PMU and handle WSA functions, if relevant.

Typically, in these municipalities the technical services director should be a registered professional engineer with extensive municipal experience.

As municipalities increase in size, the number of civil engineering staff per discipline will increase simply to cope with the volume of work, but the broad break per discipline and activity as shown in Figure 5.9 will remain the same.

5.6.6 Two hundred thousand households and more – metros (6 municipalities)

Metros are simply very large local municipalities, attending to all authority and service provision functions. However, owing to their density and complexity, all metros require regional offices or distributed service centres. Furthermore, owing to the sheer numbers, additional management levels are necessary, which further increases the number of civil engineering staff required. An allowance of 5% to 7% should be made for these additional staff. Directors and deputy directors should be experienced professional engineers.

5.6.7 Districts

Due to the huge variation in skill sets and powers and functions accorded to districts it has not been possible to develop a formula for districts since there are few patterns. The formula should therefore be used with caution, but the first component and area adjustments can be used to give some indication of the number of civil engineering staff required.

By adopting the above suggestions it would seem that the overall number of civil engineering professionals required in local government would be at least 2 500 to 3 000 – double the current number. Whilst this may seem daunting, with strong leadership, determination, an enabling environment and ongoing workplace training this can be achieved.

It has been recognised that South Africa has a national skills shortage. Developing capacity in local government is simply one facet of the multi-faceted Joint Initiative for Priority Skills Acquisition (JIPSA) plan to build capacity for the nation.

In her speech at the Mayors' Conference in May 2006, the Director-General of the Department of Provincial and Local Government, Ms Lindiwe Msengana-Ndlela, clearly stated that the two main challenges to be tackled in local government over the next five years should be those of capacity development and accountability. To address this, the first of three major priorities was defined as the need to:

> *… mainstream hands-on support to local government to improve municipal governance, performance and accountability …*

and in order to do this it would be necessary to:

> *… roll out an unprecedented national capacity building, training and support programme to local government over the next 5 years …*

This is indeed the role ENERGYS has started to play and there is no reason why five-year national targets should not be set and agreed to at this stage, against which an expanded ENERGYS type of project should be launched to build the structures and expertise so desperately needed in technical departments.

5.6.8 Outsourcing

The alternate approach would be to outsource. A hot topic on which everyone has strong views – the unions for fear of job losses; technical staff for fear of losing control and, worse, being made redundant; the public for fear of price increases and a reduction in service levels; and the private sector, for fear of the public sector's propensity to transfer rather than share the risk in such ventures! However, there are many models that will allow load to be carried by the private sector. The need to consider and embrace these was emphasised by President Mbeki in his State of the Nation Address in February 2005 when he said:

> *... we must further consolidate the practice of creating public private partnerships and building government/civil society cooperation, to ensure that we utilise our collective capacities to give further impetus to the overall development of the country.*

However, the options are complex and require tight management as outlined below.

(a) Contracting

Contracting is currently taking place where municipalities let out specific, short-term tasks to the private sector, for example appointing consultants to design and contractors to construct specific projects. Service providers are selected by means of a tendering process.

As has been demonstrated in the previous chapters, the quality of work resulting from this approach has proved to be a problem and expertise and strong control are required by

the client to ensure acceptable quality. Generally speaking, significantly more experienced technical staff are required in local government to ensure quality service from contractors and service providers in all outsourcing models. This is not unique to South Africa.

> *Contracting is one of the most difficult methods a public organisation can choose, because writing and monitoring contracts require so much skill …* [9]

America's Union Movement,[10] coordinated by the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO), has filled books with horror stories on private contractors failing to deliver what they promised.

According to Professor John Benington of Warwick University, who addressed a PPP (public private partnership) conference in Midrand in February 2007, the quality of solutions let out on short term contracts at the lowest price have proven to be a problem worldwide, so much so that the Japanese manufacturing industry is now embarking on what they term 'relational contracting', that is, building long-term relational strategic partnerships with selected contractors based on return business in exchange for quality delivery.

Prior to the advent of supply chain management, a similar model was in place for the appointment of consultants. They were appointed on a roster system, based on expertise, knowledge of the local environment and the quality of past performance.

Contracting need not be limited to technical service providers. Services such as debt collection, payroll, HR and management of workplace skills plans can also be handled on a contract basis.

(b) SMME involvement

SMME involvement is the same as contracting in the sense that work is let out, but it requires considerably more supervision than traditional contracts because of the inexperience of most SMMEs.

(c) Franchising

It has been suggested that O&M should be franchised to SMMEs that are developed and supported by large players in the market (such as water boards) who will act as the franchisors, as well as by major contractors. This option may offer the guidance and control so desperately needed.

(d) Privatisation or divestiture

In this case the entire asset, its O&M and the opportunity to earn are sold to the private sector. These deals meet with the most resistance since the total responsibility is transferred to the new owner, which makes it difficult to hold them accountable for the long-term investment in and sustainability of the service, and renders the public sector helpless when things go wrong.

The privatisation of utilities in the UK has received considerable attention. Thames Water, transferred to private hands, was subsequently sold off-shore. The new owners are now said to be supplying water at lower quality norms than in the past, in line with their national standards, much to the horror of British consumers.

The collapse of British Rail is another spectacular example of what can go wrong when the crown jewels are sold (see inset).

However, privatisation and divestiture often lead to cost savings and improvements in service levels, as identified by Barbara Stevens of Ecodata.[11]

British Rail

The privatisation of British Rail has become the classic 'how not to do it' from which we all should learn. Structures, teams, capacity and systems were dismantled, investment in technology ceased and little or no O&M took place. The problems quoted below should be considered not only in terms of crafting PPP or privatisation contracts, but also as lessons for all involved in the development and O&M of public sector infrastructure.

Reliability and cost[12]

Increased volume of public subsidy … with both the decline in service reliability and fortunes made by some of the privatised company executives … rail staff numbers declined by 48% between 1994 and 1998, costs have increased slightly when reductions were being sought … rather than enhancing efficiency, cost-cutting has undermined the system.

Investment and safety[13]

The privatisation neither imposed investment targets on Railtrack nor empowered the ORR to do so, the inevitable result was a growing maintenance backlog … the tragic consequences could be seen in post-privatisation train crashes … the scheme has failed, and failed spectacularly.

Experience and team work[13]

It is true to say that a lot of experience did leave the industry. The effects of staff reductions have been compounded by the replacement of a trained, integrated and knowledgeable workforce with an unstable structure of contractor and sub-contractors each making money out of hiring the next down the food chain until at the base – where the work is done and the greatest strength is needed – labour is casualised.

Said *The Financial Times*:[14]

The first consequence was the breakdown of the old comradeship, which used to mean that problems were easily spotted, repairs made and people could talk to each other. Track workers operated in gangs and knew their stretch of rails like their own back gardens. Instead … workers became nomadic … with little or no local knowledge. Privatisation broke traditional bonds and practices of passing on skills and experience.

Private contractors tend to:

- *Require more work from employees*
- *Offer equivalent salaries but fewer benefits*
- *Match skill levels with job requirements*
- *Use part-time labour when appropriate*
- *Require that managers be responsible for equipment and labour availability*
- *Allow first-line supervisors to have hiring and firing authority*
- *Use incentive pay systems, and*
- *Use less labour-intensive means of providing a given service*

A survey by a citizen task force in the City of Charlottesville found such factors as less vehicle downtime, lower rates of absenteeism, and higher labour productivity to be key contributors to cost savings achieved through privatisation.

Careful crafting of sale agreements is critical to maintaining quality long-term service levels when going the privatisation route.

(e) Corporatisation[15]

Income streams from the delivery of various services are essential to a local authority. If the main services are privatised, the cash cows are lost.

To ensure dedicated service delivery per discipline, corporatisation or the agency route may be adopted since it separates the strategic from the non-strategic, and policy from operations. The council sets policy and service standards and holds these units accountable against the standards, but does not oversee these structures.

Departments and individuals can assume responsibility for their own tasks and be held accountable. The central administration body, however, ensures that good quality, affordable services are delivered. In making its decision to go the agency route, the iGoli 2002 strategic plan[16] to transform Johannesburg stated that:

> *… from an organisational perspective, iGoli seeks to put in place a 'sensible' structure that will deliver services at greater levels of efficiency …*

The key here is to ensure that these delivery units are efficient technical bodies and are not bedevilled by staff shortages and political interference.

The New Zealanders have all but perfected this model, setting up individual departments in which departmental managers have greater flexibility in running their departments. However, argues the *World Bank Research Observer,*[17] New Zealand's system is heavily dependent on a strong system of regulating contract enforcement and should not be tried in most developing countries. The article continues to say that:

> *… developing countries must first take the step of formalising their structures before they can try new forms of public administration.*

However, this may be the solution for some of our larger cities that still have some structures, systems and capacity in place, but requires strong planning and coordination, as well as realistic budgeting, to enable them to achieve their delivery goals.

(f) Public private partnerships

There is a view that the woes of local authorities will be addressed successfully by public private partnerships (PPPs). A few such initiatives have been successful, particularly in terms of O&M of water infrastructure, revenue enhancement and debt collection. The following definition accurately defines a PPP:[18]

> *A collaborative arrangement over one or more phases of the life cycle of a project between government or its agency and one or more private sector parties. The rights and responsibilities are innovatively specified with the element of sharing risk and rewards in a long-term contractual relationship.*

The emphasis is on a partnership and sharing risks and rewards. On the surface this seems like the way to go, since private sector involvement allows additional capital to be raised and introduces additional capacity and expertise.

However, at some stage capital must be repaid, impacting on the later costing or development of the service.

Unfortunately, many South African municipalities service large indigent populations, which makes providing services unattractive to the private sector. An international scan on urban development reflected that in both developing and advanced economies:[19]

Formal privatisation in many cities has not benefited lower income communities, which underscores the need for the public sector to have a role in the delivery of essential services.

Furthermore, moving to this mode of service delivery on a large scale will meet the same capacity constraints that the country is facing already unless these contracts include meaningful capacity development.

It seems that only significant ring-fenced income-earning activities would therefore lend themselves to PPPs. Comprehensive guidelines have been developed by **dplg** on the selection and implementation of municipal service partnerships.[20] While PPPs involve outsourcing of service delivery, the municipality remains accountable. Under a municipal service partnership, the:

> *… municipality's focus shifts from managing the input of service provision to managing the outcomes. It becomes the contract manager rather than the resource manager.*

Again it requires astute technical staff in local government to identify these opportunities, and develop and manage partnerships that will better serve their municipalities. Hence the urgency to start developing in-house capacity, as called for by Director-General Lindiwe Msengana-Ndlela.

In support of her idea, Professor John Benington of Warwick University mentioned that in the UK there is now a major drive to bring skills back into the public sector. A similar view was expressed by Professor Steven Kelman of Harvard University on a visit to South Africa in early 2007. He suggested that 'teams of civil servant technical staff' should be handling public sector needs.

(g) NGOs or the 'third sector'

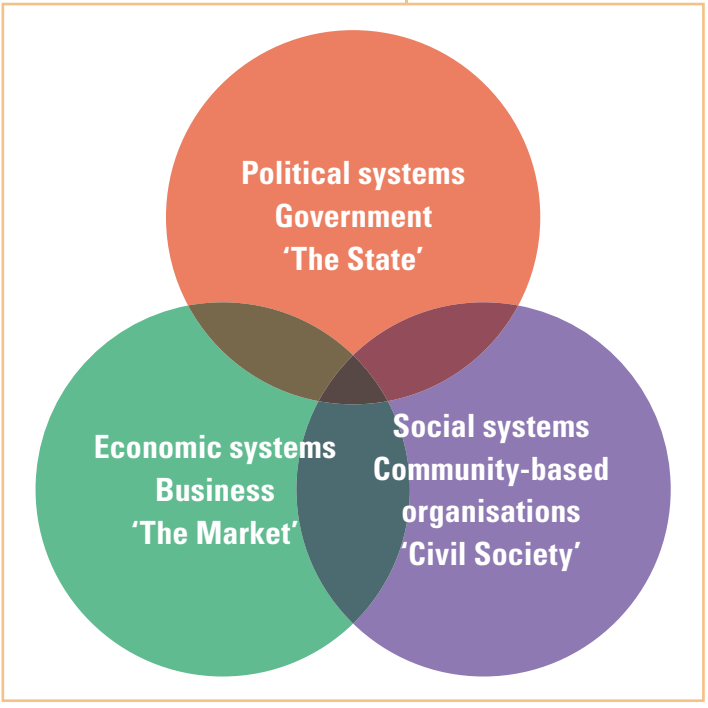
Research in the USA in the 1980s showed that non-profit organisations delivered 56% of all social services financed by government, 48% of employment and training services and 44% of all health services. In South Africa NGOs are equally valuable as they bring passion to the party – passion to address the problem or cause around which they are constituted.

A good definition of NGOs is the following:

> *Organisations that are privately owned and controlled but that exist to meet public or social needs, and do not accumulate private wealth.*

In terms of developmental local government there are many areas in which NGOs could be harnessed rather than setting up yet more in-house departments. The role of the NGO is primarily to improve operator or developer understanding of poor customers thereby facilitating

Figure 5.10 The three sectors



Source: *Societal learning*

Table 5.5 The three sectors – comparative attributes

	Government	Business	Civil society
Primary interest	Political	Economic	Social
Primary control agents	Voters/rulers	Owners	Communities
Primary power form	Laws, police, fines	Money	Traditions, values
Primary goals	Societal order	Wealth creation	Expression of values
Assessment frame	Legality	Profitability	Justice
Goods produced	Public	Private	Group
Dominant organisational form	Governmental	For profit	Non-profit
Relationship basis	Rules	Transactions	Values
Organising frame	Administering	Managing	Developing
Temporal framework	Election cycles	Profit-reporting/ business cycles	Sustainability/ regeneration cycles

Source: *Societal learning*

better needs analyses, planning, designs and hence sustainability.[21] A respected NGO with the necessary credibility to maintain trust can often move business or the public sector towards achieving environmental, social and/or development objectives.

The comparison of sectoral differences shown in Table 5.5 was developed by Waddell.[22] He suggests that because the three sectors each have unique resources, as can clearly be seen in Figure 5.10,[23] their interaction can generate important innovations. Of importance in terms of service delivery is civil society's emphasis on social rather than political aspirations and value-based development rather than administrative, rule-based activities. Such flair should be welcomed in local government.

The term 'third sector' thus relates to the additional service delivery capacity offered by NGOs, over and above that of the public and private sectors.

The ENERGYS team like to think that the value of their independent thinking has brought about changes in many of the municipalities in which they have served.

Support for the third sector is also echoed in the British White Paper on Local Government,[24] as follows:

> *… partners such as local third sector organisations can play a huge part in building cohesion. They can provide the glue that binds … together and create the opportunities for people of different backgrounds to work together for shared goals. They can also reach groups at grassroots level whose voice is critical to the debate.*

Partners such as local third sector organisations can play a huge part in building cohesion. They can provide the glue that binds … together and create the opportunities for people of different backgrounds to work together for shared goals

The British have even established an Office of the Third Sector under the direction of a minister appointed specifically to look at ways of harnessing this capacity more widely and effectively.

However, to extend the scope of the third sector in South Africa, procurement criteria will have to be expanded, since points for ownership can at present not be scored by NGOs and this compromises them in the procurement process.

(h) The danger of silos

Many functions carried out by local authorities would not be profitable or attractive to the private sector. In outsourcing specific services and disciplines only, many functions are in danger of 'falling between the cracks'.

The following questions must be asked:

1 **Who** will develop the spatial development framework?
2 **Who** will handle master planning and using whose data?
3 **Who** will plan network extensions?
4 **Who** will maintain corporate data – rainfall figures, aerial photography, traffic volumes, accident statistics, consumption figures, geotechnical data gleaned from excavations, etc?
5 **Who** will manage servitudes?
6 **Who** will co-ordinate and record where new services are to be located in the road reserve?
7 **Who** will provide reaction teams to deal with emergencies, such as high-pressure water main bursts, failing fire networks, gas explosions or sink holes over the reef outcrop or dolomitic material?
8 **Who** will coordinate service upgrades to minimise excavations and reinstatements? (see Figure 5.11)
9 **Who** will reinstate road markings or traffic signs after repairs or vandalism?

When all services are coordinated centrally the big picture is much easier to develop and keep up to date. The challenge with outsourcing is to keep all service providers in the loop to ensure that work is not duplicated or overlooked.

One wise ENERGYS engineer, after studying the challenges facing the municipalities in which he was deployed, suggested that outsourcing should be directed at non-critical services, such as parks and sidewalks. He observed that municipalities outsource complex and key services in which it is difficult to manage the service providers (for example, water supply, sanitation and electricity). Furthermore, outsourcing these critical services hampers the collection of statistical data for future planning. The final challenge in outsourcing complex engineering services is that service providers also require sufficient people trained in local government service delivery to be in a position to perform adequately. As little or no training has taken place over many years, the pool of competent municipal engineering experts is dwindling in both the public and private sectors.

The key to outsourcing is to ensure that the service partner is capable of offering the service, is committed to do so and has the capacity required.

Regardless of the models adopted, of critical importance is the oversight role that must be played by local government. (See Figure 5.12.)

Clause 81 of the Municipal Systems Act 2000 (Act 32 of 2000) states that:

> *If a municipal service is provided through a service delivery agreement … the municipality remains responsible for ensuring that the service is provided.*

Figure 5.11 Reinstatement required by one municipality after excavations had been carried out by the water service provider. Lack of coordination and resources resulted in the excavation remaining open for many months

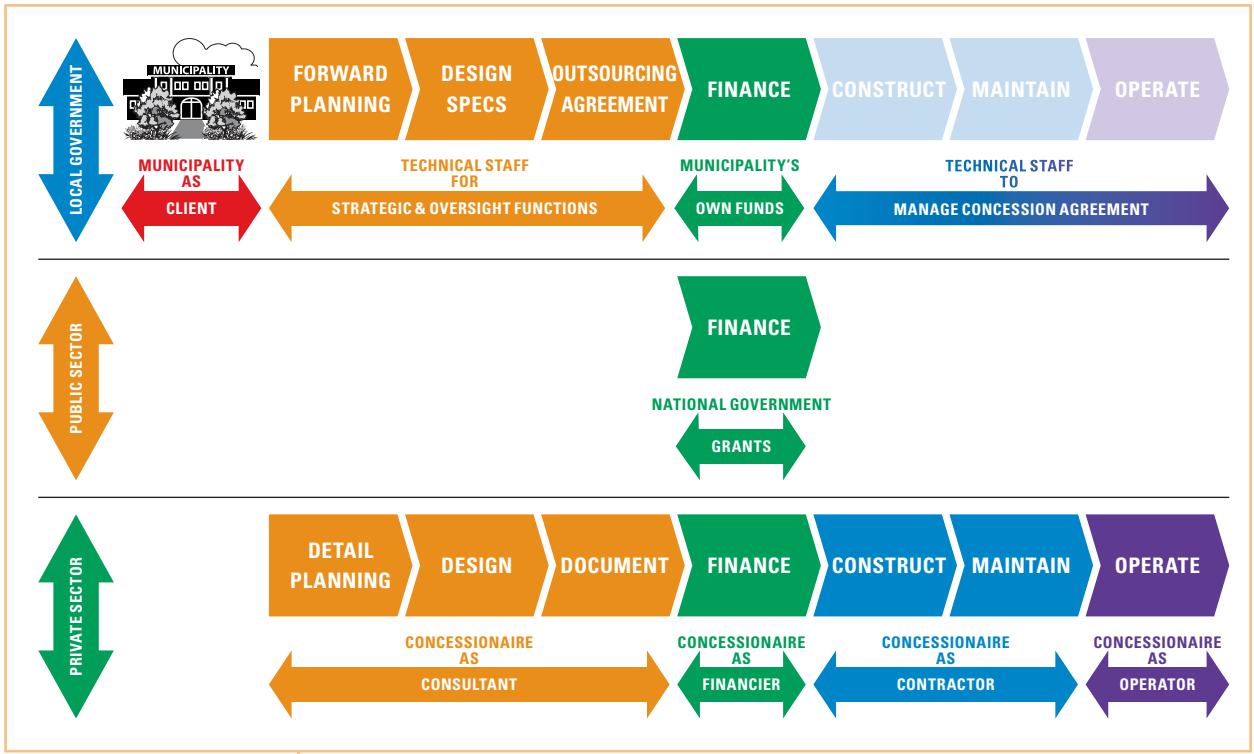


Figure 5.12 Recommended staff and functions to be performed or managed when all technical functions are outsourced

The informed client requires a core of experienced, highly trained technical staff to plan ahead, to initiate schemes that suit their communities (including convincing the politicians of their necessity), to brief consulting engineers, to monitor progress and expenditure, and to liaise with developers, affected property owners and service departments or service providers. Planning must be based on reliable surveys and data.

Interestingly, a comprehensive survey of contracting of various forms in the USA[25] showed that outsourcing highways and electricity resulted in higher costs, whereas savings were effected when outsourcing parks, cultural services and other non-technical activities. The difference was attributed to the need for experienced technical staff to be retained by the public sector to manage and monitor the contracts.

Without this oversight it is unlikely that the municipality will achieve its service delivery goals. This once again emphasises the need to expand the pool of competent municipal engineering staff.

5.7 QUALIFICATIONS AND EXPERIENCE

Experienced staff who have the interests of the municipality at heart are required. Staff need to be motivated, and excited by their jobs. They need to see their municipality as their own business and have the flexibility to make decisions accordingly

Efficient service delivery in all spheres of life requires competence, which is in essence a product of experience. Municipalities are no exception. Research has shown that municipalities with experienced technically qualified professional staff are providing better service to their communities.

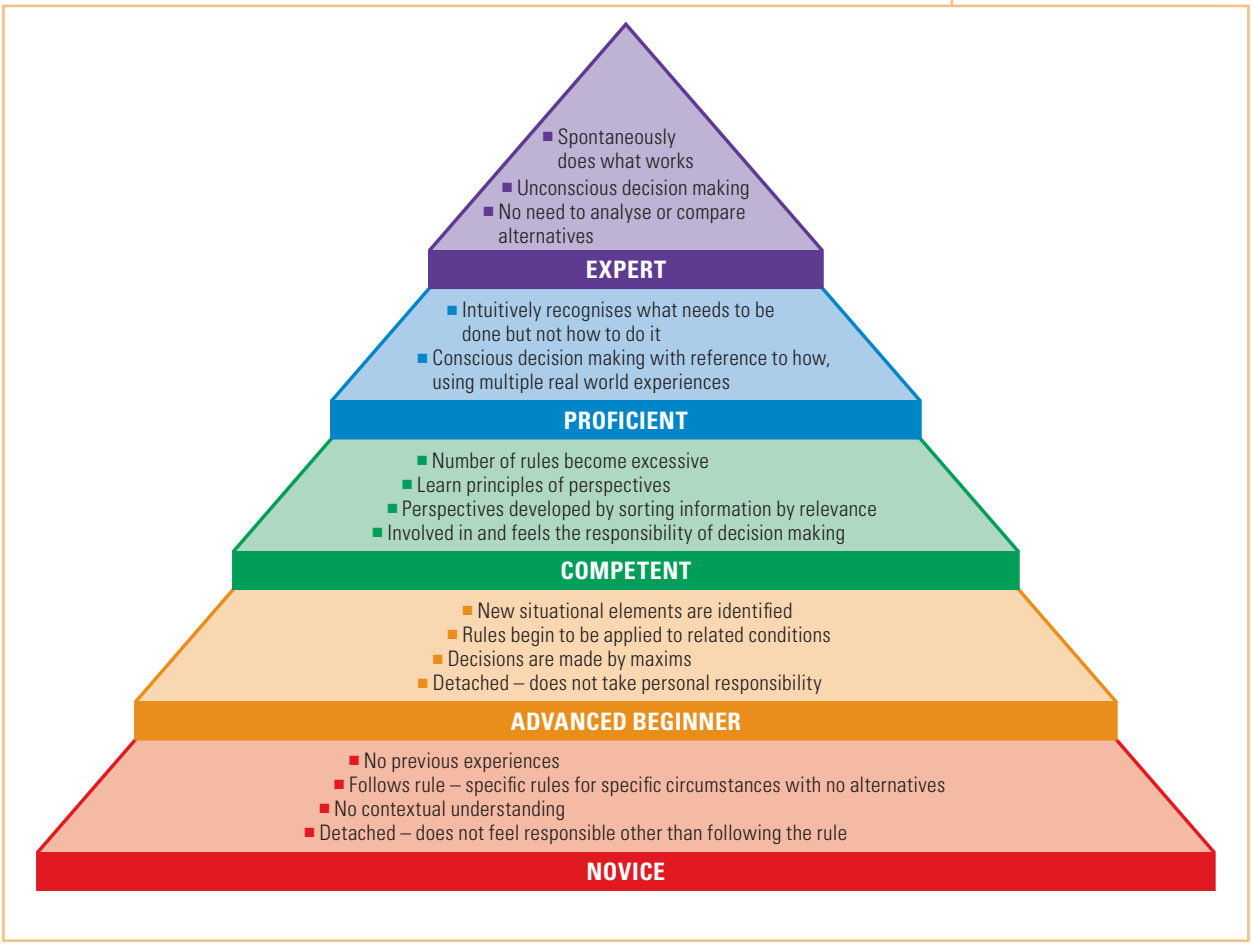
Looking at the five stages of skills development as depicted in Figure 5.13, the responsibility for major decisions can clearly not be left to the novice or advanced beginner.

Competence is the minimum level we should be striving for at junior level and expertise is the minimum we should expect from senior managers responsible for making strategic decisions.

In designing organograms all technical aspects outlined in the project cycle in Table 5.6 must be taken into account. Master plans based on sound asset registers should inform the IDP which should outline the full spectrum of activities required, and numbers and levels of technical staff. The skill level of the most senior person per department would be determined in relation to the most complex service offered by that department. For instance, in a rural municipality with a well-established dry sanitation programme, a technician who has gained a few years' experience under supervision in that field could comfortably take over and expand such a programme. However, departments in major centres faced with complex choices in terms of levels of service, technology options, difficult local conditions, etc would require a professional engineer who has experience of the pros and cons of all the options.

The functions discussed above relate only to the technical departments and do not indicate positions or grades in relation to the rest of the municipality. Current municipal organograms have buried the technical departments below administrative structures. This has resulted in some municipalities allocating technical managerial positions to non-technical staff, the impact of which has generally been non-delivery.

Figure 5.13 The skills acquisition pyramid



Source: Adapted from *What is moral maturity?*

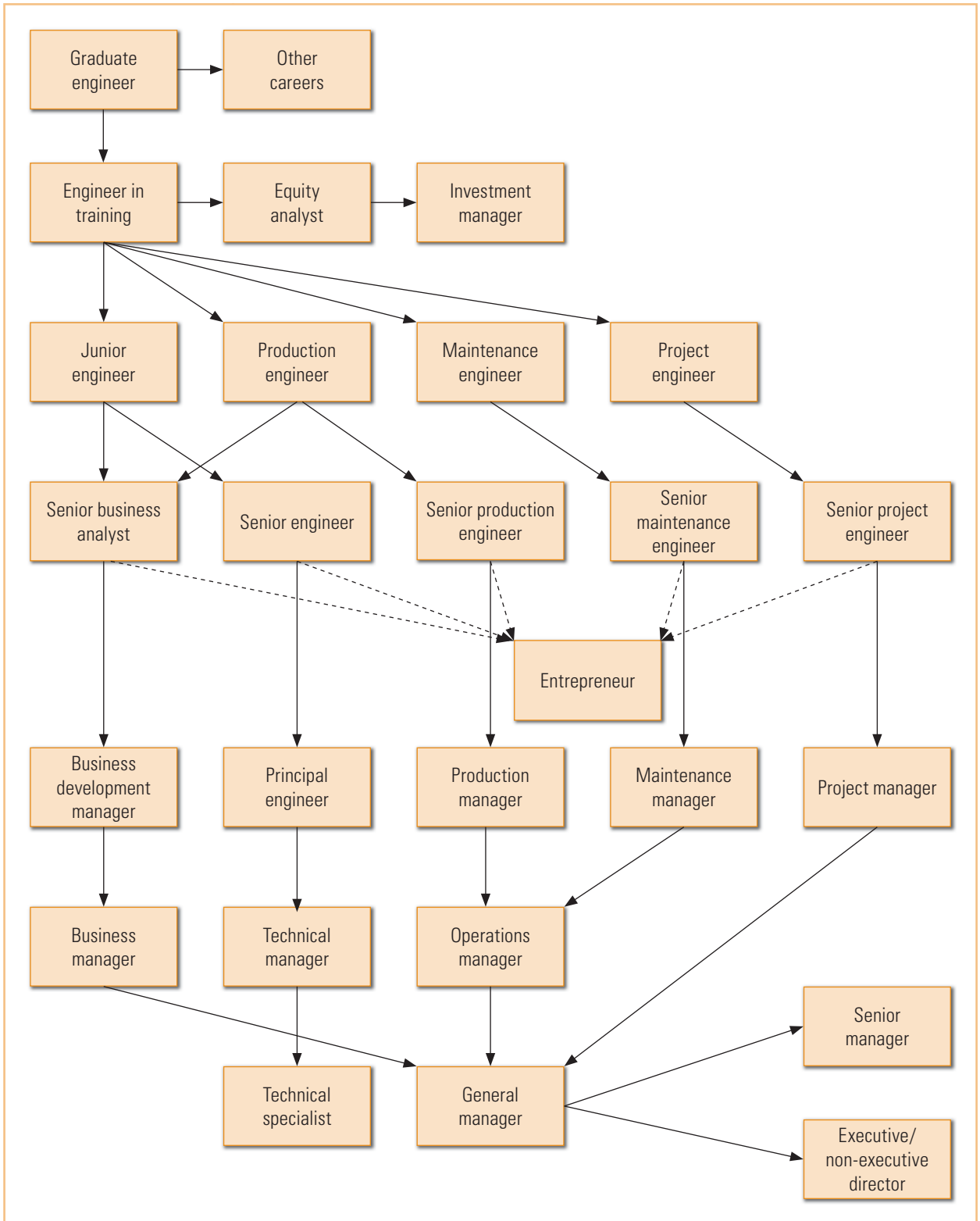


Figure 5.14 The career path of an engineer in a large private sector organisation

Whilst non-technical people may be trained in administrative elements of service delivery, staff with technical know-how are needed to manage and drive these departments, make decisions and ensure that the huge investment being made by the country in infrastructure is not wasted because of a lack of quality control and ongoing maintenance.

Says Paul Kgole, past president of SABTACO:

> *Whilst it is understandable that the ANC led government needed to rely on people it trusted in service delivery, the cross boundary municipalities as an example has shown that that notion cannot substitute professional technical knowledge and excellence.*
>
> *It is common cause that the majority of experienced Engineers are white, however to the extent that they received this experience using the resources of South Africa, it is only correct that they be allowed the opportunity to share this wealth with their young black Engineers.*
>
> *It is against this background that there is a need to review the sunset clause agreed upon during CODESA, since the experienced white Engineers have a massive knowledge of the Municipal Service Delivery Systems.*
>
> *It is very wrong for any reason whatsoever to put young inexperienced black Engineers to look after Municipalities, which has very intricate infrastructure problems including monitoring and controlling highly experienced and sometimes very sly consultants without any backup plan.*
>
> *Government should therefore formalize the twinning of experienced white Engineers with young qualified inexperienced black Engineers to create a mentorship programme, which has a massive skill transfer aimed at providing the much needed service delivery in South Africa.*

It is high time that we build our civil engineering capacity again.

Career pathing is essential. It is not just a matter of graduating and assuming a senior role. The entire project cycle must be understood, and hierarchies of young, mid-career and experienced professionals must work together to address all levels of service delivery: the young to carry out simple tasks from which they will gain sufficient experience to progress to the production phase, the mid-career professionals being responsible for day-to-day production, and the senior professionals offering strategic direction and overall management.

Figure 5.14[26] shows the progression of an engineer in the manufacturing environment. The business imperative is to develop technical expertise and strategic management skills to ensure optimum production and maximum profitability. Top-heavy or inexperienced structures would never be entertained. Table 2.1 in Chapter 2 showed the equivalent progress for students and graduates to proceed through the ranks of a municipal technical department.

Staff at all levels have a role to play. If there are no young people, senior staff would have to spend too much time on mundane engineering activities (which nevertheless require engineering skill) and if there were no senior staff, astute decisions relating to long-term sustainability and profitability would be unlikely.

Ideas on rebuilding capacity are given in 5.9.2.

Table 5.6 The civil engineering project cycle in more detail

Engineering and re-engineering

Forward and master planning

Offer specialised technical input into long-term plans, such as the Integrated Development Plan (IDP), Water Services Development Plan (WSDP), Integrated Transport Plan (ITP) and master plans on engineering issues with regard to service provision options, construction costs and future operations and maintenance costs.

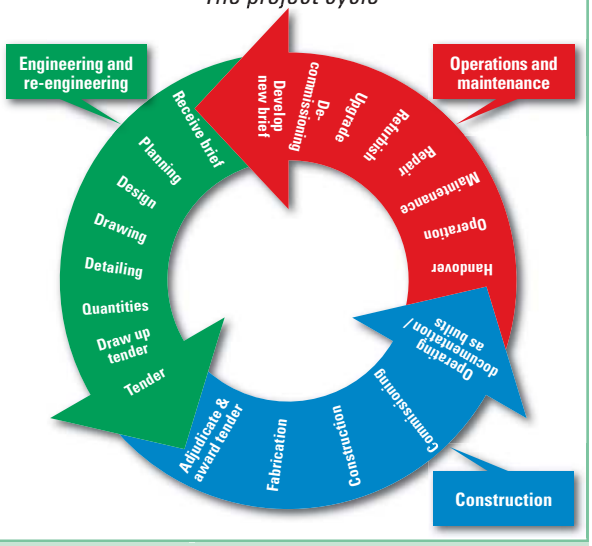
Development framework

Ensure an effective and efficient, sustainable service is provided by drawing up municipal by-laws and policies and setting technical requirements/specifications and associated tariffs for private and industrial development.

Identification and analysis

Plan at a macro-level to determine needs. Examine master plans and consider demands and constraints, including demographic, land-use, socio-economic, geotechnical, hydrological, topological, environmental, servitudes and access. Motivate for project acceptance and include in the IDP. Raise funding via MIG, Equitable Share, capital, loans, etc.

The project cycle



Project proposal

Develop project proposal, including requirements for construction approach, technical performance, life cycle costing and maintenance projections. Define lines of communication, reporting and coordination with local communities and other stakeholders, such as DWAF, DOT, Eskom and Unions.

Planning

Research: Undertake or ensure an informed planning process, including socio-economic and biophysical considerations. The system should fall within the community's technical skills for operations and maintenance and their financial ability to meet maintenance costs where appropriate.

Collect data: Arrange for selected information to be collected, for example current population, number of households and residential users, non-residential users, current level of service, and demand for services in relation to willingness to pay.

Investigate: Investigate the relevance of information collected.

Feasibility: Formulate or manage formulation of first preliminary designs considering parameters below. Include budgets to confirm viability and affordability and ensure that community aspirations are met. Ensure integrated approach is adopted.

Design

Resources: Assess all resources, as follows:
- Climate, for example rainfall, evaporation and seasonal changes
- Hydrology, for example sources of uncontaminated water, water table, ground water and presence of streams, rivers and dams
- Geology, for example prevalent rock and soil types, impervious and pervious layers, geological faults, boreholes and dam sites
- Availability of suitable materials checking in-situ CBR of subgrade and grading modulus and life cycle costing of overburden removal, operation, extraction and re-establishment of suitable borrow areas

Legal compliance: Determine the effects of legislation and guidelines on the design, for example the effect of environmental legislation on the disposal of sludge, DWAF guidelines on the standards for potable water and DME legislation covering siting and use of borrowpits. Be aware of the constraints of the various Acts as outlined in Section 3.10.3. Obtain sector department approvals where necessary.

Carry out designs: Evaluate all technical solutions. Calculate construction, operation, maintenance and replacement costs/budgets for each alternative. Cost and evaluate influence of each alternative on other services, e.g. water mains may have to be relocated due to vertical alignment of proposed road. Consider new systems and techniques or alternative approaches and implement where beneficial and appropriate e.g. saving on smaller diameter pipe vs. higher pumping costs, new binding additives for roads, package plants to treat sewage, sludge dewatering equipment to reduce the need for drying beds, self cleaning pumps to prevent blockages and keep sumps free of silt deposits etc.

Review designs: Review alternative design approaches and assess in terms of the brief. Assess the advantages and disadvantages commercially, socially and technically presenting the full life cycle costs for assessment.

Design considerations: These vary per discipline, as outlined below.

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5.7.1 Chief engineer

Based on the need for technical leadership, the senior technical position in each municipality should be legislated, as is the case with the municipal manager and the CFO, so that technical staff have authority to ensure that technical issues are given sufficient attention and recognition.

Furthermore, as outlined in Chapter 3, senior technical posts should be held by experienced professionals registered with the Engineering Council of South Africa (ECSA). The number of years of experience and level of registration will vary according to the size of the municipality and the complexity of the services provided.

Say Paul Kgole, past President of SABTACO:

> *The Municipal Legislative Framework should be simplified to allow managers (especially those with technical knowledge, such as Engineers) ease of decision-making without fear of reprisal.*
>
> *The political decision-making processes should be clearly demarcated from technical and other managerial decision-making processes.*
>
> *Engineers working in the Municipalities should have a comprehensive Professional Indemnity Insurance to cover them in case they make a decision which may have serious repercussions. There would thus be no need for them to fear making any technical decision due to inherent fear emanating from the Municipal Finance Management Act.*
>
> *Whilst the Municipal Manager is the overall responsible person for the performance of the Municipality, the Engineers should take full responsibility on matters of a technical nature, in the case where the Municipal Manager is not technically qualified and not in possession of the relevant technical experience.*
>
> *The notion of a CITY ENGINEER becomes very important and he/she must sit on the full Council to provide professional technical direction and advice.*

The Municipal Finance Management Act, 2003 (Act 56 of 2003, MFMA) should be fully understood and, if necessary, overhauled to alleviate the inherent fears of officials in making decisions for fear of punitive measures.

The future chief engineers should have authority on matters of human resources, supply chain and payment of technical suppliers and service providers in order to speed up projects and contracts.

In Bogotà,[27] a succession of mayors came from non-traditional parties, and had the freedom to choose members of their administration, which made it possible for them to choose people they felt were best qualified. Their teams were made up of professionals who were not politically motivated, but were:

> *… much more ethical and professional in their way of working …*

This reduced corruption, increased staff efficiency and improved the quality of contracts with the private sector.

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Engineering and re-engineering

Water

Water network design

Consider the following:

- ***Demand*** from domestic, industrial, recreational and agricultural consumers, fire fighting and gardening facilities
- ***Growth*** **in demand** and future increase in supply zone
- ***Size and location:***
  - ☐ Consider minimum standard pipe sizes
  - ☐ Consider routes and location of storage reservoirs and elevated towers, contours and pressure zones
  - ☐ Identify environmentally sensitive areas
  - ☐ Identify low points, hydraulic gradient, and need for thrust blocks, anchorage, zone isolating valves, valve chambers, etc
- ***Stream or ravine crossings – consider:***
  - ☐ Pipe bridge vs route around vs through stream bed
  - ☐ Effects of scouring in stream bed vs use of pipe bridge for pedestrians
  - ☐ Possible flood damage to structures
- ***Selection of fittings – consider:***
  - ☐ The need for air, isolating, non-return or scour valves, and hydrants
  - ☐ Maximum/minimum supply pressure and break-pressure devices
  - ☐ Effects of bursts on the environment
  - ☐ Access to maintain valves and repair bursts
- ***Material selection – consider:***
  - ☐ Static pressure and water hammer in rising mains and when closing valves
  - ☐ Long-term pressure variations
  - ☐ Hardness of water conveyed
  - ☐ Long-term health effects on consumers
  - ☐ Restrictions on depth of pipes below ground
  - ☐ Vicinity of DC current

Sanitation

Sewer network design

Consider the following:

- ***Inflows*** from high- and low-income housing, industry, commerce, recreation and infiltration
- ***Growth*** in load and future increase from upstream developments
- ***Size and location – consider:***
  - ☐ Minimum standard pipe sizes
  - ☐ Routes and location of treatment works, slope of terrain, contours along route, inverted siphons vs sewer bridges to cross valleys, effects of spills on the environment, maintenance requirements, access to sewers to clear blockages, liberation of noxious or corrosive gases
- ***Stream or ravine crossings – consider:***
  - ☐ Pipe bridge vs inverted siphon vs. route around and need to maintain scouring velocity in siphons
  - ☐ Noxious and corrosive gas liberation and scouring of foundations at crossing
  - ☐ Flood damage to structures if pipe bridge selected
- ***Silt management – consider:***
  - ☐ Silt traps where designs or practical situations require all-weather access for removal of silt and sludge
  - ☐ Safe and environmentally acceptable disposal of removed material
- ***Material selection – consider:***
  - ☐ Presence of grit
  - ☐ Temperature of effluent
  - ☐ Corrosiveness of effluent
  - ☐ Restrictions on depth of pipes below ground
  - ☐ Water hammer in rising mains

Stormwater and roads

Stormwater network design

Consider the following:

- ***Inflows*** from domestic and industrial contributors, storm sizes and storm frequencies
- ***Growth*** of paved areas
- ***Pollution – consider:***
  - ☐ Environmental issues
  - ☐ Treatment
  - ☐ Health
  - ☐ Safety
  - ☐ Risk abatement management
- ***Stormwater routing and location – consider:***
  - ☐ Natural flood routing
  - ☐ Flood line determination
  - ☐ Detention and retention facilities and wetlands
  - ☐ Outlet flow control to stormwater detention ponds using:
    - – Proportional or V-notch weirs
    - – Energy dissipators
    - – Erosion control
- ***Size and selection – consider:***
  - ☐ Kerb inlets
  - ☐ Grid inlets and side weirs
  - ☐ Concrete pipes
  - ☐ In-situ culverts
  - ☐ Steel fabricated culverts
  - ☐ Open channel
- ***Road surface drainage – consider:***
  - ☐ Sheet flow
  - ☐ Flow across traffic lanes, etc

Water

Pump station and elevated water tower design

Consider the following:

- ***Location and type*** taking into account technical vs social vs environmental parameters
- ***Water pumps*** – cavitation and maximum suction and lifts
- ***Water hammer*** – design for resultant pressures
- ***Valve selection*** – ensure air valves and non-return valves are of correct size and type
- ***Standby capacity*** – provide generators or diesel pumps
- ***Telemetry and SCADA monitoring*** – ensure performance and monitor pilfering and vandalism
- ***Maintenance*** – ensure appropriate access and lifting gear are provided

Sanitation

Pump station design

Consider the following:

- ***Location and type*** taking into account technical vs social vs environmental parameters to avoid the effect of smells, spills and liberation of gases, corrosive atmosphere created at rising main discharge points, appropriate treatment of receiving manhole considering solids being pumped are in the form of solid lumps and long rags
- ***Water hammer*** – design for resultant pressures
- ***Valve selection*** – ensure air valves are of correct size and type for sewage and not water
- ***Standby capacity*** – provide generators or diesel pumps
- ***Telemetry and SCADA monitoring*** – ensure performance and monitor pilfering and vandalism
- ***Maintenance*** – ensure appropriate access and lifting gear are provided

Roads

Road geometric design and layout

Consider the following:

- ***Classification*** of the road and street system, that is vehicle-only routes (regional and primary distributors) vs mixed vehicle and pedestrian routes (district and local distributor and access streets) vs pedestrian-only routes
- ***Design*** – vehicle
- ***Design*** – driver
- ***Road surface and design speed*** – asphalt, gravel, etc
- ***Sight distances – consider:***
  - ☐ Stopping
  - ☐ Barriers
  - ☐ Passing
  - ☐ Intersections
  - ☐ Horizontal and vertical alignment
  - ☐ Curvature and superelevation
  - ☐ Maximum gradients

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5.8 PROCESSES

5.8.1 Planning

The ENERGYS team has worked on the maxim:

> *You cannot work yourself out of a backlog if you cannot plan yourself out of a backlog.*

Few municipalities currently grappling with meeting backlog deadlines have any forward plans, let alone detailed plans on how to tackle their specific backlogs!

As outlined in previous chapters, the planning process requires much attention. The IDP was designed to ensure complete integration of all needs into a sound, long-term road map for development. Typically, the following aspects require consideration:

- Spatial development planning
- Water services development planning
- Integrated transportation planning
- Integrated energy planning
- Integrated environmental planning
- Integrated waste management planning
- Integrated disaster management planning
- Integrated housing development plan
- Integrated performance management system
- Integrated economic strategy and LED
- Integrated poverty alleviation planning
- Financial planning
- Budgeting processes

IDPs have not addressed these expectations since the approach is only forward looking and is not based on the current status quo. Initiatives related to forward and master planning must urgently be mounted nationwide.

(a) Forward planning

Says James Ngobeni, past president of SABTACO:

> *Macro planning and integration of settlements is critical to sustainable development. Unfortunately, most decision makers prefer to take a shortcut by appointing developers without giving cognisance to macro planning. One off developments do not enhance integration of different land uses within settlements and between settlements.*

Forward planning requires not only for communities to offer input on their needs, but for planners (including town and regional planners and transport planners), economists and technocrats to apply their minds to growth and development strategies as a whole. By identifying nodes for retail outlets that will keep consumer spending within the municipality, and for new residential, industrial, farming, tourism and other opportunities to attract investment and create job opportunities in the area, a longer-term spatial plan should be drawn up to improve the financial viability of the municipality. In so doing it will be better equipped to address community needs. Such planning will also indicate the need for improved through routes, amenities and increased bulk services to support growth, and will highlight opportunities for developers.

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Engineering and re-engineering

Boreholes, wells and springs
Consider the following:
- Quality of supply
- Yield
- Treatment methods
- Supply methods to consumers
- Maintenance
- Cost recovery

Dams
- Consider the following:
- Need for augmented supply
- Motivation for DWAF or water board to assist with augmentation

Water purification works and disposal of settled sludge
Consider the following:
- *Treatment processes*
  - Settlement and filtration
  - Dissolved air flotation
  - Reverse osmosis
  - Package plants
- *Variables*
  - Activated carbon
  - Chlorination
  - Settleable solids loads
  - Mineral and organic content
  - Water quality guidelines
  - Bulk chlorine dangers in transport, storage and application

Reservoir design
Consider the following:
- *Size* of storage required in terms of usage and fire
- *Chlorination* and the need to augment disinfection
- *Telemetry* and SCADA monitoring to ensure performance and monitor pilfering and vandalism
- *Health* risks through contamination

Servitudes
Consider the following:
- Water, electricity, telephone, sewer, sidewalks requiring multidiscipline co-ordination

Dry sanitation
Consider the following:
- *Local conditions:*
  - Health and hygiene
  - Ground water usage
  - Geotechnical aspects
  - Environmental aspects
  - Social acceptability
- *Type of solution:*
  - VIPs
  - Urine diversion
  - Chemical toilets
  - Composting
  - Double vault

Sewage treatment works and disposal of sewage sludge
Consider the following:
- *Treatment processes*
  - Ponds
  - Biofilters
  - Extended aeration
  - PETRO process
  - Package plants
- *Characteristics of inflows* – consider:
  - Total volume
  - Biological load
  - Organic load
  - Peak flows and their durations
  - Sewage strength during peak flows
  - Carbon emission and abatement

Sludge handling and disposal
Consider the following:
- Digestors and heated digestion
- Centrifuges, belt and filter presses
- Peletisation
- Composting
- Disposal to landfill

Re-use of effluent
Consider the following:
- Riperian river requirements
- Agricultural irrigation
- Industrial process water

Servitudes
Consider the following:
- Water, electricity, telephone, sewer, sidewalks requiring multidiscipline co-ordination

Cross-section design
Consider the following:
- Climbing lanes
- High-occupancy vehicle lanes
- Parking, cycle or auxiliary lanes
- Shoulders, verges and sidewalks
- Medians and other separators

Intersections – consider:
- Successive, isolated and control of, using signals, multiway stop, circles and roundabouts

Intersection components – consider:
- Auxiliary through and turning lanes, tapers, kerbs and channels, islands, etc

Road materials and construction
Consider the following:
- *Paved streets:*
  - Structural design and bearing capacity
  - Design traffic and E 80 equivalency factors
  - Computation of cumulative equivalent traffic growth factors
- *Pavement types:*
  - Untreated granular-based with thin bituminous surfacing
  - Bituminous-base pavements
  - Bituminous cold-mix base pavements
  - Concrete or cement-base pavements
  - Paving blocks

Selection of granular materials – consider:
- Structural design period
- Climate on foundation material
- Subgrade California Bearing Ratio (CBR) for AASHTO design
- Dynamic cone penetrometer (DCP) method
- Structural material depth and layer work
- Subsurface drainage
- Compaction requirements per pavement layer, that is modified AASHTO % compacted density

Construction approaches – consider:
- Conventional mechanised
- Labour-intensive and EPWP
- Use of ABEs

Servitudes
Consider the following:
- Water, electricity, telephone, sewer, sidewalks requiring multidiscipline co-ordination

Budgeting: Prepare budgets for the alternatives above for presentation to all parties.

Existing services – GIS: Communicate with all local and national authorities in respect of existing services and planned upgrades to services affecting the project. Using GIS, superimpose the alternative designs onto existing services and investigate the impact of service conflicts and the alternatives to relocation.

Report and design recommendations: Review all the factors above using advanced, efficient design and innovative production methodology to optimise the use of locally available materials and labour. Prepare a business plan setting out details, demonstrating how the project conforms to national policy, and how it will be implemented and managed. Describe the funding strategy, life cycle costing estimates and recommendations.

Drawing

Prepare or oversee the preparation of a full set of drawings suitable for construction and ensure clarity of design criteria.

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(b) Master and scenario planning

Master planning exercises will be hampered where there is no data. Having decided on future developments, master plans must be consulted to determine shortcomings and expanded to accommodate the aspirations of the city leaders (political and official). Master plans would then be operationalised through the IDP. Without systems and asset registers this holistic approach to planning and development is not possible. A national, funded drive must be mounted to ensure that asset registers (including location, age, condition, time, value, suppliers, etc) and master plans are developed and maintained for each municipality, ideally using in-house staff who are au fait with their infrastructure, in partnership with experienced external technical advisors who have local knowledge

The process should address backlogs in basic service delivery as well as backlogs induced by the lack of O&M. Overlaying the long-term needs, associated shortfalls should be identified and budgeted for. This will eliminate ad hoc decisions and construction of short-term or emergency 'bulk' infrastructure that is unsustainable.

With the master plan developed, the implications of developer scenarios can easily be assessed and estimates can be generated for each application. On a practical note, in planning for the long term and particularly densification, wider road reserves, larger pipe diameters, pumps, etc than currently required, should be considered for all new projects.

(c) Multi-year planning and spending

In looking at the planning, tendering, design and construction of major projects, such as bulk services, it is evident that these projects do not fit well into a calendar year, which impacts on the type of projects being selected annually. Projects should be planned and implemented over a three or five-year period in order to ensure that sustainable, integrated solutions are implemented.

James Ngobeni continues:

> *For urbanisation to occur within the ambit of sustainable development is probably one of the biggest challenges facing urban planners and local municipalities/decision makers – to ensure that whilst growth takes place it does not negatively impact on movements and interfaces of different land uses.*

(d) The IDP

It should not be permissible to prepare an IDP without all the above information to ensure selection of practical, overall solutions for the long-term sustainability of the municipality. The IDP should however also be looking at the long-term city or town development as well as immediate needs. Whilst it is understood that development in each ward is desirable, council should look at priorities in terms of overall sustainability of their towns and cities.

5.8.2 Budgeting

In deciding on capital and MIG expenditure it may be in the town or city's interest for all sectors to pool a significant portion of their funds for a strategic development, such as a through route or a bulk service, or to complete a major housing development. Councillors and technical departments need to be bold in these decisions for the sake of optimum long-term results. The Top Twenty Townships programme in Gauteng has seen some municipalities dedicate a considerable portion of their funds to provide services and housing to complete townships. To support ward councillors in satisfying their communities

Continued from page 192

Engineering and re-engineering	**Detailing** Check that full details of all components are provided, including cross- and long sections, drainage, manhole, rising main, valve chamber, pump stations and treatment works. Waterproofing, reinforcing and prestressed steel details are required in the case of structures.
	Quantities Extract detailed bill of quantities in terms of standard methods of measurement for civil engineering projects from field work survey. Check accuracy of estimates using current unit rates. Check that tender cost is within budget.
	Draw up tender Draw up tender including engineering details including specifications, final design, bills of quantities, detail drawings, general conditions of contract and tender conditions. Provide detailed methodologies in respect of advanced or innovative design criteria as well as clear and well-documented special conditions of contract applicable to the project for consideration by the bid committee.
Construction	**Tender** Define the requirements of suitably qualified tenderers including previous experience and performance on similar sized projects, expertise available and financial resources. Call for tenders in terms of procurement legislation and policies taking into account requirements of the Construction Industry Development Board (CIDB).
	Evaluate and award tender Evaluate and compare all tenders received. Undertake a detailed risk analysis in terms of quality, quantity and unforeseen scope variations on the various submissions including any alternative designs received by innovative contractors. Prepare the tender report and recommendations. Ensure contractor complies with requirements of points system. Drive tender through bid committee and tender process to effect award before expiration of the validity period.
	Fabrication and equipment delivery Fabrication would normally consist of specialised components for the project. Should these form part of the critical path programme, submit recommendations for the fabrication to proceed ahead of construction to ensure no unforeseen delays leading to costly claim submissions. Equipment such as large pumps, transformers or generators may be sourced from overseas and delivery times must be taken account.
	Construction **Budgeting:** Assess the contract programme and critical path with the contractor. Ensure that a budget for control and cash flow purposes is prepared. **Legal compliance:** Hand over all legal documentation to the contractor to ensure timeous access to the works. Check that the contractor has complied with the insurance terms of the contract, that is public works insurance, third party liability, workman's compensation, etc. **Environmental, health and safety:** Ensure compliance with the requirements of the Health and Safety Act on site at all times. Check all temporary support work, structural designs for safety as well ensuring that their construction complies with the design, safety signposting, excavation barricading, trench shoring and hard hat areas. Ensure Environmental Management Programme is implemented. **Enforcement of quality and performance:** Undertake regular quality control tests to ensure that materials, pipes and fittings comply with SABS standards. Testing will include road material (gradings and Atterberg limits), trench backfill density testing, pipework level control, concrete cube strength testing, pressure and air tests, pipeline mirror tests, etc. **HR and training:** Ensure that skills training is carried out in terms of the spirit and intent of the contract particularly with regard to labour-intensive aspects of the project ensuring sustainability and on-going employment opportunities in terms of the EPWP directives. **Administration and control:** Administer the contract by ensuring that the contractor stays within budget and time frames and meets all technical requirements as per drawings and specifications. Evaluate and sign off monthly contract payment certificates. Approve variations and contract time extensions as allowed for in the documentation. Ensure that work complies with all statutory standards, permits, licences, agreements, guidelines and consumer requirements. Resolve disputes and advise on contract interpretation where necessary. **Reporting:** Ensure timely submission of monthly reports on progress, quality, performance and risks. Analyse the programme in terms of various resource restraints, that is skilled labour, production supply and material limitations and likely completion date.
	Commissioning Agree to opening or hand over of project after testing or verifying compliance with design specifications.
	Operating documentation and 'as built' drawings Ensure 'as built' drawings and separate records of all assets are handed over and municipal systems are updated accordingly. In terms of water and sanitation, details to include valve, pump and pump station performance criteria (flow and pressures), as well as treatment works design flow criteria and standard operational procedures manuals. Accept operating manuals and train staff. Ensure that requirements of operations and maintenance are understood by staff and implemented.
	Hand over Accept completed works on behalf of the municipality, monitor during the maintenance period, have defects repaired and issue final certificate.

Continued on page 196

a percentage of the remaining budget should be made available for discretionary use in their wards.

Whilst capital development needs to be constrained within the capital and MIG limits available to municipalities, service departments should be given the freedom to spend their service fee allocation on O&M as required. It is unacceptable to move funds from one department to cross-subsidise others that are not performing.

The legislative controls that restrict funds from being carried over from one year to the next results in bonanza and often wasteful expenditure towards the end of the financial year. In addition, if the full budget is not spent, the department is likely to receive less the following year. This explains why 94% of senior managers in the Australian public service said in a 1984 survey[28] aimed at determining what reform was required, that good financial management was:

… spending no more – and no less than … [what was required].

In small town Visalia in California, controls were relaxed to create a more efficient business environment. As a result, staff have been found to handle their funds far more responsibly and behave like business owners since strict supply chain controls were lifted and they were given the latitude to save where prudent and reassign funds to other priorities.

A case study from the US Military outlined in the best-seller, *In search of excellence*, by Tom Peters,[29] concluded that with more flexibility in the use of funds, up to 10% could be saved with matching improvements in performance.

Typically, budget systems count expenditure and not results. To use funds more effectively 'reinventors':

- Introduce incentives for managing and saving money

Success story – developing the building inspectorate in Ndlambe

The training of the three building inspectors at Ndlambe Municipality was completed during February 2007. Trained by an ENERGYS engineers, the candidates were exposed to both practical, on-site training and theoretical classroom instruction. With non-stop development taking place in Ndlambe, this type of control is essential to ensure that standards are adhered to and bulk infrastructure is not overloaded.

Patrick Jokani, Janene Naude and Colin Goliath in the classroom and on site

Continued from page 194

Operations and maintenance

Operation

Performance to specification

- The primary parameters with respect to performance are reliability, health and safety. Ensure that all works are correctly operated and maintained by inspecting the installations, scrutinising reports on the quality of the service and advising on, and supervising the rectification of defects. Ensure adequate resources and materials are purchased timeously and stores are well stocked
- Sewers and water networks require regular inspection to determine structural adequacy, hydraulic adequacy and functional adequacy
- Treatment works require ongoing analysis and treatment
- Road surface rideability is the primary measure of good road condition (as measured by international roughness Indicator, IRI)
- Standard operating procedures should be well documented and followed
- Improve service delivery by investigating and evaluating new materials, processes and techniques, for example load correction on electric motors to be more efficient

Maintenance

Unplanned maintenance – emergency repairs

- Repair in response to break-down, for example burst water main, potholes in roads, blocked sewer inducing spills
- Water burst repairs must be carried out to ensure repairs are hygienically completed
- Sewer blockages and spills must be cleared to avoid contamination of stormwater pipelines, rivers and streams
- Unplanned road maintenance calls often follow major storms or heavy vehicle accidents. Rapid and appropriate assessment will need engineering expertise to determine the most suitable repair methods to return traffic flows to normal
- Failures should be recorded and analysed and the root cause of re-occurring failures determined and eliminated

Preventative, routine or periodic maintenance

- Institute regular maintenance inspections and replacements based on researched engineering principles to prevent untimely breakdowns, for example
  - Replace pump bearings at scheduled intervals to prevent breakdown and service disruption
  - Survey road surface condition to determine type, severity and extent of pavement distress and preventive maintenance required.
  - Visual and IRI surveys are prerequisites for an effective pavement management system (PMS)
- Engineering experience is required to identify appropriate repair methods, such as joint and crack sealing, slurry sealing, surface treatments or rip, rework and stabilise base and asphalt overlay
- Timely action is essential once repair methodologies have been determined
- Maintenance logs are essential
- Records must be kept of all inspections and performance of plant and equipment
- Inspections should also be directed as misuse of services and minimising losses

Descipline-specific activites

For maintenance activities relating specifically to water, sanitation, roads and stoormwater, see Table 4.1.

Communication: Inform users if service is not going to be available and accommodate them wherever possible, for example by re-routing traffic during road repairs.

Resources and materials: Ensure that adequate resources and materials are purchased timeously and stores are well stocked.

Infrastructure asset management: Records associated with physical data, maintenance activities and ongoing condition of assets to be maintained at all times.

Refurbish

Asset and equipment refurbishments will extend the design life of the service (see the Laffer curve discussion in 4.5.2 (c)). Refurbishment should follow detailed life cycle cost analysis as repair costs and repair life vary considerably with different methods.

Upgrade

An increase in water or sewage flows, or traffic volumes above the design capacities of the service would necessitate an upgrade of the system. A detailed survey of peak flows or traffic and full engineering analysis would be needed. The upgrade would follow the full project life cycle.

Decommissioning or upgrading

- Decommissioning will occur when a service is no longer required, for example when a number of small sewage treatment works are replaced by a large central works. A full decommissioning appraisal and plan must be prepared and implemented along the engineering principles outlined above
- An upgrade or augmentation of service is required where design limits are approached. The bigger service is designed using the same criteria as in planning (see above) to ensure an adequate service that complies with norms, for example where water or sewer pipeline capacity is reached due to densification, or road capacity by increased traffic due to a shopping centre development
- An upgrade may result in decommissioning, for example when a new road alignment cuts out a section of the existing road. The decommissioned service must be rehabilitated

Develop new project proposal

The decommissioning or upgrade analysis will lead to the development of a new project proposal and the continuum of the project cycle.

- Give management the flexibility to manage their resources
- Provide better financial management tools that allow long-term budget forecasting
- Reform accounting systems to help line managers do a better job – including developing full cost and activity-based accounting

5.8.3 Approving building, town planning and development plans

The problems related to indiscriminate development have been outlined. In one mid-sized municipality, the ENERGYS team found no fewer than 97 developments on the ground that had not been approved and did not conform to previous planning schemes. Urgent attention needs to be paid to rebuilding these departments to address not only financial viability but the health and well-being of all suburbs.

Of importance should be the planning of integrated communities that seek to build on social relationships rather than emphasise the historical divide. A successful outcome of such an approach would be an environment where developers create integrated housing developments that will allow for the full range of housing needs in each area.

Many more town planners are required in local government and the profession needs support to rebuild its capacity. There is the feeling that town planners are undesirable in many quarters since they were the architects of separate development. It must be remembered that they were simply implementing the policy of the day which was contrary to their training in many cases. There is no reason why town and regional planners should not be harnessed today to implement integrated development policies, policies that are much more aligned with their theoretical training. An initiative similar to that of ENERGYS is required, although in its second year ENERGYS employed two town planners with supporting graduates and students to address a couple of crisis situations!

Similarly, retired building inspectors, paired with graduates and students, need to be appointed to rebuild building inspectorates.

With the level of sophistication of systems today, there is no reason why the approval of building plans should not be processed in a week, as was previously the case. Development plans should take no longer than two or three weeks as long as they are accommodated in the IDP and long-term planning in terms of bulk infrastructure.

5.8.4 Drawings, designs, records and reference material

(a) Information

A concerted effort needs to be mounted to locate sources of drawings, designs, records and reference material. Recently a campaign was mounted successfully to find such information for Bushbuckridge. A larger campaign is required to assist all municipalities in rebuilding their data. Useful approaches for locating much of the data would be:

- Placing appeals in the SAACE newsletter and SAICE and IMESA magazines
- Sorting through provincial records since much data had to be submitted to provinces annually
- Approaching national sector departments and SOEs, such as DWAF, Eskom and Telkom, who have infrastructural plans and aerial photos of their developments
- Approaching all companies supplying GIS in South Africa for data that they have collected for their municipal clients over the past twenty years
- Acquiring data from the Surveyor-General and Surveys and Mapping

The data sets so gathered would require updating and accuracy must be verified.

(b) Design

It is acknowledged that few municipalities embark on detailed design, however to ensure that young municipal employees gain design experience it is essential that they be given simple designs to carry out under supervision, or that they be seconded to consulting firms to be involved in one or two designs for their municipalities.

A caution that must be sounded here is that a strict code of conduct or 'externship' contract should be drawn up to avoid municipal staff being enticed to remain with the consulting office. Where many small designs or modifications must be done, an alternative approach would be for consultants to second an engineer to local government to set up a small design office and manage and mentor young staff involved with design.

(c) Reference material

Whether designing or checking on designs, reference must be made to codes of practice and national standards to ensure compliance. As previously indicated much reference material has gone missing with the demise of libraries and control systems. In the short term at least a basic set of documentation per municipality should be made available in secure lockable libraries for reference by technical staff. Small secure mobile libraries may be a solution where office space is limited.

Where municipalities are able to access the internet or have sound IT systems, electronic versions of these documents could be accessed for an annual fee.

5.8.5 Project management and quality control

Project management units need to be fully capacitated with project management staff and project control systems.

Lines of reporting need to be reviewed. Should the PMU not be serving line departments rather than dictating to line departments what should be developed? As with many other functions in local government, support departments are now dictating to line departments.

Success story – water for thousands in Bushbuckridge

When the ENERGYS engineer arrived in Bushbuckridge, limited project management skills had resulted in many delays and poor quality control. After systematically working through all the project details, determining the problems and addressing disputes, most projects are back on track and many more have been initiated. Below are photos of several water projects that will take water to thousands.

The PMU should be a support department, funded by both MIG and line departments to handle capital projects. PMU development should be agreed by a development committee made up of managers from each of the line departments to ensure that all projects fit within the overall plans and capacity of existing services.

The selection of quality service providers, carrying out regular checks, tests and monthly measurements to ensure quality work within budget must all become part and parcel of the PMU function.

5.8.6 Housing

Various Acts clearly outline the housing responsibility as being that of municipalities.

Section 9(1)(a)(i) of the Housing Act 1997 (Act 107 of 1997) states that:

> *Every municipality must, as part of the municipality's process of integrated development planning, take all reasonable and necessary steps to ensure that the inhabitants of the area of jurisdiction have access to adequate housing on a progressive basis.*

Section 9(1)(f) of the same Act states that:

> *Every municipality must, as part of the municipality's process of integrated development planning, take all reasonable and necessary steps to initiate, plan, coordinate, facilitate, promote and enable appropriate housing development in the area of jurisdiction.*

As outlined in the previous chapters, the vast number of uncoordinated bodies, departments and levels of government dealing with housing is causing delays, duplication, poor quality, and lack of alignment with local standards, all of which eventually become an increased financial burden to the municipality. Furthermore, delays result in more informal settlements.

To obviate these problems, housing development needs to be rooted firmly within each municipality. Initially, departments will require grant funding. As with MIG, a percentage of the housing allocation should be utilised to build in-house capacity familiar with the landscape to ensure that all plans are in line with the municipality's long-term development and honour their standards.

Urban municipalities are finding that current housing plans will substantially increase the number of households they will have to support, in some cases even doubling the current number. In the urban context, water-borne sanitation, in-house water and electricity are expected. The installation of prepayment metering and community education on care of urban infrastructure and household responsibilities, including payment of rates, are essential to ensure that these developments do not lead the municipality to bankruptcy.

A housing initiative similar to ENERGYS needs to be mounted where senior architects, building scientists and building inspectors are redeployed along with appropriate students and graduates to handle:

- Raising of funds
- Acquisition of land
- Liaison with communities, in cooperation with community workers
- Registration of indigents
- Planning and selection of the level of service
- Project management
- Transferring of completed houses to their final owners

5.8.7 Construction

A balance needs to be struck between in-house construction and the use of contractors. In major centres, the in-house team is able to respond better to small contracts and those which need to be handled quickly. In most other municipalities, construction needs to be let out to contractors, although the use of SMMEs can be seen as in-house contracting since this type of construction requires considerable involvement by the municipality.

5.8.8 Operations and maintenance

The need for efficient O&M is not understood. Infrastructure assets are written off as they depreciate. This could be the reason why the country does not seem to have a record of the extent of O&M that is required. Life cycle costing will be dealt with in the next chapter. Suffice it to say that by not carrying out preventative maintenance, the resulting capital replacement costs are significantly larger than the cost of the initial maintenance required. As an example, abandoning a relatively new 'yellow machine' because it had a flat tyre, allowing it to rust and fall into total disuse is possibly the most extreme case of neglect witnessed by an assessment team.

National norms should be determined and legislated to ensure that a percentage of income is allocated to maintain assets. This will vary from service to service and will require a top-up where infrastructure has already deteriorated to the point of requiring refurbishment rather than just preventative maintenance. From the work carried out by the ENERGYS teams it seems that few elements of infrastructure can be maintained by spending less than 3% to 4% of the current replacement value per annum. Sadly, owing to the lack of asset registers few municipalities are aware of the current value of their assets and thus minimal amounts are set aside simply to cover emergencies rather than for preventative maintenance.

Government has acknowledged the need for increased spending on maintenance and detailed research has been commissioned to develop guidelines on the appropriate costs and activities per type of service. However, municipalities should not wait for this document before considering O&M.

Success story – road completed in Emfuleni

At Mackay Road project in Emfuleni impressive progress was made under the management of the ENERGYS team.

17 May 2006

30 June 2006

Until ongoing O&M become part and parcel of the culture of each and every municipality, income will not increase, and the occurrence of unexpected, huge expenses will accelerate as infrastructure begins to fail. We are in fact consuming our capital investment instead of preserving and growing it! It is therefore not a matter of not being able to afford to operate and maintain, but rather that municipalities cannot afford not to operate and maintain. The longer-term financial implications will be too severe to contemplate.

5.8.9 Purchases

Technical departments must expend funds and deliver services, but they are not given the authority to manage funds! A return to some autonomy in technical departments is essential. Alternatively, an additional staff member from finance must be assigned to technical departments to ensure that their needs are being met within an appropriate time scale.

5.8.10 An improved climate

If each employee could feel that he or she were achieving something, the climate would be greatly improved. Giving staff meaningful roles to play, support in the form of funds, equipment, appropriate manpower and some authority will go a long way to restoring morale. The need for authority and substantive appointments will be considered in more depth in 5.9 below.

5.9 GOVERNANCE AND DECISION MAKING

If you always do what you've always done, you'll always get what you've always got!

It would seem that the time is right to review the powers and functions of both the political structures and senior administrative staff. The current apparent overlap is undermining efficient administration and service delivery.

5.9.1 Council

Clearly, there needs to be much closer cooperation between council and officials. The functions accorded to councils in the Constitution, such as 'deliver' and 'institute', should be the responsibility of the officials; council's role should be to feed community needs into the planning process and approve and oversee implementation. Councils should thus operate more like private sector boards than the operational model that they appear to follow at present.

All committees should be composed of politicians and senior officials. Officials should accompany politicians to community meetings to ensure that practical solutions are agreed upon. The current shortage of technical staff is a serious bottleneck in this regard, making it even more important to build up the local government technical skills base.

All too often the most appropriate solution is cast aside as it is feared that if the community's needs are not met in a specific way, votes will be lost.

Technical issues must be depoliticised. The need to win votes should not be used to force unsustainable 'quick wins'. Councillors must understand that unsustainable solutions will eventually impact badly on the householder. The cost of ownership of the range of proposed solutions must be understood and practical solutions must be adopted.

The mayors of Bogotà,[30] referred to under the section 'Chief Engineer', developed a new kind of government that:

… centred on issues rather than party politics or ideology …

and, in so doing:

… transformed one of the most chaotic cities in the world to a model of urban development and transport.

We face a challenge of leadership. John C Maxwell[31] asks and answers the question:

How do leaders earn respect?
By making sound decisions, admitting their mistakes, and putting what's best for their followers and the organisation ahead of their personal agendas.

The important '7 Cs' must be built back into the management of municipalities:
1 **Contribution** – contributing towards the greater good
2 **Coordination** – bringing together
3 **Cooperation** – mutual assistance
4 **Communication** – exchanging of ideas
5 **Collaboration** – team work
6 **Commitment** – honouring obligations or promises
7 **Community** – considering what is best for the community as a whole

The sense of well-being developed through achievement is more likely to win votes than the frustration resulting from poor quality service delivery.

5.9.2 Expertise

(a) Councillors

As outlined previously, many councillors are inexperienced as are senior officials. Consequently, many councils are not confident to allow their municipal managers to make decisions and thus micro-manage the municipality. This causes huge delays as all decisions must wait for council meetings.

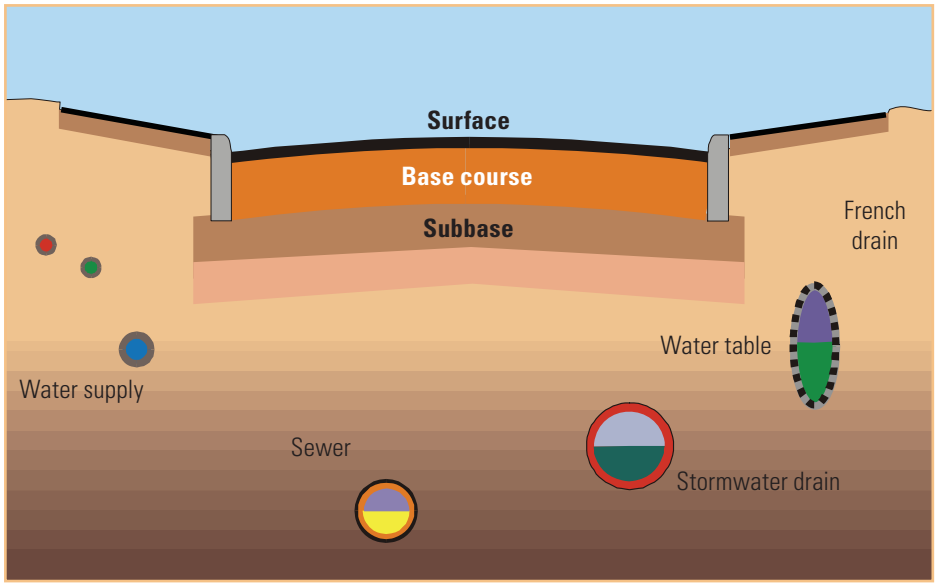
The following suggestions may help to address this problem:

(i) Utilise proportional representation seats to fill skills gaps

Since many councillors are selected from the national ranks of political parties to fill the proportional representation seats, parties should strive to select those in their ranks who are experts in specific fields, such as planning, engineering, finance and human resources. These councillors will then be able to guide and support those with limited experience.

(ii) Appoint advisors

Few if any leaders can be expected to be experts in all fields. Therefore, presidents, premiers, ministers and other leaders have advisors who help them understand underlying principles and strategies before making major decisions. A senior engineer as advisor to



Source: *Sustainable infrastructure for South African towns and cities*

Figure 5.15 Councillor programme – a lesson on the complexity of road construction and laying pipes correctly

the infrastructure councillor may well be useful in municipalities where there are few or no experienced engineering personnel.

(iii) Orientate councillors on infrastructure

It is essential to orientate councillors in the complexity of the development, operation and maintenance of infrastructure. SAICE developed such a course for roll-out after the 2000 elections (see Figure 5.15). The course was well received by the few municipalities who showed an interest in participating.

The ENERGYS engineers who were involved in the programme after the 2006 elections used the material to offer informal training for councillors in their municipalities. They reported improved understanding and cooperation between politicians and officials and recommended that the course be updated to incorporate all the legislative changes of the past seven years. Such a course should then be delivered nationwide.

(b) Experienced officials in leadership positions

Without leadership, passion and control, the resulting lack of discipline and responsibility severely hampers service delivery. As long as there is no leadership, there is no pressure on staff to deliver. This applies to senior staff who require the MM to motivate and direct them, to junior staff who need senior staff to manage them and to consultants and contractors who must be managed to deliver effective solutions.

Experience in people management, financial management and developing structures, systems and appropriate capacity to ensure efficient delivery of the products they are selling are essential areas in which an aspirant CEO should have acquired experience.

Many local government 'businesses' are substantial. There are over 100 local municipalities and metros that turn over in excess of one hundred million rand, with 12 turning over in excess of one billion rand. The turnovers of the big metros exceed those of the largest construction companies, and match those of Edcon, Massmart and other major retail

Table 5.7 Company size variation as defined in the Construction Charter, 2005

Built environment consultants			Contractors		
Type	**Turnover**	**Staff**	**Type**	**Turnover**	**Staff**
Micro	< R300 000	< 3	Micro	< R1 m	< 6
Small	R300 000 – R3 m	3 – 9	Small	R1,1 m – R12 m	6 – 60
Medium	R3,1 m – R36 m	10 – 100	Medium	R12,1 m – R60 m	61 – 300
Large	> R36 m	> 100	Large	> R60 m	> 300

outlets, placing them in the big league when considering South Africa's Giants. Only the larger mining, banking, finance and manufacturing companies in the top 25 companies exceed their turnovers.[32]

When preparing the break points for the Construction Charter,[33] the turnover figures shown in Table 5.7 were used. On analysis it was found that there were only about 25 built environment consulting firms with turnovers in excess of R36 million and 10 contractors with turnovers of more than one billion rand.

None of these companies would consider appointing a CEO without a proven track record in their field of expertise. They would also strive to find CEOs who have run similar sized organisations and who have made significant improvements to the businesses they previously ran. They would mount extensive head-hunting campaigns to find the right person.

Our MMs need to be hand picked from those who have a proven track record in managing large or complex organisations. (In the past, the Town Clerk, like the City Engineer, worked his way up over many years and was therefore well prepared for the challenges facing the most senior position.)

With this type of experience, newly appointed MMs would soon develop sound structures, resources, systems, discipline and financial control and put municipalities back on their feet. The same should apply to appointing the likes of the CFO and other senior officials, including a chief engineer.

When researching the effectiveness of public sector agencies in Canada, the UK and New Zealand, the authors of *The reinventors fieldbook*[34] found that:

> *The quality of Chief Executives … has been a critical success factor … people and particularly the agency head make a difference.*

Their recommendation is unambiguous:

> *Take very seriously the challenges of recruiting quality chief executives.*

The success of General Electric and the philosophies of Jack Welch are well documented.[35] Decisions need to be made at the level where expertise exists. Experienced leaders are required at every level to ensure that the organisation lives its vision and mission, which in the case of local government should be to supply quality services to all.

Jack's '4 Es' of leadership calls for leaders who have the Energy, can Energise, have the Edge and Execute. Execute of course relates to decisive decision making, a weakness in the public sector that must be overcome.

In municipalities where the MM committed to the ENERGYS programme, the results have been gratifying. Structures have been refined, staff employed, projects identified and registered and delivery is indeed taking place. When MMs were not in a position to make the decision (either due to a lack of experience, or because they were held back by council, or because they were acting) only limited progress has been made. Thankfully this was the case in only a few municipalities.

In 1993, Rudy Guiliani ran for Mayor of New York. He was pipped to the post. Such was his determination to become mayor that he spent the next four years studying everything there was to study about local government and running a world-class municipality. He read numerous public sector books, interviewed many other mayors to establish lessons learnt, and held think tanks with business people and public figures alike seeking their input on what would be needed to turn the then bankrupt New York around.

By the time of the next election he knew exactly what was needed and pitched his election campaign accordingly. He won by an overwhelming majority and was true to his word. So prepared was he that he had selected all his top staff in advance of his election and all started work immediately after his inauguration. Within six months he had made a dent in the major crime problem that had been keeping visitors away from New York and within a year the city was back to being financially sound.

There is a lesson to be learned from his preparation. It should be essential for municipal leaders to have had extensive business and public sector experience and they should also be well versed in the affairs of local government and in particular of the municipality they are joining.

At present, Section 57 incumbents are selected by council and are therefore generally also political appointees. In order to ensure the appropriate level of skills in each of these posts, search and selection committees should be set up who define the roles and responsibilities expected of the new incumbents. Committees should be composed of politicians, senior officials and members from rate payer and professional bodies and the business community in the case of the MM and CFO. Professional bodies and the engineering community should be harnessed in the case of technical appointments.

Applicants for the position of MM should be provided with extensive data packs on their prospective municipality. They should present and be assessed on the understanding they have gleaned and on the strategies they propose to improve the well-being of the municipality. In the private sector it is not unusual for senior executives to put through competitive interviews to assess how they would tackle various case studies or to participate in role playing situations as part of the interview.

(c) Adequate technical expertise

The shortages have been elaborated. In a sense local government has suffered a major brain drain.

The brain drain is however an international phenomenon. The rest of Africa complains that their skills move to South Africa and further afield,[36] South Africans have moved abroad,[37] and India complains that their top staff migrate to the USA[38] where they contribute in excess of $2 billlion per annum to wealth creation. Aggressive returnee campaigns have been mounted by India, China, Korea, Croatia and Brazil, amongst others. The main problem with the brain drain is that it does not occur across the board. Generally, it is the senior or highest calibre staff who move on since they are able to pick and choose positions anywhere in the world.

Phase	Level	Process followed	Planning	Design	Construction	Operation & maintenance
Preliminary	Senior management	Intuitive	Forward and master planning	Collect brief and select options	Land and negotiate contract	Initiate O&M activities
Pre-implementation	Mid-management to senior-management	What-if ability – must be able to make decisions	Feasibilities	Design considerations and detailed design	Resource allocation and project planning	Monitor O&M activities
Implementation	Junior staff to middle-management	Process can be largely rule-based	Programming, collecting data	Detail and production drawings	Site supervision and monitoring	Manage O&M teams

Increasing experience

Figure 5.16 Changing roles with experience

According to Dr R A Mashelkar productivity is proportional to the square of the number of top staff. Losing top staff dramatically reduces the quality of leadership, as well as the level of innovation and output in a company or organisation.

Nobel Laureate, physicist Ricardo Giacconi, explains his move to the USA:

> *A scientist is like a painter. Michael Angelo became a great artist because he had been given a wall to paint. My wall was given to me by the United States.*

Whilst much of the local government brain drain has not been to other shores, but into the private sector, to gain, regain, train and retain civil engineering staff in the public sector we need to offer challenging careers – walls to paint.

In view of the functions and numbers required to build a basic engineering department as outlined earlier in the chapter, a major drive needs to be mounted to attract staff to local government, regardless of age, race, or gender.

Figure 5.16 considers the various activities that must be carried out in local government, and separates them in terms of phase: preliminary, pre-implementation and implementation.

Where the majority of work is outsourced, it is the implementation phase and perhaps part of the pre-implementation phase that is no longer handled in house, requiring fewer junior staff. However, where work is handled in house, staff at all levels are required. Interestingly, in missing numerous backlog targets and deadlines and grappling with poor quality, it has been found that many of the problems had to do with lack of implementation staff. Site visits to check on quality, raise the alert when there is a problem, sign off on progress, etc can be handled by relatively junior staff as long as they have guidance.

To ensure that the requisite staff are available to perform these functions, a number of changes in approach and policy will be necessary. These will be discussed immediately below.

(i) Increase the spending on technical staff

South Africa's ratio of population to engineer is 3 166:1 whereas that of the developed world is of the order of 300:1. The country cannot afford to lose engineering staff and should be utilising all staff available. It seems that financial controls are resulting in the reduction of technical staff in many municipalities.

It is suggested that the 32% limit on overall salary expenditure in relation to total expenditure should be reviewed and that a percentage salary spend on technical staff should be determined, perhaps in relation to their operating and capital budgets or their income streams. This would ensure that adequate technical staff are available to address all development and O&M needs. All too often when limited funds are available for additional staff they are split equally across many departments, resulting in a large percentage increase of staff in small departments and an insignificant increase in staff in technical departments that already have a staff shortage.

The original guideline of 32% also needs to be challenged. This figure was suggested when municipalities of the time had a substantial rates base, had consumers who could afford to pay for services, did not service large numbers of indigents and municipalities had not embarked on the current major drive to address backlogs.

Imposing this limit across the board precludes many rural municipalities from employing technical staff, the very staff they need to address backlogs and begin to offer the

Delivering through people – the UK experience

In the UK a complete re-look at the nature of challenges related to the attraction, development and retention of the local government workforce is under way. Extracts from their positioning papers highlight challenges similar to those experienced in South Africa.

Change is happening faster than ever

That is how it can feel sometimes especially when you are juggling a plethora of needs, demands and opportunities. Councils, working with partner organisations, face the challenge of leading their communities and satisfying rising customer and citizen expectations. They need to be place-shapers and strategic leaders to achieve more with tighter resources. Authorities will need to maximise employees' performance, streamlining processes, minimising bureaucracy, introducing new technology and new ways of working, promoting innovation, changing attitudes and behaviours, supporting staff to work in different and more flexible ways and discarding old, rigid practices. Engaging staff positively in changes is key to sustainable improvement.

More prepared than ever

It would be great if councils felt that way but 72 per cent say that they have insufficient organisational development and change management capacity. The change journey that lies ahead will require skilled and effective leadership and management.

Better than ever

That is what all councils want people saying about their local area. They also want it said about the council. In the councils that get that kind of feedback, staff are likely to feel that way about their jobs. High performing authorities recognise that effective people management is central to performance. It is not the responsibility of human resource specialists alone. In top performing authorities, leaders and chief executives know the importance of personally taking action to ensure that they have motivated employees at all levels.

More competitive than ever

Many authorities continue to report difficulties in attracting sufficient quality candidates for Chief Executive and other senior posts, yet only 28 per cent are undertaking succession planning, and only around 25 per cent of authorities have ever participated in the national graduate development programme. Local government has the oldest workforce of any sector in the UK economy, with 31 per cent of staff over 50 and 6,5 per cent under 25. Some authorities report that younger staff and those recruited from the private sector do not stay long because they find local government slow and bureaucratic. Many authorities suffer from significant occupational skills shortages.

Source: http://www.lga.gov.uk/Briefing.asp?lSection=0&id=SXD64D-A7842EF7

services from which they were historically excluded. With indigent populations, values of homesteads below the rateable level and dry sanitation being the norm in these areas, the income base consists largely of the Equitable Share and MIG allocations, a trend that will continue for the foreseeable future. These communities also have a right to the basic levels of service as described later (see Table 5.9), but without technical skills this is impossible.

As part of the social contract with the poorest of the poor these municipalities should have simplified structures whose responsibilities relate only, or largely, to infrastructure delivery and O&M. Until local economies develop as a result of improved access and education these municipalities will require continued financial support with staff and O&M costs consuming the total Equitable Share allocation and MIG funding all capital developments and rehabilitation. In terms of economies of duties, rural municipalities should perhaps employ experienced technical staff to carry the dual role of MM and chief engineer.

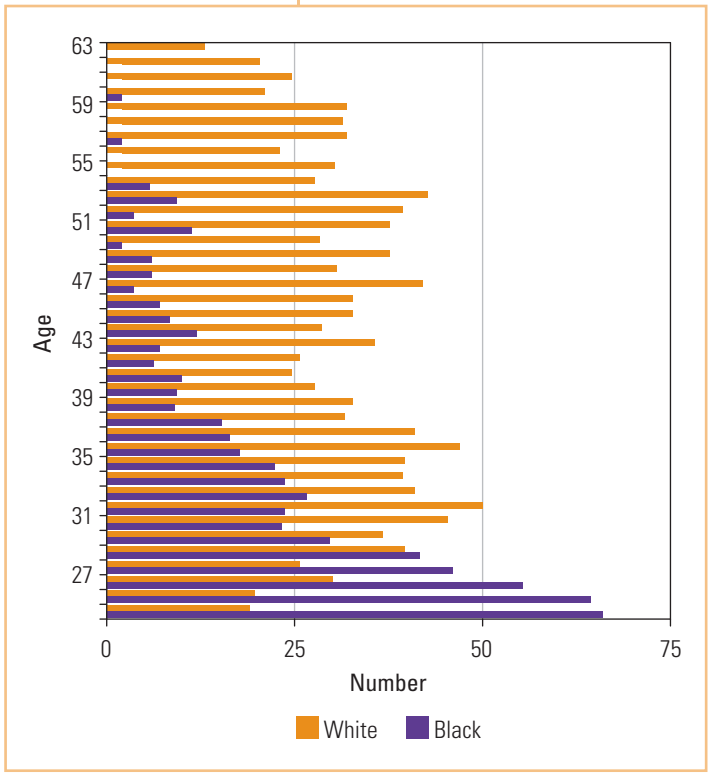
In rebuilding technical structures it is accepted that orientation courses, change management and the likes are necessary to align teams made up of young and old, black and white, male and female professionals. The ENERGYS programme has shown that this is not idealist but can work very effectively as long as all are committed, remunerated fairly and given responsibility and authority.

(ii) Appoint acting staff permanently

Another major problem with regard to capacity is the 'acting' phenomenon. Many technical directors and senior staff have been acting for long periods. In these positions they are unable to make major decisions and drive major change.

Morale is low owing to lack of leadership and the uncertainty about what the future holds. In instances where a person has been acting for more than a year or so, and is found to be competent, he or she should automatically be appointed to the substantive position.

Figure 5.17 Civil engineering professionals – age distribution by race, August 2005



Source: *Numbers & needs*

(iii) Retain senior staff

Public sector employers need to have knowledgeable staff to effectively shape policy and guide development. Hence there is a clear need for experienced management and staff.

The category of senior engineer, which relies on registration (hence sound experience) is the most challenging, and will take a long time to develop. With the need for better employment equity representation at higher levels, this is even more challenging since professionally registered black engineers (and even technologists) are few and far between and are quite likely to enter or be in private practice.

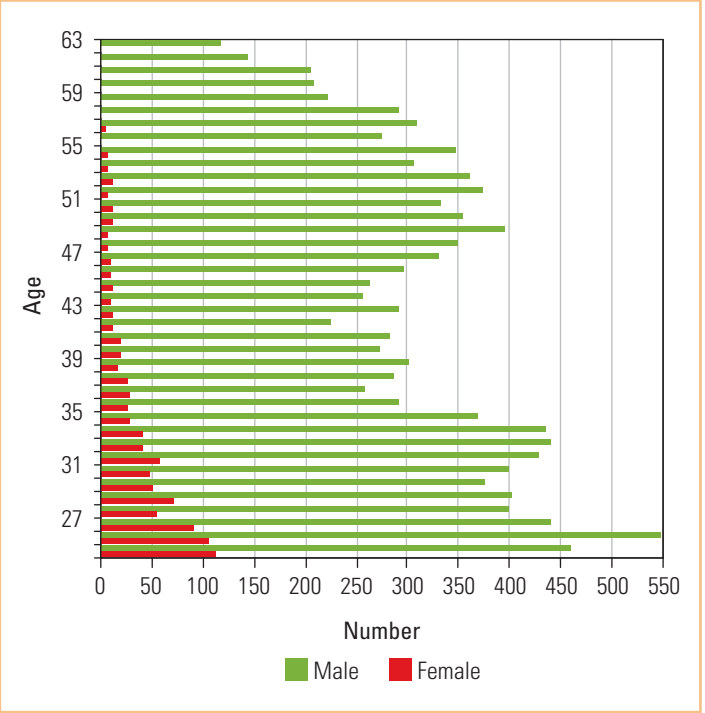
Furthermore, without senior staff, young staff entering the industry at present cannot be mentored and developed adequately to eventually take over the reigns. Figures 5.17 and 5.18 indicate the age, gender and racial distribution of

civil engineering professionals. Seniors need to be retained regardless of age and gender because they are the custodians of our country's civil engineering knowledge and need to spend the next few years transferring the considerable skills that they have developed to the younger generation!

The need for expertise in terms of capacity development is understood the world over. In an interesting presentation on knowledge management in Danish public technical administrations,[39] the speaker outlined the need for experience, as follows:

> *Know-how and professional experience are of vital importance in maintaining a dynamic and professional public administration in Denmark … surveys have shown that the best try to learn from the best.*

In South Africa is it essential that we have the best in place to lead and train our young people.



Source: *Numbers & needs*

Figure 5.18 Civil engineering professionals – age distribution by gender, August 2005

(iv) Develop appropriate organograms and appoint according to qualifications and experience

The numbers needed, qualifications and experience have already been covered. It is now up to each department to develop an organogram encompassing functions at all levels to address service delivery. These should include qualifications and experience per post. The senior engineering posts must take the ECSA criteria for Identification of Engineering Work into account (IDoEW). This calls for complex engineering work to be carried out by an engineer, broadly defined work to be carried out by a technologist, and well-defined functions to be carried out by technicians. Where suitably qualified people cannot currently be found, retired staff need to be redeployed to offer their expertise until such time as in-house staff have been adequately trained. This could take several years.

Professionalisation

In recognising that expertise is required at all levels in local government, the **dplg** is busy debating professionalisation and trying to determine appropriate courses and qualifications to be developed to ensure that key staff have what it takes in senior positions. Considering town clerks and town treasurers of the past, experience (preferably in local government) and qualifications were assessed against which various categories of registration were possible. The categories then dictated the post level the person could attain.

Defining professional requirements for engineering staff is very simple. All have professional qualifications at NQF 6, 7 and above and professional registration conferred on them by a statutory body, ECSA. By matching ECSA registration and experience with various positions and the sizes of municipalities there should be no need to develop further qualifications for engineering staff.

It is accepted that understanding the local government environment is essential, hence local government orientation courses related to legislation, budgeting, planning,

O&M and asset management should be put in place for those entering local government for the first time. These topics should be covered by IMESA and the AMEU as part of the continuing professional development (CPD) service to their members.

They should also be working with ECSA to determine the positions that should be held by registered engineering staff. Professionalise versus politicise should thus be the maxim when selecting technical staff.

- **Base promotion on ability and complexity of responsibility**

Municipalities require specialist, highly experienced technical staff to deal with their complex and expensive assets, yet HR systems reward only those who become managers, rather than those who deliver a service.

Technical staff who have developed expertise and gained further qualifications and professional registration, have not been financially rewarded or recognised for the development of their ability.

According to the American Public Works Association:[40]

> *… the greater the employee's job knowledge … the greater the quality of service …*

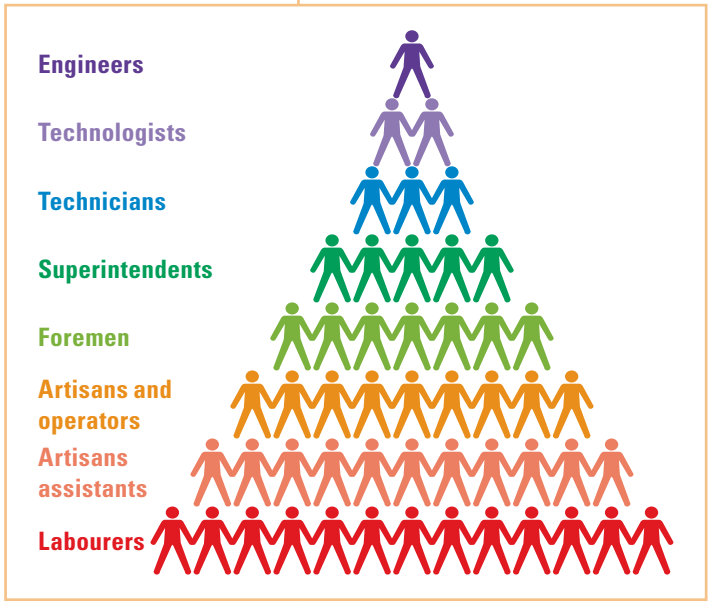
Promotions and grading should be determined based on technical competence, responsibility, value and complexity of tasks handled.

- **Operations and maintenance**

A distinct weakness found is the lack of operations and maintenance staff. Figure 5.19 depicts a diagrammatical matrix of staff necessary for developing, operating and maintaining infrastructure. The ratios of labourers to artisans, etc vary from industry to industry, however the fact is that many more labourers, artisans, operators and superintendents are required than technicians, technologists and engineers. The LGSETA (Local Government Sector Education and Training Authority) reports that in many municipalities there are no labourers or elementary workers, and many municipalities complain of having only one or two artisans left. Historically, technicians learnt the nuts and bolt of municipal engineering by working in, and later managing, O&M activities in local government. The collapse of this area of civil engineering has been detrimental not only to infrastructure, but also to our ability to train young staff.

In assessing organograms, particular attention must be paid to the whole technical team and not just the positions for engineers, technologists and technicians.

Figure 5.19 The technical team



(v) Employ young graduates on training contracts

Any professional team should be composed of the appropriate range of skills and age groups to allow for succession planning. Civil infrastructure departments typically require a mix of engineers, technologists and technicians spanning all age groups.

Success story – development in Fetakgomo LM

Sekhukhune District in Limpopo is one of the poorest regions in our country and has been identified as a Presidential Nodal Point for infrastructure development and poverty alleviation. Such was the determination of the only civil engineering staff member, technician Batile Sepheu, to help her municipality that she insisted on Fetakgomo's inclusion in the ENERGYS programme, although it was not initially earmarked for support. Her determination paid off. William Garnett, a retired engineer, was dispatched to the area and over time two graduates and two students have been taken on. Fetakgomo now has a formidable technical team and the people of Fetakgomo are experiencing service delivery, which is BIG NEWS in Limpopo.

Water for almost 80 000 people

The first of their projects is the Olifantspoort South Bulk Water Supply Phase 6, which is worth R48 million. This project is a regional water scheme (RWS) and services more than 38 000 people on the southern branch and more than 30 000 people on the northern branch of the river. The project received MIG funding and approval late in 2006. The sites were handed over to the contractors at the beginning of 2007. This regional bulk water supply scheme is being constructed over vast, extremely rocky mountainous terrain. At least 50% of the pipeline routes will require blasting.

A new civic hall for Fetakgomo was placed on hold in the 2005/2006 financial year because only half the funds required were available. Through delicate negotiating it was finally resolved to complete the project in two phases over 18 months. At present, a project that was only a pipe dream is well under construction, and it being used as a pilot project for day-to-day project management training of the graduates and students.

Deployed students

The ENERGYS students have been kept busy addressing community complaints pertaining mostly to water services. They also participated in the IDP analysis and the development of water sector plans.

Junior staff can be assigned usefully to implementation phase tasks, be they planning, design, construction, or O&M, whilst more experienced staff handle the pre-implementation and preliminary 'what-if' phases.

In the ENERGYS programme young people have been used across the range of activities, including contract management in the PMUs, operating treatment plants, supervising maintenance teams, carrying out surveys, designs, gathering data and assisting with logging of infrastructure for asset registers.

Junior staff require much time invested in them, in terms of management and supervision, and employers complain that:

… just when they become useful they are poached …

Thus it would seem sensible to employ graduates on training contracts linked to the promise of a post-graduate bursary after successful completion of an agreed period. Continuing with a BTech or an MSc greatly expands horizons, should be set as a goal and should form part of the retention strategy from the outset.

Of great concern to the ENERGYS team has been the realisation that few municipalities have junior positions on their organograms. This precludes those on internship contracts with municipalities from being appointed when they graduate. Young people can make significant contributions during the implementation phase and offer relatively low-cost support to overloaded senior staff.

(vi) Develop a progression scheme for technologists and technicians

Any technician who shows great promise should be encouraged to continue with BTech studies and earmarked for increased coaching to be able to carry the more challenging responsibilities accorded to technologists.

Where a technologist excels, an extra-special effort to groom him or her to move up the hierarchy is essential. The opportunity exists through ECSA to register as a PrEng through the 'senior' route, which recognises many years' experience under the supervision of a PrEng and requires supplementary courses to be completed. Few disadvantaged entrants to the field have been able to enter via the professional degree route, but when adequately trained they are able to 'catch up' and should be encouraged to do so. However, it is a lengthy process.

(vii) Employ retired engineers to actively coach and manage career pathing and succession planning

The model of pairing retired engineers with students and graduates to perform functions in local government has borne fruit, in that service delivery is being accelerated and the young people are gaining experience under the guidance of seasoned engineers.

This model should be replicated in all departments and expanded in terms of engineering. However, gaining sufficient experience to work independently is a long process that requires three to five years of coaching. This process requires significant investment as salaries for both juniors and seniors must be paid. Unfortunately, most local government organisations are cash strapped and cannot afford to implement such a model without financial support.

Clearly, capacity building grants are needed to ensure that this type of sustainable training is in place for long enough to develop competence, if not expertise.

(viii) Employ retired engineers to perform municipal functions

Engineers who have been accustomed to problem solving and creating all their lives may find retirement stressful and may welcome the opportunity to 'get their hands dirty' again. It is common cause that not everyone is disposed to mentoring and coaching, but there are many stand-alone tasks that can be attended to by retired engineers without their having to enter line functions with the associated challenges in terms of hierarchy, seniority, etc. Developing project scopes, managing projects, assessing development applications and managing master planning exercises are but a few tasks that can be neatly packaged for these extra pairs of hands to deal with.

(ix) Re-visit employment equity criteria

Equity targets preclude the appointment of experienced staff since they are generally white male, as can be seen from Figures 5.17 and 5.18 (above). One municipal department has set itself the task of transforming from ten white males and three black males to eight black males, eight black females, one white female and three white males in the next two years. This means that they would have to get rid of seven existing members of staff, along with their experience and institutional knowledge – this at a time when that same municipality has a high number of technical vacancies. Furthermore, appointing nine females would generally mean appointing nine young people who would require mentoring. Without the seniors who will have to move on so that equity targets can be realised, there will be no one to coach and mentor these young people.

Setting targets in relation to age, commensurate experience and availability would be more sensible. However, even this will not lead young people to drive themselves to be the best, but breeds mediocrity.

This problem is not unique to South Africa but is evident in many countries trying to address demographic and social imbalances.

In Malaysia, the quotas defined for Malaysian participation in education, employment and business ownership versus that of Chinese and Indians have resulted in the fact that:

> *Malay students and recruits, who have felt that their successes are assured, are under less pressure to perform.*[41]

The writer, as a female engineer who graduated in the 1970s (the only woman amongst some 200 engineering graduates), did not enjoy the benefit of scorecards favouring companies who accorded women development opportunities. Even 'old school tie' contacts were meaningless in the all-male environment of the time and new networks had to be created. However, by gaining experience, working hard, and developing competence and, over time, expertise, it was possible to compete with all-male companies and win projects and business from male competitors. This was not without competitors trying to intimidate and complaining that she was 'making waves' for 'their' businesses!

Success relates to the product or service delivered. The long-term opportunities for today's young graduates will be vastly improved if they work their way to the top through developing solid knowledge, and through experience, competence and ultimately expertise.

Policies in place contribute to huge tension that is not conducive to cooperation and sharing of knowledge. Again the experience is not unique to South Africa. Among the ills accorded to affirmative action in the USA, black American critics[42] lamented that:

> *It creates hostility and constantly reinforces racial divisions and stereotypes.*

We cannot afford this when we are so short of skills!

In the Western Cape, MEC Marius Fransman has taken a brave stand in relation to scarce skills. He suggests that:

> *… we place an immediate moratorium on affirmative action in all priority skills areas.*

In response to the employment equity debate, Dr Mamphela Ramphele comments:[43]

> *I really think we need to move beyond bean counting and look at the broad principle. We are looking at it in terms of compliance or competition, and that is a very authoritarian, archaic, apartheid way of looking at it.*

As has been seen, the number of engineers involved in roads and transport nationwide has dropped from about 450 in the late 1980s to 150 in early 2007. The various structures are now taking action to try and rebuild capacity. Skills shortages of this magnitude are not limited to transport but apply to all technical departments in the public sector. The only way to grow the skills base is through an increase in the number of entrants into the field and training them. It rests with those who are experienced to carry out the training. By virtue of past policies, those with the requisite experience are senior white engineers. Removing them from senior positions limits the ability to train young entrants and perpetuates the skills shortage problem. Journalists in the USA have adopted a wonderful maxim for their campaign to attract and train young reporters: 'No train, no gain!' Let us draw all in to mount this major campaign to rebuild the much needed capacity.

… we need more engineers … they are problem solvers…

Cyril Ramaphosa

(x) Review packages

The problem of salaries has been raised in most municipalities. An urgent review and adjustment of salaries and perks is needed to bring them on a par with salaries and perks offered in the private sector.

Vacancies are hardly surprising when advertisements in the Sunday press call for applications from qualified engineers, on salary scales of R60 000 to R76 000 per annum. These levels are lower than that of the office secretary!

The IPET/SAICE salary survey of 2005 showed that the salaries of civil engineering professionals in local government trailed slightly behind those in consulting and both were lower than the packages on offer in contracting.

By comparison, the SAICE 1994 survey showed that, apart from the self-employed, civil professionals in JSE-listed companies were the highest earners, followed by local government and then consulting (who were 18% percent below local government). Clearly, the local government salary advantage has been eroded over the last decade.

Although small municipalities find it particularly difficult to pay adequate salaries, even in bigger municipalities packages are below market rates. Those nearing retirement are likely to remain in order to keep their retirement benefits intact, but younger staff are lured away by higher packages.

Conversely though, in some municipalities the packages have become unrealistically high. Attention needs to be given to aligning salaries across the sector and with the private sector. Salary scales for all technical staff need to be reviewed, looking at the degree of complexity and responsibility they carry regardless of the size and locality of the municipality.

Indeed, the Minister of Education has recognised this as imperative in the teaching profession and has recommended that entry-level salaries be increased. In addition, the new salary scales will take experience and qualifications into account.[44]

Some municipalities and public sector departments have been dabbling with the notion of scarce skills allowances – with little success. In trying to define the range of scarce skills, staff from all disciplines are clamouring to be recognised as scarce, thereby slowing down the process. The distinction for engineering staff is very simple, as has been explained. Few other staff can claim having an NQF 6, 7 or above qualification and professional registration. By linking grades and salary scales to these criteria and the level of experience it should be possible to draw a distinction between engineering staff and others when determining packages.

Furthermore, funds should be set aside for performance bonuses to reward those who do go the extra mile, rather than rewarding all, even if they do not perform or are mediocre.

(xi) Curtail job hopping in the public sector

Owing to the scarcity of female and black civil engineering professionals they are in great demand to fill senior posts. They can command high salaries and are often amenable to being poached by competing organisations. High mobility of this group is not only disruptive and costly for the organisation, but does not allow the young person to develop his or her technical skills. Public sector departments should refrain from appointing job-hoppers or serial job-hoppers as some municipalities have now begun to call them! Accepting that an employee may have made a poor choice of organisation or company the first time around and may need to move within a short period, a moratorium should perhaps be placed on appointing staff who move more than twice in any 24 or even 36-month period.

Success story – upgrading schools in Bojanala Platinum DM

As part of his training, an ENERGYS student was involved in renovations and repairs to ten schools in Bojanala Platinum DM.

Since the project was labour intensive, the contractors employed locals from the villages where the schools were situated. Each contractor was given a maximum contract period of three months to complete a project and some were given two-month contracts. Work started in May 2006.

The scope of work differed from school to school and included the construction of new toilets. All work had to be done during school hours. The contractors had to draft their works programmes in consultation with the schools' managements. Furthermore, they were to work on one building/block and finish it before moving on to the next block.

This presented a challenge as some schools consisted of only two blocks and learners had to be integrated in one block while work was done on the second. Health and safety of the learners were paramount. The safety officer from Bojanala paid regular visits to the sites to ensure that contractors were complying with the Occupational Health and Safety Act. The educators were extremely helpful and ensured that learners were restricted from the areas where work was taking place.

At four of the schools water-borne toilets consisting of eight units for girls and five units for boys were built. The fifth school's toilets were ventilated pit latrines.

Community feedback

The community was very happy with the renovations because all the schools had been in a bad state of repair, which impacted negatively on learners' motivation and self-esteem. The new toilets were welcomed as some schools previously had pit toilets that had been built more than ten years ago and had not been maintained. In addition, these toilets were shared by learners and educators.

During the hand-over ceremony of the schools back to the community, the principal of Tebogo Intermediate School expressed his happiness over the new toilets. All the principals were so impressed with the work done that they requested more work to be done!

– Josias Mabusela, Bojanala Platinum DM

A further frustration to those who have remained in their municipalities has been those who left only to return a short time later to occupy higher positions. In many cases those who had left had not been performing adequately and added no value on their return. Exit interviews should entail not only interviewing those who are leaving, but also the departments where they had worked in order to determine how effective they had been.

(xii) Review conditions of employment

Absenteeism has become a major challenge, with staff being off for weeks at a stretch. On examination it has been found that conditions of employment in many municipalities include an allowance of 80 days' sick leave over a three-year period! This is significantly more than the 30 days suggested in the Basic Conditions of Employment Act. Further, by listing sick leave as a 'perk' rather than a concession in the event of ill health, staff

have come to expect their annual leave plus a further 20 or 30 days off even if they are not ill. As such it is impossible to discipline staff for absenteeism and with almost three months off per annum continuity and thus productivity are severely hampered. Sick leave in particular needs to be 'repackaged' as a concession in case of illness, rather than a right to time off.

(xiii) Making better use of staff

Staff and deployees complain of lack of access to senior management throughout. Without access or delegated powers they are hindered from performing their duties. Meetings, workshops, courses and reporting, whilst meant to align, direct and enlighten those who are insufficiently experienced or qualified, are all but strangling the system.

The American experience captures this phenomenon:

Our attempt to prevent bad management made good management impossible!

The major problem of time and resource utilisation will be discussed in more detail below.

- **Time Management**
  - ***The menace of meetings, workshops and courses***

    The many meetings and workshops that are held remove staff from their offices for weeks on end.

    When one examines the content of many workshops it is found that they are aimed at participants who know little about the topics, that is, at the inexperienced or incumbents who do not have qualifications or training in the field. If departments were structured correctly, with teams of junior, production and experienced staff, knowledge sharing would take place in bite-size chunks in the workplace, ensuring skills transfer and dramatically reducing the need to attend courses and workshops.

    Bearing in mind that one learns little by sitting in a one or two-day course, by comparison with workplace training, course attendance needs to be reviewed.

    Many meetings are also convened to brain storm solutions in the absence of adequate guidance, often resulting in solutions that are totally inappropriate. As outlined in Chapter 3, structured workplace training is the key to building solid capacity.
  - ***'Being seen'***

    Whilst we love to see our ministers, MECs and other leaders playing their part in leading change, too many supporters have become professional function attendees.

    By using the simple time-management technique of rating time spent on activities as **V**aluable, **D**oubtful or **U**seless, if one were honest, little of the time spent in meetings would be logged as **V**!

    A moratorium needs to be placed on the number of days spent out of the office at meetings, workshops and gatherings – production work is really suffering.
  - ***Manager on duty***

    An interesting concept of 'manager on duty' (fondly known as 'Mug of the Week') has emerged in many private sector companies, whereby one manager per branch or division is committed to being office bound for a week at a time to ensure that there is at least one manager to make decisions, handle customer queries, etc at all times. Whilst some municipalities have no staff to whom to assign this duty, those with larger structures could easily implement a roster of this nature to ensure that there are no delays in decision making.

The tyranny of targets and reporting

Reporting has become another bugbear in the lives of key staff. In the strategic plan of a Johannesburg city engineer some years ago, it was resolved to tackle the problem of reporting, which was getting out of hand, as follows:

> *At Committee meetings when a Chairman is unsure how to proceed he will often instruct officials to submit a report. At present we even have reports about reports. These are a new type of report wherein the author explains what is delaying the submission of the main report! If it were possible to analyse the cost of a report comprising senior officials' time, typing, translation, etc it might be possible to convince Councillors that unnecessary reports waste money.*

It is doubtful that Johannesburg got it right at the time. Statistics, impact assessments, management and financial reporting, whilst important, take up huge amounts of time.

The time spent by ENERGYS engineers on reporting has been found to be in excess of 5% (excluding individual project assessment reports), which is extremely high considering that they were not performing a line function. Nationally there must be hundreds of cupboards filled with reports on which little or no action has been taken!

Of particular frustration is the fact that each department requires similar data but in a different format. It is critical that a national matrix covering all data required be developed and set up electronically for all to use, to obviate the huge duplication that is currently the order of the day.

Care must be taken not to measure everything! 'Measurement creep', that is, the endless demand for more and more measures, must be guarded against. Possibly the best way to limit this is to consider the cost of measuring.

Departments and service providers should be able to claim payment for the additional effort when more measures are demanded. Indeed, the need for additional secretarial services represents some of the increased costs of measurement from which we are suffering – but these costs must be borne by the municipality and not by the departments demanding the extra information, which simply increases the financial burden on already cash-strapped structures.

A caution from Osborne and Plastrik[45] must be considered:

> *Watch out for overkill: don't try to measure everything.*

In their report to the US Vice President in 1993, the developers of Streamlining Management Control[46] made the following recommendations, amongst others:

- *Reduce the burden of congressionally mandated reports*
- *Reduce internal regulations by more than 50%*
- *Expand the use of waivers to encourage innovation*

It is extraordinary that applying for and being granted waivers has become a 'science' in the USA, with many employees getting a kick out of such achievements and devoting much time and energy to formally 'getting around the system'!

A plea from an engineer leaving local government after 25 years

Please – streamline processes and shorten reporting lines.

After every meeting with "someone" you must report more of the same in a different format!

We are but simple engineers – reporters work for newspapers – engineers work for the people at grass roots level!

We build rural roads – for the people.

We solve water supply problems – for the people.

We take care of sanitation – for the people.

We look after solid waste – for the people.

If we worked for a corporation we would write reports to the CEO and earn big bucks.

We like to keep our feet on the ground and make life better – for the people.

Professionals the world over complain that the new politics of accountability restricts their professional autonomy, and strikes at the heart of what it means to be a professional, employed for skills, experience and the benefits of 'professional judgement'

Another phenomenon that robs employees of motivation and time is the setting of numerous targets.

An audit is never going to be neutral … it is politics which determines what should be measured and what constitutes success.

Professionals the world over complain that the new politics of accountability restricts their professional autonomy, and strikes at the heart of what it means to be a professional, employed for skills, experience and the benefits of 'professional judgement'. The book, *Willing slaves*,[47] gives voice to professionals sharing their frustrations.

Onara O'Neill, a philosopher, made the following statement during the 2002 Reith Lectures, entitled *A question of trust:*

Real accountability requires substantive and knowledgeable independent judgement.

The amount of paperwork has detracted from service delivery and increased the level of stress worldwide. Said Sarak Nazran in West Yorkshire:

Paperwork has contributed to a rise in sick leave and stress in my office.

Her views were reflected in a British study carried out by the Audit Commission in 2002, which found that:

Bureaucracy and paperwork are the biggest cause of stress.

Measuring and reporting have also changed the type of public sector employee. A sense of public esteem used to be an important reward for the public servant. Indeed, salary was usually low down on the list of factors that prompted people to leave the public sector. The rapid development of technology has enabled information to be gathered and analysed ad nauseum, supporting the development of the 'audit society'. Political focus places all under scrutiny – something that few with professional skills are able to stomach, particularly when they often do not have the authority to make decisions or overcome bottlenecks towards meeting targets.

'Naming and shaming' must be one of the most destructive aspects of the audit culture … the pressures to perform to a political agenda and to rising public expectations are enormous.

Said Robert Crawford, CE of Scottish Enterprise when he resigned in 2003:

Criticism has to be judicious and fair or people will not go into the public sector jobs.

It is time we recognise professional judgement and relax many unnecessary or unreasonable measures and demands, and adopt strategies along the lines of the recommendations made to the US Vice-President in 1993.

Employ quality support staff

Technical staff should also have sufficient support staff to ensure that they do not waste time on non-technical activities. In many municipalities even the technical services

director must do his or her own secretarial work, which is clearly a very inefficient use of technical capacity!

There may be scope for an FET (Further Education and Training) course that covers office practice in the civil engineering environment. There are secretarial qualifications for legal secretaries, medical secretaries, etc, so why not train an engineering secretary? In a bid to assist secretarial staff to understand the technical jargon they were typing, one municipality reported having taken their staff to various sites. The ladies climbed down manholes, worked grinders, and drove graders so that they would understand volumes, quantities and the other jargon they were typing. They enjoyed themselves tremendously and the level of productivity of the engineers, in their own words, 'went sky high'.

Figure 5.20 Three determined ladies, from left to right: the author; Linette Oliphant (Mayor of Thembelihle Local Municipality); and Linda van Wyk (Acting Municipal Manager in 2006, now Director of Technical Services – a position she prefers!)

With the increased demand to collect statistics and produce reports, secretarial services will go a long way towards relieving technical staff of heavy administrative loads. They could also assist with the many tasks that infrastructure councillors delegate to technical services directors.

Delegation

All our challenges cannot be attributed to bureaucracy alone. We must remind ourselves that there are extreme staff shortages and in order not to fail, senior staff are carrying the load of many people. As explained earlier, South Africa has a tenth of the number of engineers per capita when compared with the Developed World. Seniors in other disciplines are no less loaded. Until competent staff are employed to fill the voids our senior staff are going to continue with their 24/7 efforts and be inaccessible to their production teams or fade away due to burn out, both of which dramatically impede progress.

In all but the smallest municipalities there is a large, expensive workforce that must be directed to gain maximum benefit.

A manager should therefore be concerned with:[48]

- *Getting things done*
- *Finding out what is going on*
- *Reacting to new situations and problems*
- *Responding to demands and requests*

Rather than sitting in meetings related to external issues, managers should be working with their staff, understanding their challenges and delegating downwards to ensure that work is being carried out – that is, 'management by walk-about'.

Rudy Guiliani quickly cut superfluous external meetings when he took office, scheduling instead a one-hour meeting each morning with his senior staff to debate strategy, address problems identified in the past 24 hours and ensure that he and his managers were informed of what was happening at all times to facilitate quick and accurate response. The managers

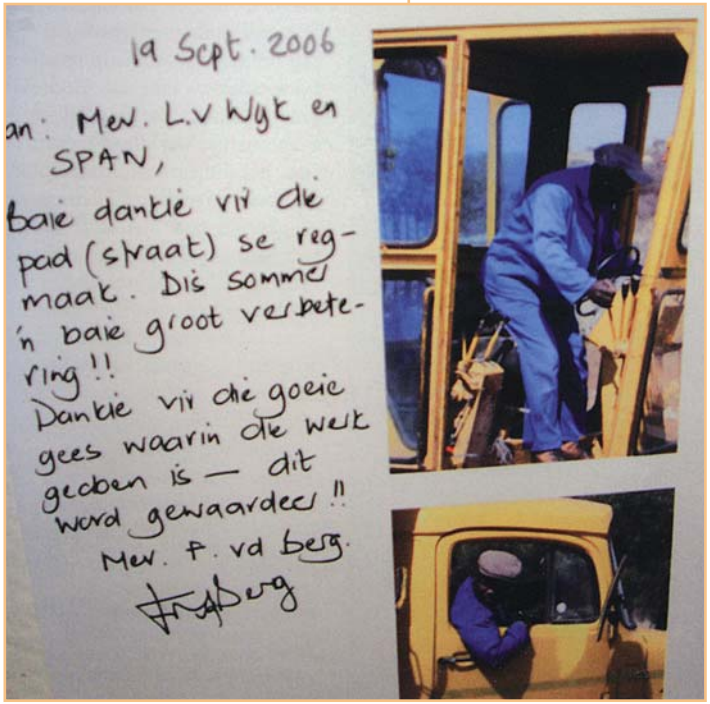


Figure 5.21 A letter to the acting MM, from a grateful resident of Thembelihle

were then tasked with meeting their subordinates in a similar manner. Consequently, problems from the ground were handled quickly, and all staff were adequately briefed to be able to live and work towards accomplishing the vision and mission of the city.

The acting MM of Thembelihle (Hopetown), Linda van Wyk (see Figure 5.20), developed a similar strategy, of morning meetings which saw her staff excited about their roles and responsibilities. One of the ENERGYS graduates placed in Thembelihle was so excited with her role and participation in the overall well-being of the municipality that she decided to start work at six every morning to ensure that everything was up and running well before the town started relying on her infrastructure! Without everyone being adequately briefed to play their part, senior management cannot hope to have sufficient time to deal with all issues, even in the smallest municipality! The thank-you letter reproduced in Figure 5.21 demonstrates the results of team commitment in Thembelihle.

- **Give technical departments more autonomy**

The idea is not that technical departments should go off and 'do their own thing' in complete isolation, but to empower them so that they are not impeded in terms of good engineering practice.

Essentially, technical staff are skilled knowledge workers who should be consulted rather than dictated to. Knowledge workers are key employees who identify more strongly with peers and networks than with the organisation.[49] They relate to intrinsic motivational satisfiers, such as responsibility, scope to use and develop skills, and interesting and challenging work. As long as they are micro-managed by non-technical staff, given instructions to carry out unsustainable projects, are bogged down by bureaucracy and carry no responsibility themselves, they will not remain in local government.

- **Change managment**

Much of the tension reported between young and old, male and female, black and white, relates to job security. There should be no such threat as all are needed and have a role to play.

There is clearly a need for general change management. In most departments, good capacity is not being fully utilised and potential capacity is not being developed as a result of the 'us versus them' / 'old boy versus new boy' syndrome.

Responses elicited by an e-mail research exercise on diversity conducted for *Numbers and needs* (published in 2005), were a sad reflection of the prevailing attitudes. Each e-mail started along the lines of: 'I am not making progress because …

- **I'm black and …**
- **I'm white and …**
- **I'm female and …**
- **I'm too young and do not have enough experience …**
- **I'm too old and no longer valued …**

Organograms need to be revisited and positions defined to cover all service delivery needs at the outset. The roles, responsibilities and value of each staff member should then be outlined to all. Team building should be a high priority to get the most out of all employees.

The generation experts[50] have neatly categorised the value systems and qualities that each generation brings to the workplace (see Table 5.8.) These differences must be understood for all to be able to value each other!

In the ENERGYS project, generation differences have been very evident as the senior team spans the silent and boomer generations, and juniors are largely X-generation.

Table 5.8 Generational differences

Silent generation	Boomers	X-generation
Dedicated	Passionate	Thrill seekers (easily bored)
Duty before pleasure	Involved	Whiners, insist on choices
Adherence to rules	Strategists	Self-reliant
Hard work	Workaholics	Not now!
Respect for position	Team spirit	Individualism
Problem solvers	No problem	Pragmatists
Slide rules and log books	Calculators	Techno-kids
Generalist	Specialist	Only do what I can find on the Internet
Delayed gratification, frugal	Prosperous	Immediate gratification
Sacrifice	Concerned with health	Concerned with quality of life
Conformity	Reinvented everything – the 'Bosberaad' generation	Only know change
Modest	Excellent at everything they do	Survivors
Authoritarian	Participative	Informal

Source: TomorrowToday.biz

Detailed reporting, timeous responses and advice freely offered have been characteristics of the silent generation group.

They were raised as generalists, and have infinite knowledge to share. The words of the prophet Isaiah still apply today:

… with love and faith, buildings will be rebuilt, cities will be repaired …

We should take care not to:

… snuff out smouldering wicks.

Let us keep everyone, including the 'old guys', to build our country.

A change manager needs to be appointed in each municipality with the express intent of making all feel that their jobs are secure and that they are valuable, and to ensure that the environment is conducive to the transfer of skills and to the growing of capacity.

5.9.3 Legislation

Clearly, legislation has become so complex that little can be achieved with any speed or efficiency. A balance needs to be struck – some relaxation and reality is definitely needed to address the various bottlenecks.

Whilst legislation is there to manage risk, it has been forgotten that management is about people – people interpreting visions – people conceptualising projects – people writing motivations – people doing complicated sums – people doing drawings – people digging holes in the ground – people operating machines – people finding money – people

checking quality – people delivering a product – in our case, a service. It seems that we are concentrating our energies on compliance whilst all the delivery activities are going begging. The Americans lament the same problem:

> *When things go wrong we respond with a blizzard of new rules. A business would fire the individual responsible, but governments keep the offenders and punish everyone else by wrapping them up in red tape.*

Red tape costs municipalities dearly because it requires a battery of staff to check on compliance. When restructuring the US Defence Department, the solution was simple:[51]

> *[They] took all the people in the business of checking up on compliance with silly rules and put them in charge of helping base commanders …*

In other words, they shifted the resources to the field to get things done!

The sections below looking at governance, HR, supply chain and training, challenge the complexity of the system and make recommendations on relaxations (or waivers, if changes to legislation are going to take a long time).

Rules were made to protect. However, merely following rules will produce poor performance.[52] We need to develop staff from novices and advanced beginners to experts. (See Figure 5.13 on p 185.)

In the words of Aristotle:

> *The expert immediately does the appropriate things at the appropriate time in the appropriate way.*[53]

We must develop competence and expertise, so that we can dispense with the myriad of stifling rules!

5.9.4 Duration of appointment

The lack of continuity in respect of council members, MMs and other senior staff resulting from terms changing every five years, must be addressed.

As outlined throughout, long-term planning is critical. At present, the IDP is limited to five years, is prepared under the hand of the outgoing council and is revised by the new council to bring it in line with their philosophies and to ensure that projects can be completed within their term. Consequently, long-term sustainability remains threatened.

On tertiary councils and industry boards, care is taken to retain at least one third to a half of board or council members going into the next term. When discussing continuity in relation to directors of a board, King and Naidoo[54] state:

> *Board continuity, subject to performance and eligibility for re-election is imperative. The board should set up a programme ensuring a staggered rotation of directors where this is not already regulated by article.*

In the absence of such continuity the same debates will take place every five years, and contradictory decisions, resulting from a lack of institutional knowledge, may be made reversing good work done by previous councils.

Here again, some of the councillors placed through proportional representation should be retained to provide a measure of continuity.

5.9.5 Practical decision making

The current model of transferring services to structures on the ground, for example transferring assets from DWAF to local municipalities, was motivated by the fact that those on the ground are best equipped to handle the service. This should also be applied to decision making.

(a) Team decision making

Communities must be consulted on their needs. The consulting team should comprise politicians, social scientists and technical staff, au fait with the area and with the 'cans' and 'cannots' so that practical solutions can be worked out with communities. Once a practical IDP has been developed and priorities have been set, those appointed to deliver the service should be left to do so.

(b) Devolution of authority

At present, each discipline operates in a silo, reporting to the infrastructure councillor who then reports to council who make decisions, in isolation.

In times past, all departments worked together to produce practical, integrated solutions that were then motivated and approved by council. A return to this mode of operating is essential. This will once again require experienced senior staff in whom council have complete faith.

Table 5.9 Service levels

Service type	Minimum service	Level 1 (basic)	Level 2 (intermediate)	Level 3 (full)
Water	6 kl of drinking water per month, delivered to within 200 m of each household	Communal standpipes	Yard taps, yard tanks	In-house water
Sanitation	VIP latrine or better	VIP latrine	Loflos or septic tanks	Full water-borne
Electricity	50 kWh per month, or equivalent delivered to each household. Street lights at a rate of one for every four stands or high-mast lighting for dense settlements	5–8 A or non-grid electricity	20 A	60 A
Roads	Residential roads should provide all-weather access to within 500 m of the dwelling	Graded	Gravel	Paved/tarred & kerbs
Stormwater drainage		Open earth-lined channel	Open lined channel	Piped systems
Solid waste disposal	Refuse into a street container within 200 m per household. Weekly collection	Communal (residents)	Communal (contractors)	Kerbside

Source: Adapted from *Industry guide to unit costs and service levels*

Line functions need all the support they can get to execute their task, being that of delivering direct services to the people

5.9.6 Technical solutions and level of service

The above relates closely to this topic. The agreed current service levels need to be understood, communicated to and accepted by communities to ensure affordable and sustainable solutions. Table 5.9 outlines levels of services.

5.9.7 The advent of shared or central services

Shared services refer to the staff in these departments being clustered to offer the most efficient services to line functions. Looking at local government in developing countries, Harold F Alderfer[55] of Pennsylvania State University lamented the fact that the organisation of staff services:

> *… is another problem inadequately dealt with in developing systems of local administration …*

The distinction between staff functions and line functions needs to be clearly understood. Line functions, he declares, need all the support they can get to execute their task, being that of delivering direct services to the people, which, he continues, is:

> *… the real reason for the existence of local government …*

Staff functions, on the other hand, do not render services to people but help line departments to do a better job and should therefore play a supporting role. The following sections will suggest a more balanced approach on how to handle the various administrative functions that seem to be hampering rather than supporting line departments with service delivery.

The decision now needs to be made as to whether one should be supporting the shared services model, reverting to the previous support services model, or developing a hybrid solution. The authors of the *Reinventors fieldbook* motivate strongly for decentralisation when they say:

> *… give line agencies the authority to manage their own resources … it changes budget and finance, personnel, procurement, and auditing systems to make agencies accountable …*[56]

This is undoubtedly the delivery model that should be considered, but it requires systems per department and experienced staff with the flair for running such businesses.

5.9.8 Human resources

As has been stated, employment processes are extremely long winded and rarely is the immediate superior or anyone from the employing department invited to the interview! In *Reinventing government*[57] the authors lament:

> *In the business world, personnel is a support function to help managers manage more effectively. In government it is a control function and managers bitterly resent it. Managers must hire employees from lists who have taken exams and must take the top scorer, regardless of whether they are motivated or qualified!*

Surely, HR should return once more to rendering a **support** function. Managers and immediate superiors must participate in interviews, and where experienced technical staff

Table 5.10 The decentralised process for using funds suggested in The reinventor's fieldbook

Create incentives for managing money ■ Shared savings ■ Capital charging ■ Efficiency dividends	Improve steering performance budgets ■ Long-term budgeting and forecasting ■ Biennial budgets ■ Financial reports to citizens
Give managers flexibility and lump-sum budgets ■ Line-item flexibility ■ Innovation funds ■ Internal enterprise management	Use accounting to improve management ■ Full cost accounting ■ Activity-based costing ■ Accrual accounting ■ Generally accepted accounting practices (GAAP)

are not available to make such judgement calls, expertise from groups such as ENERGYS and associated professional bodies and the private sector should be harnessed to assist with the selection and orientation of new incumbents.

5.9.9 Finance

Much has already been written about improved utilisation of funds in terms of service delivery. Meaningful costing, reporting and flexibility on the use of funds on a needs basis are essential for future efficiency. Table 5.10[58] offers suggestions on more efficient utilisation of funds through decentralisation.

5.9.10 Appointing suppliers and service providers

Since service delivery seems to have slowed down rather than accelerated, the procurement regime must be overhauled in such a way that it can meet the quick turnaround times required.

Authority has been moved to support departments, but line functions are still accountable and responsible for service delivery. This is an untenable situation. Now is the time for authority to be transferred back to municipal engineering departments so that appropriate technical decisions can be made quickly on purchases and the appointment of service providers.

(a) Purchases

Purchase decisions must be made by technical departments. Supply chain should revert to being a support department streamlining the flow of paperwork and must not control the selection of products and services.

(b) Service providers

Appointing quality service providers has become one of the biggest hurdles in local government. It is necessary that all services be put out to tender and a comprehensive brief, including service level specifications must be finalised before service providers can tender. Few municipalities have the capacity to draw up such tender documents, and most require the services of professional service providers for this process. A viscous cycle!

A hybrid solution between the past and present must be developed to overcome this impasse, offering some relaxation when appointing consultants.

Table 5.11 Recommended changes to supply chain processes for the appointment of consultants

Phase	Current process and responsibility	Proposed process and responsibility
Developing and reviewing the scope and terms and conditions	The technical department develops the scope and the Bid Committee reviews and expands the document – in many cases the scope is inadequate owing to capacity constraints and this causes delays	Technical department or a consultant with expertise in the field of the project, selected from a panel of advisors. (Consultant who develops the scope may not tender for the project unless he is the only specialist in the field.) Terms and conditions adopted from code of practice or guidelines
Issuing a tender	Supply chain	Supply chain to issue to a consultant's roster, selected from an RFQ (request for qualification)
Evaluating the tender	The Evaluation Committee – in many cases inadequate capacity causes delays	Techncial department or consultant who developed the scope to develop a short list based on quality of submission, price, preferences and, where appropriate, locality, and recommend the most appropriate tenderer
Adjudicating the tender	Adjudication Committee	A small committee composed of the CFO, supply chain manager and technical staff from departments requiring the service
Awarding the tender	Supply chain	Technical department to develop contract documents. Supply chain to issue the order
Monitoring	Technical department	Technical department
Claims	Technical department	Technical department
Payments	Supply chain	Supply chain
Sign off	Technical department	Technical department

Further the processes and responsibilities are protracted. Tender activities should incorporated as integral activities in the project programme and milestones and responsibilities should be set per individual or team to ensure timeous decision making. Such people should attend project progress meetings and be answerable for delays.

Owing to the multiple, large committees, and the fact that the same people may not sit on the evaluation and adjudication committees, long delays are experienced as it is difficult to get sufficient attendance at each of these meetings. The size of these committees should be reduced.

The need for the bid committee to sit for each and every tender is unneccesary. Technical scopes must be developed by technical personnel. The degree of labour-based points and preferences, etc should be outlined in a code of practice that should be applied in accordance with the type of project and budget price.

Furthermore, the need for a separate evaluation and adjudication committee is superfluous. Evaluation pertains to technical adequacy and should be assessed by the department initiating the project. A short list and final motivation should be prepared for a small adjudication committee to make the final decision.

A maximum time limit should be set for each phase and municipalities must be forced to comply, as all too often the approval period exceeds the validity period and tenders must be re-advertised and the process started again. The cost of delays in terms of wasted time and increasing contract prices has become a problem.

Tables 5.11 and 5.12 look at these activities again and suggest different roles and responsibilities.

(c) Consultants

To streamline the adjudication phase even further, the development of a roster listing consulting engineers with the requisite skills for the disciplines, types and values of projects the municipality is likely to let in the following 12 to 36 months would cut short the long debates over appropriate companies each time a tender is issued.

The roster would be based on an RFQ (request for qualification) and qualifying criteria would include:

- Specific, project-applicable expertise, such as staff and project experience in this field
- Approach and methodology, including understanding the terms of reference or brief, project conceptualisation, innovation in approach (such as new technology) and the consultant's ability to fit in with the client's procedures and practices
- Track record, which would entail looking at completion of previous assignments on time and within budget
- Locality – in many instances local knowledge is an advantage
- Transparency and openness in progress reporting
- Willingness to partner with and grow emerging consulting companies

The above approach would still satisfy the MFMA requirement that professional services be acquired on a competitive basis – competitive in ability and empowerment credentials and not in price only.

Appointments should however, not only be once off. The problems and costs associated with loss of institutional knowledge have already been outlined. For large or complex projects that span phases or years it is costly and impractical to change service provider for each phase of the contract, particularly if a service provider is performing well.

Contracts should be offered with the option of extension should the service provider perform adequately. This would move closer to the Japanese model of relational contracting. Indeed, once-off contracts do not inspire service providers to offer excellent quality work or service as there is no possibility of repeat business.

The consultants' roster should be reviewed annually, adding new firms to the list and removing companies that are not performing.

The appointment of consultants from the roster would still be subject to quotations or tenders, where pricing and BEE status would be assessed and contribute towards the overall points earned. (See Table 5.11.)

(i) Appointment of consultants

In terms of consulting, it is clearly stated in the Engineering Professions Act, 2000 (Act 46 of 2000), that engineering work must be carried out by a professional registered with the

Table 5.12 Changes recommended to supply chain processes for the appointment of contractors

Phase	Current process and responsibility	Proposed process and responsibility
Developing and reviewing the scope and terms and conditions	The technical department develops the scope and the Bid Committee reviews and expands the document. In many cases the scope is inadequate due to capacity constraints and this causes delays	Technical department or a consultant with expertise in the field of the project, selected from a panel of advisors. Terms and conditions adopted from code of practice or guidelines
Issuing a tender	Supply chain	Supply chain to advertise widely and add contractors suggested by technical department
Evaluating the tender	The Evaluation Committee – in many cases inadequate capacity causes delays	Techncial department or consultant who developed the scope to develop short list based on quality of submission, price, preferences and, where appropriate, locality, and recommend the most appropriate tenderer
Adjudicating the tender	Adjudication Committee	A small committee composed of the CFO, supply chain manager and technical staff from departments requiring the service
Awarding the tender	Supply chain	Technical department to develop contract documents. Supply chain to issue the order
Monitoring	Technical department	Technical department
Certificates	Technical department	Technical department
Payments	Supply chain	Supply chain
Sign off	Technical department	Technical department

Engineering Council of South Africa (ECSA). ECSA registration details are available on the web at **www.ecsa.co.za**

Municipalities should ensure that they appoint professional staff. Should a project turn sour when using an unregistered engineer or technologist the only recourse is instituting a criminal case, which is lengthy and costly.

(ii) Fees

There have been major problems with fees, as outlined in Chapter 3. Minimum fees are published as a guideline on the ECSA website (see above). In using this site the municipality must be aware of the two different methods of pricing, as follows:

- Using the fee basis in which the consultant quotes a percentage of the value of the job. This is an all-inclusive price. The client should not be faced with additional hourly bills and subsistence and travel (S&T) expenses. In instances where a service provider pro-

vides only part of the service and the rest is handled in house, a reduced percentage would be applicable
- Using time and materials as the basis for pricing, which means that all hours and expenses related to the job are charged

(d) Contractors

Here, once again, expertise and track record are important for major contracts. Table 5.12 suggests a more technical approach to the problem of appointing the right contractors, which will hopefully address many of the current quality problems.

(i) Spreading the sunshine

The more rigorous selection may fly in the face of the philosophy of 'spreading the sunshine', that is, giving work to every hopeful start-up company. The 'spreading the sunshine' philosophy is unfortunately costing municipalities dearly owing to these young companies' lack of experience, equipment and capital. The results are poor quality, stop-start progress and an increased load on municipal staff who must manage the fledgling companies.

(ii) Qualifications

In terms of contracting, the Construction Industry Development Board (CIDB) guidelines were created to protect the public sector against the above phenomena, but few municipalities are applying the guidelines at this stage. It is essential for all municipalities to register with the CIDB at **www.cidb.org.za** and to apply the CIDB guidelines when appointing contractors. Contractor registration per category should be checked on the CIDB website to ensure that the firm is approved for the type and value of the contract under consideration.

(iii) Development of contractors

To avoid exposure to the numerous ill-equipped contracting companies some local municipalities annually select a small group of developing local contractors to whom they offer basic contract and financial training and entrust their small projects. If they carry out the work successfully they are given further support and more work; if not, they are no longer eligible for work.

Most of the infrastructure in rural municipalities can be constructed using labour-intensive construction methods. This ensures that funds provided for construction will stay in the areas improving local buying power. Such appointments have a multiplier effect on local economies and address two of the goals in the National Growth and Development Strategy (NGDS), namely:
- Developing SMMEs
- Transferring skills

Allowing technical departments to have greater input or control of these processes is feasible and in keeping with both the spirit and the letter of the PFMA and MFMA providing that the engineer overseeing the project is experienced enough to be able to assess the levels of competence needed, draft the required advertisements and is given sufficient authority to make the necessary evaluations and decisions. Hence, once again the need for experience!

5.9.11 Information technology

As with vehicle and infrastructure maintenance, funds must be spent annually to keep computer hardware and software up to date, and staff must be employed to keep data up to

In examining the gains made in the ENERGYS programme, one of the gratifying outcomes has been the improved morale in several technical departments as a result of the recognition and support given to technical staff by the seniors

date. It is quite impossible to prepare realistic plans and estimates for development if the status quo is unknown.

Engineering design programs, CAD and geographical information systems are complex, require significant computer power and by their very nature make greater demands on IT than applications used in finance and other departments. As with the other services required by line departments, technical departments require autonomy in selecting the appropriate hardware and software and should have their own server on the corporate network to reduce overloading corporate systems and improve performance.

(a) Real-time information

Pavement, stormwater, bridge and network management systems, stores control systems, town planning and building plan approval systems, to name but a few, should also be reinstated to improve the efficiency of technical departments. By having real-time information systems, the reporting burden (as discussed earlier) would be a thing of the past, since reports could be generated as a standard by-product of such systems.

5.9.12 The overall effect

If more time is devoted to production, if systems are in place, and if those whose duty it is to deliver services have the experience and authority to make decisions and drive development and O&M, our municipalities would be very different environments from what they are today.

Staff, politicians and communities alike will be motivated as they see progress, and the power plays which have beset us would be a thing of the past.

In examining the gains made in the ENERGYS programme, one of the gratifying outcomes has been the improved morale in several technical departments as a result of the recognition and support given to technical staff by the seniors.

It is essential to distinguish between steering and rowing. Whilst politicians have been appointed to steer, officials must be given the oars and the right to row the boat and deliver services. Once again, King[59] clearly differentiates between the role of the board and that of management:

> *The board must give strategic direction … Reserving specific power to itself and delegating other matters to management with the necessary written authority.*

Internal policies must be developed to draw clear distinctions between decisions that councillors should handle and those that should be attended to by officials. A detailed research programme carried out in the City of Cape Town[60] in 2005 showed that many minor technical decisions still rested with council, which affected the speed and quality of solutions.

However, it was recognised that there was no arena where both parties could communicate and share points of view (beyond committee meetings), hence there was a lack of trust on both sides. A more enabling environment clearly needs to be created.

Says Willem de Liefde:[61]

> *The atmosphere of distrust, and lack of inspiration in many western companies can be explained by … the tendency among managers to regard employees as … cogs in a machine. Because there is not dialogue or mutual respect … the behaviour*

of employees can only be regulated by bureaucratic rules. The irritation … causes loss of productivity and job satisfaction.

A return to joint committees, composed of officials and politicians, is clearly needed, and officials should once again be accorded authority to carry out their roles and responsibilities.

5.10 TRAINING

If you think training is expensive, try ignorance.
– Tom Peters

Much tutoring and guidance is required. However, senior staff are over-loaded and cannot devote time to training. The ENERGYS model has shown how this training can be handled. By dedicating time to developing young professionals, future capacity can be developed. (See the beautiful letter received by one of the mentors from our 'cover girl', Tshepang.)

In the first 18 months of its existence, the team comprising 56 seniors, 99 students and 45 graduates, could boast of 17 students being able to graduate, 40 completing P1 and P2 and being able to return to study, 36 permanent appointments of graduates in local government, 9 elsewhere in the public sector and 17 in the private sector. The rest should be in a position to return to study or complete their studies by the end of 2007.

Universities of technology have been complimentary about the programme, whilst the University of Johannesburg commented that the approach to training witnessed in Merafong was one of the best they had seen.

ENERGYS students consistently received much higher marks for their P1 and P2 submissions than colleagues who had not had the benefit of dedicated mentoring. Over and above this, the intrepid team were engaged in the delivery of some R4 billion worth of infrastructure! There simply is no better way to cut one's teeth as a young civil engineering trainee.

Many are sceptical about this effort being put into training, reasoning that the young people will move to the big cities and will not contribute to service delivery.

Success story – thank you from a graduate

Masibonge, Tshepang and 'Mr Schumann'

Hi Mr Schumann

When I first came here I knew very little of what to expect. My stay, my well-being, my health, my career – my life! I thought to myself: 'If He is the One who brought me here, He will see me through.'

This piece of paper is just to thank you for allowing Him to use you to make my stay here in the Northern Cape worthwhile. For giving my parents peace of mind knowing that there is a certain old man looking after their little girl. Yes, I am a little girl, but each day I receive some form of transformation. Growing in every aspect of life (thanks to you).

In my ladder to maturity I am always reminded of your kindness, your generosity, your gentleness and your role in my life as a father. I am reminded of the very first time we met while I was wondering what kind of a person you are. But I know now: you are to me a fatherly figure, and for that I am forever grateful.

Just a short poem for you …

PS: Read it slowly.

I landed on my feet,
Not knowing how long I'd remain standing,
I walked slowly,
Not knowing how far I'd arrive to,
I tried to reach up,
Not knowing how high I'd get,
I tried to grasp,
Not knowing how long I'd hold,
But throughout all this time,
I knew there was someone I can count on,
Someone standing behind me,
Ready to catch me … just in case
Thank you, very much!!!

Signed with love

Tshepang

Simon builds for his communities – career guidance pays off

When Simon grew up in Enkalweni Village in Ugie, he was intrigued with the way roads, dams and the dipping tanks to which he herded his cattle, were built. When his father's employer, a civil engineer, helped him with matric physics and maths and opened his eyes to the link between these subjects and pressure in the pipes, forces on bridges, etc, his mind was made up about his future career. Against all the odds at the time, he graduated from UCT with a civil engineering degree in 1995 and, true to his dream of helping his communities gain improved services, he returned to Mthatha to find work. Simon has since carried out many developments to improve the lot of those communities.

When he was growing up, a neighbouring community was cut off from the rest of the world for about four months of the year while the Tsitsa river was in flood. He had always wanted to build a bridge to solve their problem.

The picture above shows Simon (in front) with fellow engineers and community members shortly after the bridge was completed in the year 2000. Those in attendance were fascinated to see Simon's young children play on the side of the river building roads and dams in the mud. Their proud father explained that his children must all be civil engineers one day, saying:

There is still so much to do for our communities.

It is interesting to note that no fewer than nine students from the sewage-soggy town of Thulamahashe previously discussed, were studying civil engineering in 2005. Their reason was that they wanted to be able to return and fix the problems in their home town.

Many of the young technicians found in rural municipalities studied civil engineering for the same reason – they wanted to fix their home towns and they are back there now trying to do just that.

The story, *Simon builds for his communities* (see inset above), supports research findings elsewhere in the world that many who grow up in appalling conditions are driven to study and return to attend to their communities' needs, be they engineering, health or education.

Figure 5.22 shows the distribution of students who were studying civil engineering in 2005. There were no students from slightly more than 50% of LMs and a further 44 LMs only had one student enrolled. These figures do not bode well for the future well-being of rural areas. Looking again at Figure 5.22, it is obvious that, on the whole, the further one gets from centres offering diploma courses, the lower the number of students per household studying civil engineering. This could indicate that it is tertiary institutions that do most career guidance today, and that their reach is inadequate to cover the very areas that require engineering skills. This presents a problem in terms of the altruistic behaviour described above. It is essential that career guidance be targeted at remote municipalities to ensure that capable students heed the call to take up the challenge of civil engineering, ultimately to address their commmunities' needs. Curiously, the number of students from the Eastern Cape and northern Limpopo seem to be quite substantial.

This begs the question: what can be done to develop a new generation of civil engineering professionals across the country?

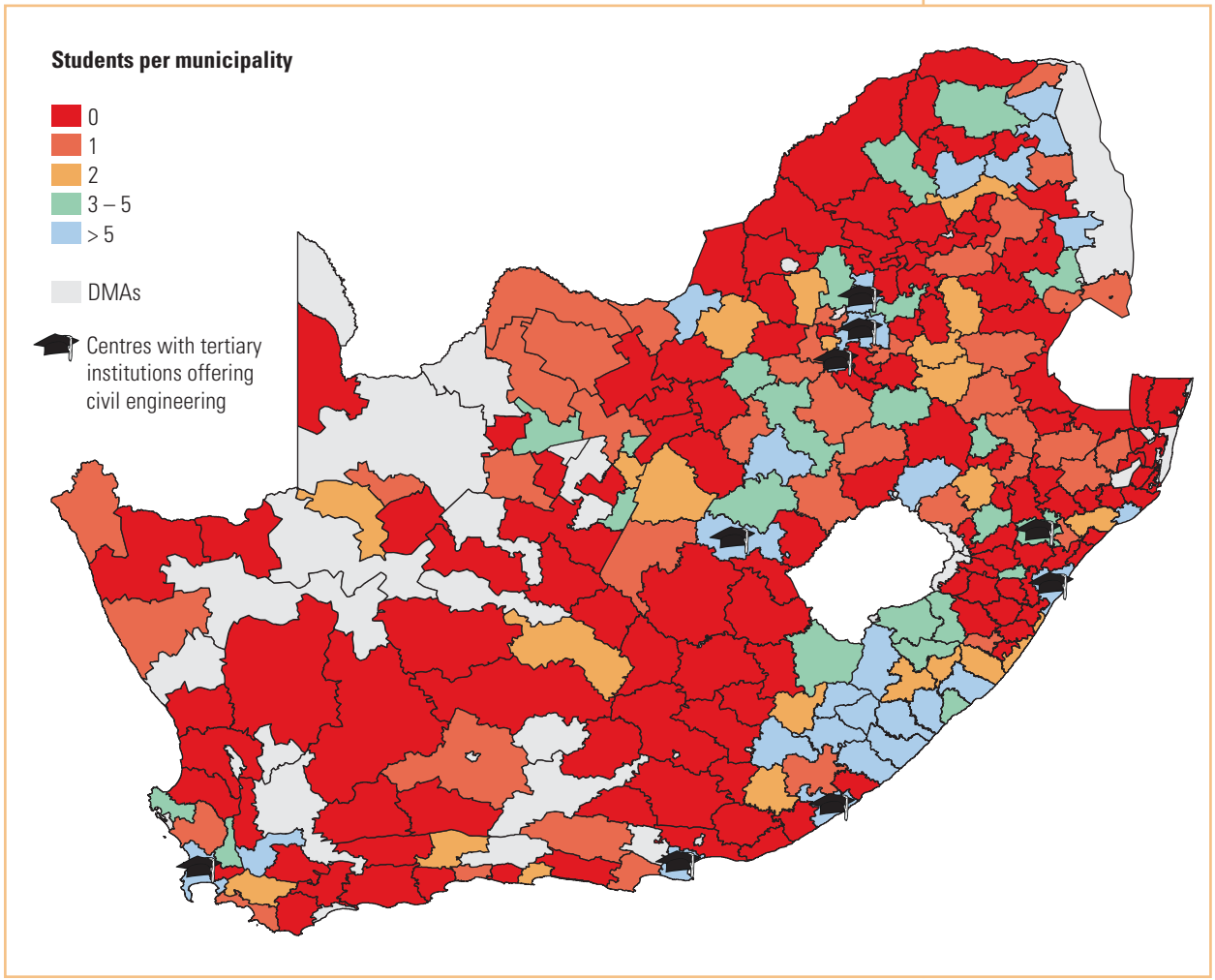
5.10.1 Career guidance

Currently the view is held that the number of matriculants with adequate maths and science training is insufficient to increase the number of engineers in the country. However the SAICE 100x100 project, which, in SAICE's centenary year, set out to try and identify 100 rural students to register for a civil engineering degree, found that there were many talented young people in these areas who would never have dreamt of being able to get to the big city, let alone enter one of the six universities offering civil engineering degrees.

The first recruits began their studies in 2004. Of the initial 21, several moved to other engineering fields at the end of first year, but eight made it into final year in 2007. No mean feat, considering that less than 30% of all Bachelor of Engineering students nationally reach final year in the minimum time of four years.

Every municipality should take it upon themselves to organise career visits to the schools in their areas that have students passing maths and science. Details of schools that have potential candidates studying higher grade and standard grade maths are available from **numbersandneeds@ally.co.za**

Figure 5.22 The home towns of students studying civil engineering at universities of technology, November 2005



Source: Municipal Demarcation Board. Map generated by GIMS

5.10.2 Bursaries

Many talented students are the poorest of the poor. Without funding, they cannot hope to succeed. They require funding not only for tuition, but also for accommodation and living expenses.

Although some families will attempt to pay, their funds are limited, resulting in students staying in unsuitable accommodation and even going hungry. These conditions are not conducive to studying and passing. Where a student is really struggling financially he or she may find part-time employment, once again to the detriment of good results.

The ideal solution therefore is a full bursary from first year but it is currently common practice to offer bursaries only from second year. This means that many of those deserving students from disadvantaged backgrounds never get access to tertiary education.

However, experience has shown that merely awarding bursaries and not linking students with mentors during their academic training does not yield the best results.

Municipalities should be developing a complete strategy of funding, keeping contact, monitoring and offering additional support by way of extra lessons, site visits and holiday work to keep students motivated and up to speed in subjects that might be problematic at the outset.

Said President Thabo Mbeki:[62]

> *We have to exert maximum effort to train the necessary numbers … We should consider the necessary expenditures not as a cost but as an investment in our future.*

Guideline documents on running bursary schemes and support required by students are currently being prepared and will be available from the LGSETA.

It must be accepted that the lion's share of investment in developing professional capacity must come from the budget rather than from SETAs, as SETA funds were intended for ongoing training of in-house staff at a time when the acute skills shortages had not been

Success story – positive feedback from students and graduates

I am working at the water treatment plant and I have done well in optimising the plant and monitoring and controlling the treatment process. I want to register for water care with the University of South Africa and want to focus on water treatment. My mentor has taught me to work as a team player and to believe in myself

– Tumelo Matokonyane, Phokwane LM

Wilhelmina Moeng

I was involved in the construction of a sewer pump station and the provision of water-borne sanitation. I supervised the project and took levels and measurements. I learnt from my mentor that I should always ask questions if I don't understand, even if it sounds stupid. I learnt that communication and documentation is the way I'll find information regarding civil engineering. My goal is to work hard, get my diploma and do a BTech in Water Engineering

– Wilhelmina Moeng, Francis Baard DM

Mlungisi Mnganga

I would like to take this opportunity to thank you for an excellent mentoring experience and also the wonderful educational exposure in the field of engineering. I enjoyed my time as a trainee and look forward to additional experience in the field

– Mlungisi Mnganga, Francis Baard DM

quantified. Every municipality should be putting funds aside for bursaries for professionals and artisans alike.

5.10.3 In the workplace

Academic success in tertiary studies does not signify the end! Universities of technology require that students enter industry for two semesters to gain practical experience before they are allowed to complete their final academic studies. These semesters are known as Practical 1 (P1) and Practical 2 (P2) and are usually termed internships by the SETAs.

Students battle to find opportunities for this practical training (see inset), even though in the local government context, the LGSETA is prepared to pay the stipend for this internship as long as the municipality is in good standing.

Graduating with a diploma or a degree is also not the end, but the beginning of a long journey. Figure 5.13 on p 185 depicts the steps in Hubert L Dreyfus's skills development model of moving from a novice to an expert. Clearly, our young people are at novice level and there is a burning desire to see them become experts overnight!

We need our managers to be people who do not even have to think before they make a decision, but just get on with doing what works – their intuition leading the way.

(a) The ten-year rule

One thing that all the experts have done is to practise. In the book, *Deep smarts*,[63] written by Professors Dorothy Leonard of Harvard Business School and Walter Swap of Tuft University, it is argued that the amount of practice is not a predicator of expertise, but that extended periods of concerted effort combined with self-reflection build expertise. Having studied many companies in the USA the writers conclude:

> *… most evidence suggests that it takes at least ten years of concentrated study and practice to become an expert. The ten-year rule places some inescapable limitations on the development of expertise in management or any other knowledge-based, complex domain, limitations that are frequently ignored or minimized by those trying to accelerate the process …*

Letter from a young black student in construction

Re: SEEKING HELP ON CERTAIN MATTERS IN THE INDUSTRY

I am a student at Eastern Cape Technikon [now Walter Sisulu University of Technology] and currently I'm doing my in-service training at a construction company from Queenstown.

Firstly I would like to know about the basic salary that the student technician should be paid when he or she is doing in-service training. I also want to know who the person is who is responsible for paying a student doing in-service training. Does the student have to be paid by the company owner using his own rate, or is there some money put aside to pay students from the tender sum in the case of construction companies?

I would also like to know if there are any guidelines and regulations that enforce the protection of students in the workplace and prevent them from being used by the owner. If there are any guidelines and regulations, how can I access them?

I wonder if the South African Institution of Civil Engineering is aware of the difficulties faced by students when it comes to getting training. According to the research that I have done, many students do not get experiential training for a year or more after they have finished their S2 or S4.

I did research and found out that even the students who get experiential training do not get proper training. Some students find themselves being forced to sacrifice and even do manual labour in the companies as they want to finish their diplomas. It would seem that developing construction companies are mostly interested in making big profits for themselves out of the contract sums of different projects forcing students to work under very difficult conditions and paying them very small salaries.

Consulting firms and municipalities in South Africa are not capable of providing experiential training to students as they take a very small number of students per year.

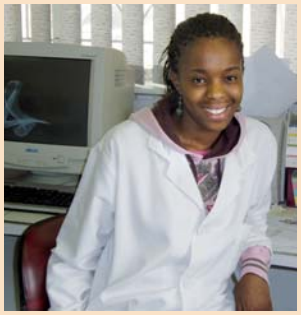
The civil engineering students must feel that they are living in a democratic country and must get their rights in the workplace. All the parties concerned with the Civil Engineering Institution of South Africa should have the ambition to develop students who will help the country in future and stop focusing only on their own needs.

I will highly appreciate it if the institution can intervene in all the issues raised above.

Success story – positive feedback from students and graduates

I received better training than colleagues because the mentor is qualified and has lots of experience and knowledge about civil engineering. One of the main obstacles to finding a job is the need to have a driver's licence. I have studied the Red Book and learnt a little to use a CAD system. I have worked in sewerage and have learnt about designing of sewer and water reticulation systems from my mentor. My goal is to study further
– Thabo Matshabe, Southern DM

I have learnt to carry out different analyses for waste water in the lab and handle routine plant operations. My mentor has taught me that whatever I do in my work I should do it positively, with enthusiasm and always make sure that I meet deadlines. I would like to see myself gaining experience in different sectors of chemical engineering, for example water treatment, fuel technology and mineral processing
– Lorraine Xamageleo, Mogale LM



Lorraine Xamageleo

Lorraine was the only chemical engineering student in the ENERGYS programme. She laments the state of the plant and carries on to say that the plant should be monitored regularly to ensure that everything is in order. Lorraine has since been appointed by Mogale.

In other programmes interns are treated as students but at our municipality we are treated as colleagues so we get to learn everything they are doing. Our mentor is always available to help if you need clarity on something you do not understand and he tries his best to teach us everything
– Ntombi Mayinga, Buskbuckridge LM

They conclude that the failure of the dotcom companies was due to the inexperience of the young technology whizz kids who headed up the numerous hatchling companies at the dawn of internet trading. They also trace many other failures and catastrophes to youthful management and inexperienced technical personnel.

The authors do concede that developing competence in complex processes, as opposed to expertise, takes a little less time, about five to seven years. However, progression up the ladder of experience requires that the initial processes be mastered before moving to the next step.

Pressure to fast-track has resulted in steps being skipped, leaving many young or inexperienced managers floundering. In a sense South Africa has experienced the service delivery bubble as a result of inexperienced staff being fast-tracked to managerial levels before having developed the necessary expertise.

Whilst fast-tracking has improved equity ratios, it has achieved little in terms of building capacity within local government or the country. Furthermore, in the long run it disadvantages those who have been fast-tracked, because eventually their level of development will be inadequate for further promotion. Alternatively, if they are promoted and cannot cope, they bring themselves and the profession into disrepute.

Fast-tracking is also detrimental to the development of future generations of engineers as those who are currently being inadequately developed will not be in a position to pass on adequate expertise to those who follow.

The fast or express train runs from one major centre to another, without stopping to pick up passengers or goods along the way. Our young people are expected to make it from graduation to senior positions at break-neck speed and are not given adequate opportunity to gain experience along the way.

The slow or milk train, on the other hand, stops at every siding and waits long periods for the fast trains to pass. We cannot afford our students and graduates to be sidelined on menial tasks or have several repeat experiences of the same exercises or types of projects.

Mainline trains, however, take a little longer than express trains because they stop at the major centres to pick up passengers and valuable commodities. Our young people need to be 'mainlined' or 'right tracked'.

(b) Right tracking

It is essential that a formula for 'right tracking' be developed and promoted within industry to give all those employing young students and graduates an insight into the current weaknesses of the education system. Employers must therefore plan and offer methods of addressing the gaps in order to develop competent engineering professionals.

In South Africa today we cannot dismiss those who have graduated from our tertiary institutions as being 'useless' – a view expressed all too often. These young people have paid heavily for their studies, often with the meagre earnings of their parents and their own clandestine efforts. Employers need to throw them the life line, but in most cases need guidance on how to develop them.

(c) Graduation and professional registration

The bulk of workplace training for engineers takes place after graduation, although they are expected to be involved in some vocational training during their studies. Technicians, on the other hand, require workplace training for at least 12 months to gain sufficient experience to meet the requirements of the national diploma.

Once graduated, the accepted assessment for having developed sufficiently to be able to work independently is the attainment of professional registration with the Engineering Council of South Africa (ECSA). The process of gaining registration is a long one, and the success of the candidate depends on many factors, including his/her nature, aptitude, culture (upbringing), primary, secondary and tertiary education and workplace training. In times past, it was normal for graduates to gain registration in their mid- to late twenties. Today, only 25% of candidates register before the age of thirty, the delay in most cases being a lack of skills development and readiness for this level of assessment.

In post-independence Tanzania concern was expressed at the quality of local engineers,[64] resulting in Tanzania's continued reliance on expatriate capacity. A major campaign was mounted to encourage local engineers to register with the Engineers Registration Board (ERB). However, few engineers met the registration criteria and concerns were expressed that the country would:

> *… end up with a large pool of engineers whose engineering contributions in the national development would be minimal …*

On investigation it was found that there was a complete lack of post-qualification professional experience and no proper mechanism to ensure transfer of technology by expatriates.

At an early age we generally acquire skills by trial and error, but as adults we generally acquire skills by instruction, which requires us to be exposed to dedicated expertise as a source of guidance.

In 2003, the public sector launched a structured workplace training programme for young graduates, which was funded by donor agencies. In terms of the programme, young

Tanzanian graduates were paired with expatriates to develop the skills required for registration. Within a short period 300 graduate engineers were participating and several have since registered as professional engineers. South Africa finds itself in a similar position at present with few young people being mentored to develop the competence required for registration.

(d) The team solution

Experienced professional staff are in short supply and are working long hours. The line manager therefore can at best only offer input on what is required in terms of the project or task he is delegating to the graduate, and cannot afford the time to offer technical training on concepts that the graduate failed to grasp during his studies. The following skills are required:

- A comprehensive understanding of the theory relating to technical subjects
- Communication skills, including the ability to speak and write fluently and comprehend complex documentation
- Numeracy and the ability to carry out engineering calculations
- Computer literacy
- Problem solving ability
- The ability to study and work independently and to drive themselves
- Life skills, including self-discipline, diligence, ethics, financial management, time keeping and responsibility

Since many students are weak in all of the above, a range of interventions is required. Methods of compensating for these weaknesses include small-group instruction, tutoring, independent learning and individualised instructional systems.[65]

A toolkit of interventions is required to guide employers on how to address the many shortcomings. The ENERGYS programme has offered valuable insight into many of the interventions required and these will be discussed briefly below. A comprehensive document

Success story – positive feedback from a graduate in Randfontein

Mr Gerrit Venter (Senior Engineer) rolled out a very well-planned schedule of tasks for me to perform. These include norms that always emphasise responsibility, trust, accountability, positive attitude, discipline, honesty, productivity and communication to make me a firm and strong Technologist/Technican.

Some of the tasks I have been involved in towards this goal are:

- Survey and preparation of drawings (using CAD) for the R28/R559 intersection for the application of a way-leave from the Gauteng Department of Transport
- Involvement in the supervision of a stormwater pipeline installation
- Testing of bricks at Mogale City LM laboratory to build manholes at the stormwater pipeline installation

This is a phenomenal programme for students and graduates because it exposes them to various situations within the municipality and also to the feeling of being in a workplace getting practice in the study field and career path of one's choosing. One sometimes finds recent engineering graduates who decide to pursue other career options because of the perceived lack of jobs and/or training programmes in civil engineering and this is sad. Mentoring is of vital importance in the training programme as acquiring the appropriate professional skills is fundamental to a successful career.

– Ernest Russell, Randfontein LM

is currently being developed to guide municipalities and companies on the training regimes needed to help students and young graduates move from the novice to competent state.

It is essential that additional capacity be harnessed to play the mentor and coach roles in support of line managers. A team effort to address the gaps would therefore include:

- The line manager
- A dedicated knowledge coach, typically a retired engineer, who can offer one-on-one supplementary training to address the gaps identified above
- The HR department, to document the workplace training (including rotation) mapped out with technical staff, ensure timeous log book submissions, monitor progress and organise participation in formal training as recommended by the coach

(e) Assessing students and graduates

With regard to the gaps outlined, it will be necessary to assess student and graduate skills at the outset to determine the range of support required. Initial assessment also offers an excellent benchmark against which to measure progress during internship or candidate phases.

Furthermore, psychometric testing is invaluable in identifying areas where young people require personal growth and support.

(f) Selection tips and issues to be considered

Although all students and graduates should be given employment opportunities, there are many parameters with regard to student selection that should be considered. Whilst contractors are happy to employ students upon completion of S2, such students will have had little or no exposure to theory or application related to civil engineering disciplines as these subjects are only offered from S3. Students in the ENERGYS programme who had completed part or all of S3 or more were utilised more effectively and gained greater value from workplace training than those who had only completed S2. It is recommended that students should have completed S3 before commencing experiential training in local government.

Another important point to note is that until students actually register for P1 or P2, any work that that is carried out in the workplace may not be included in their record of experience.

Many students have accumulated huge debts that they are unable to pay and thus cannot register for P1 or P2. When interviewing students, it is important to determine their level of outstanding debt, help them develop a repayment plan and ensure that they do in fact register and acquire their P1 or P2 log books before commencing experiential training.

(g) Assessing the workplace

As can be concluded from the above, if technical management, coaching and HR capacity are not in place to ensure that the student or graduate is adequately supported, it would be inappropriate to offer these young people workplace training positions.

Furthermore, municipalities must ensure that their infrastructure is adequate in terms of office space, computers and software, transport to and from sites, codes of practice and technical reference books for the training process to be meaningful.

If all is well, then it is also possible to apply to the LGSETA for a contribution towards the stipends of students during their experiential year.

(h) Orientation

The following section describes all the activities related to workplace training. However, before setting out, it is important that all involved participate in an orientation workshop to ensure that all roles and responsibilities are understood and aligned. A series of workshops are offered by SAICE. Visit the website **www.civils.org.za** for annual programme details.

(i) Workplace training

The workplace training phase should be an adaptation and formalisation of the training programmes of the past in which the trainee was exposed to all aspects of the project cycle in a structured manner.

This requires that employers compile a detailed curriculum for each candidate. The ENERGYS team have developed a comprehensive compendium of engineering activities per municipal engineering discipline, which may be adapted per trainee to form the basis of a log frame for workplace training.

Essentially, graduates and students need to develop skills in the following areas:

- Administration
- Planning
- Drawing
- Survey
- Design
- Contracts
- Construction
- Materials/testing
- O&M

The ENERGYS compendium covers each of these in the fields of water, sanitation, roads and traffic, stormwater, solid waste and electricity.

When assigning a project to the student or graduate, all aspects to be tackled in the project cycle should be marked on the log frame to give the trainee an indication of the overall scope of the project and his or her involvement. Milestones must be set and regular progress reports must be submitted to ensure that the student or graduate has grasped the challenge and to hone writing and language skills.

(j) Practical training

Practical training implies simulated experience in which the young person is not actually responsible for the work being carried out but works through processes to understand them. Whilst useful, this type of training does not allow the trainee to make mistakes and, in so doing, to learn from them. It should therefore be seen as supplementary only! Typical examples of supplementary practical experience include site excursions, hypothetical projects, case studies and standard operating procedures as outlined in (i) to (iv) below.

(i) Site excursions

To broaden the student or graduate's horizons, visits to sites in other disciplines or at earlier or later stages of the project cycle from that in which he or she is currently involved, are invaluable. These should not be passive visits, and details on site need to be described thoroughly by the coach.

The student or graduate needs to be questioned and stimulated to think why things are being handled in a particular manner, and after every site visit the student or graduate

Success story – positive feedback from students and graduates

My mentor taught me that nothing is impossible. If you give your best at all times the results will be beneficial and good. I dream of opening my own construction or consulting company and seizing every opportunity that comes in my direction
– Ayanda Buthelezi, Alfred Nzo DM

I rate my experience in the ENERGYS programme as better than that received by my colleague because the municipal engineering field is wide and offers more choices and fields of study. I learnt about managing the implementation of projects. My mentor taught me that one can only be successful through hard work and gathering valuable information in the field of engineering. My goal is to do a BTech
– Onke Gzaba, Amathole DM

The team in Amathole

I got better experiential training in ENERGYS than my colleagues because I had professional engineers as my mentors; they were organised and met with us often. The biggest obstacle to getting experiential training is living in the rural areas and not getting access to firms. I was involved in surveying work, taking levels and working in roads maintenance. I learnt a lot about surveying, office design and how to draw on a CAD system. My goal is to finish my national diploma and later study BTech
– Gcobani Ziqu, Amathole DM

needs to do research on the topic, write a report on what was seen, including background theory if appropriate, and make recommendations on how to improve the solution, efficiency or some aspect of the project.

The authors of *The reinventors fieldbook*[66] confirm that:

> *… taking people to see something for themselves is always more powerful than telling them about it or having them read about it … they get a visceral feel for the new reality.*

Site experiences should be captured in a report for future reference and a formal presentation should be given to peers so that they too can learn what their colleagues have learnt and catch a glimpse of their excitement.

(ii) Hypothetical projects

Where projects have already been designed (or even built), a useful exercise is to give the student or graduate the same brief. On completion the student or graduate's design can be compared with the professional design and the pros and cons of the differences can be discussed.

Yet other exercises can be creative hypothetical projects where the student or graduate is asked to come up with innovative or new ways of addressing a problem or a need. Whilst the answers may not necessarily be right or wrong, or may not be adopted, the research and thought associated with the development of the solution and subsequent discussion of the proposed solution with peers and seniors offer excellent experience in problem solving and presentation.

… taking people to see something for themselves is always more powerful than telling them about it or having them read about it … they get a visceral feel for the new reality.

(iii) Case studies

Case studies of successes or failures and the reasons also present useful material for study. WIN-SA[67] has produced a detailed set of case studies in the water sector, which should form part of the workplace training programme.

(iv) Standard operating procedures

The use of standard operating procedures (SOPs) is invaluable to understanding processes. Where they have been lost or do not exist, students and young graduates should be harnessed to redevelop them under the guidance of a senior who has experience in carrying out such processes, for example the process for operating a treatment works, approving plans or adjudicating tenders.

(k) Supplementary courses and support

(i) Specialist technical courses

As already alluded to, specialist courses may be attended to either supplement a lack of education or to fast-track the understanding of many practical design and detailing topics. Typical organisations offering such practical training include:

- C&CI (Cement and Concrete Institute)
- IMESA (Institute of Municipal Engineers of Southern Africa)
- SAACE (South African Association of Consulting Engineers)
- SABITA (South African Bitumen Association)
- SAICE (South African Institution of Civil Engineering)
- SAISC (South African Institute of Steel Construction)
- SARF (South African Road Federation)
- WISA (Water Institute of South Africa)
- WRC (Water Research Commission)

Many of these courses have been validated for earning CPD credits for retaining professional registration.

(ii) Industry-specific courses

Experience and skills required vary per industry. In the consulting world, project management, ethics and indemnity are of key importance, whilst in the contracting world contract management, materials, labour and contract law are of key importance. In local authorities and other government departments, issues such as the budgeting cycle, division of revenue, procurement, working with decision makers and legislation are of major importance. Mining has its own challenges in terms of labour, mining rights and safety.

One of the most valuable formal learning experiences for all the young people employed in the ENERGYS programme during 2006 was to attend the IMESA conference in Soweto. They attended lectures spanning the range of municipal engineering for two and a half days, visited all the service providers' exhibits and were expected to write reports on a lecture and an exhibitor of their choice and deliver a presentation to their group. The top participants were awarded text books or technical reference books for future use as engineering professionals.

(iii) Life skills

Over and above technical competence, proficiency in life skills, including communications, negotiations, leadership, and interpersonal relationships, must be honed during this

phase. Furthermore, students and young graduates must be exposed to the many soft or non-technical issues that are critical to the success of their projects, including political, socio-economic, institutional, environmental, health, legal, financial and management issues.

Many courses offered by commercial organisations and professional bodies are in place to address these aspects and training should include attendance at a number of these courses as the need arises in the workplace.

(iv) Support for female students

Mention should also be made of the additional support required by female students and graduates.

A number of research projects carried out in 2004/2005[68, 69] were aimed at identifying success factors for women entering science, engineering and technology (SET) and came up with a surprising result. The only factor that all research found in common was the fact that successful women were 'hardy' personalities!

Civil engineering is still very much male dominated and entry for young women is rather intimidating. Further, young women find it very difficult to overcome the cultural barrier of talking confidently to the older men with whom they must interact. An ENERGYS engineer involved in interviewing students for the programme expressed extreme concern after interviewing ten female students, suggesting that they would not find work as long as they were not confident to converse!

The programme did employ some of these students who, after a lot of support, have become confident young women. It is doubtful that they would have been employed by the private sector, or built any confidence if employed in other public sector projects in which there was no support. Help is desperately needed to grow 'hardy' personalities.

(l) Coaching

Since the individual cannot absorb new material if his foundation training is inadequate, it will fall to the coach to offer supplementary lectures or encourage the trainee to recall previous lessons before progressing to the next concept. Thus a checklist of all theoretical concepts is required for coaches to ensure that they cover training systematically and do not miss steps or move through the introduction of concepts too quickly.

Success story – technical capacity enhanced in Zululand DM

When the ENERGYS engineer was introduced to the Zululand DM, senior technical staff explained that the majority of their technical staff were insufficiently experienced to carry the load, and required dedicated training in all phases of the project cycle. After preparing a lecture programme covering all disciplines and the phases (known as the five-by-five matrix since five topics and five sub-modules per topic are covered per discipline) the engineer held weekly classes for 13 junior civil engineering staff, setting each tasks on which to practise their new-found skills for the following week. Now they are all au fait with survey, design and the tender process and are cutting their teeth on the construction of major 'real live projects' as they call them. As the initiative draws to a close, the ZDM has expressed their satisfaction at the great progress made, enthusing that all the staff are now able to handle projects delegated to them.

The five-by-five matrix developed by the ENERGYS programme (see inset on p 243) for training young students and graduates may be used as a framework for this check list. The topics covered are:

- General management
- Surveying
- Hydraulics
- Hydrology
- Pipelines
- Water distribution
- Water losses
- Roads
- Structures
- Project management
- Fleet management
- Materials

Apart from formal lectures, case studies and presentations on successful projects given by enthusiastic experienced personnel add to the learning experience. Where these are carried out on Friday afternoons, in an informal environment with beer in hand, they seem to have more impact!

(m) Self study

(i) Technical and business

Students and graduates need to learn how to use reference material to build their knowledge and gain a wider understanding of each field in which they work. It is therefore essential that they be encouraged to study the recognised texts in each field and ultimately use them in decision making. The log frames for guiding workplace training include comprehensive bibliographies. All projects set for graduates, whether practical or hypothetical, should include research, findings and conclusions from these references.

(ii) Motivation

Although increased learning does boost confidence, many young people feel overwhelmed by the long road ahead and require as much motivation as possible.

Setting projects to research and report on famous people, industry role models and pioneers will go some way to inspire. At the turn of the last century an interesting research project into the rise to achievement and fame of the top 100 achievers of the 20th century showed that only three of the group came from privileged backgrounds. The rest had poured their life's energies into climbing out of disadvantaged situations or overcoming impediments.

In profiling the ENERGYS team, it was found that although the seniors and juniors shared similar MBTI (Meyers Briggs Type Indicator) profiles, emotionally the young people were very pessimistic compared to their mentors.

This type of motivation, but particularly introducing them to young role models sharing their own challenges, is important. Linking students and young graduates with those who are making good progress was found to be beneficial.

A technique that worked very well in the young teams was identifying the team member with the most potential and confidence and setting him or her up as team leader. This not only enhanced the individual's leadership skills but motivated the rest because

Success story – students meet a role model, Moses Maliba, the president of IMESA

A number of students were recently very inspired when they met Moses Maliba, the 2006 to 2008 president of IMESA. They are pictured here with Engineer Moses wearing his ceremonial chain, Dr Michael Sutcliffe, the City Manager of eThekwini and the author.

they could see that by taking initiative and responsibility their colleague was able to make excellent progress.

(n) Continuous assessment

Continuous assessment is essential to ensure that students and graduates are making progress. Re-assessing trainees against assessments done at the outset provides an excellent indicator of progress.

(i) Maintaining records and log books

The completion of log books is essential to ensure that trainees systematically build up their experiential records and their own body of knowledge. Hand-written information is far more likely to be committed to memory than computer-generated information. Recording sizes, forces, costs, etc for each project worked on, in a preformatted record book will help students develop a feel for the magnitude of all these parameters. Rules of thumb gleaned from experienced engineers should also form part of their records.

(o) Final assessments

(i) Students – Submitting P1 and P2 log books

Universities of technology require that students gain exposure to at least four or five of the areas listed under 5.10.3(i) 'Workplace training'. The mentor and/or coach should ensure

Success story – in-house concrete teams mentored in Eden DM

The engineer deployed in Eden had the interesting challenge of teaching concreting skills to in-house construction teams involved in rehabilitating stormwater structures after the 2005 and 2006 floods. At the end of January 2007, the structures in Riversdale and Heidelberg were complete and ready for final inspection, as follows:

- Divisional road 1577 – at chainage 11,97 km in the Riversdale area
- Olieboor minor road – at chainage 2,00 km, also in the Riversdale area
- Divisional road 1328 – at chainage 6,00 km in the Heidelberg area

Norman Angel of the Eden DM enthused:

I am so impressed. The fantastic improvement in the quality of work since mentors were introduced needs to be communicated by our Mayor to ***dplg*** *with the request for* ***dplg*** *to continue with the programme.*

More is the pity that the successful short-term intervention by national government (the best I have experienced in 23 years of local government) is to end in March!

that sufficient ground has been covered before the student submits P1 or P2 log books and reports. It is essential to check on the conditions set by the appropriate university of technology when the student is taken on because conditions change from time to time.

Having finally passed P2, the student would either be ready to graduate, in which case he or she may be offered permanent employment as a graduate, or may need to return to complete part of S3 or S4. The ENERGYS team found that many students had only one or two S4 subjects left to complete. The most sensible way of dealing with this scenario is to offer students who have made good progress permanent employment on condition that they complete the remaining subject(s) through UNISA in a specified period, or if in a university centre, allowing the students to have hours off to complete their subject(s).

(ii) Graduates – preparation for the ECSA interview

The ECSA interview process is very demanding. Graduates need to be schooled in the process and seniors need to give input on their submissions. Seniors must also ensure that students have done sufficient research on the essay topics to be authoritative in the interview and report writing phases of their assessment. SAICE offers workshops on the registration process, which could be of benefit to graduates and coaches alike.

(p) Training in-house staff

Where in-house staff do not have the depth of workplace training as described above, ENERGYS engineers have extended their training efforts to address these needs, or have made themselves available to offer advice to those who required support with major technical decision making.

In several municipalities groups of in-house staff have attended dedicated courses offered by ENERGYS engineers on a weekly basis.

The improvement in workflows and efficiency as a result of the project management training offered in the West Rand has been so successful that Gauteng DLG is now making this programme available to all municipalities in the province.

(q) Refine terms and conditions of public sector tenders with respect to training

Having seen the complexity of training young people it is clear that tenders calling for one or two students to be taken on as part of the project merely pay lip service to training!

When public sector tenders call for the professional service provider to offer students experiential training, the terms and conditions should include the provision of a dedicated supervisor or coach and that the log frame approach developed for the ENERGYS programme be followed to ensure that the young people are exposed to all aspects of the project cycle.

(r) Set up driving schools at all tertiary institutions

Any section on training young people would not be complete without mentioning the need for support in this area.

One of the drawbacks to involving young people in all facets of the project cycle, is the fact that few have driver's licences, which means that the majority cannot get to sites to understand the construction phase or carry out project management duties. Furthermore, those who have learner's licences are unable to get driving test appointments in under six months' time! This impacts their progress severely.

A system of training and testing all technical and accounting students should be set up at tertiary institutions since manpower is being vastly underutilised as a result of this drawback. All too often municipalities and employers in general insist that they will only take on students or graduates who are in possession of a driver's license. The Department of Transport would need to be part of this initiative to ensure that adequate numbers of learners and driving tests can be scheduled per annum to get the students through the system.

5.10.4 Expanding the ENERGYS model

The shortage of engineering and technical skills in our country requires urgent attention. The continued use of seniors to train and develop capacity is essential. This should not be limited to civil engineering, but should be extended to all technical fields and professions.

In the UK, of the top ten staff shortage areas identified in local government[70] three were financial, three social and the balance technical in the form of building inspectors, land surveyors and property surveyors. Building inspectorate apprenticeships currently being developed will comprise a four-year progression scheme from theory to workplace training.

In South Africa, as has been shown, all technical skills are in short supply. Development is needed, as follows:

Support for GCC training requested

Attention: the Bursary Administrator

I am currently working as the Deputy Director in the Electricity Department. As part of my conditions of employment, I am required to obtain the Electrical/Mechanical Engineer's Certificate of Competency (Factories). I have however been evaluated by the Department of Labour and hereby submit the attached letter (showing extra subjects to be taken).

If I can get the bursary, I wish to start doing my N subjects at the beginning of next year.

[The outstanding subjects included one N3, five N4 to N6, and nine S1 to S3 subjects covering a significant range of fundamental engineering theory.]

(a) Civil engineering

Although many students study civil engineering, few are given workplace experience. The ENERGYS model needs to be vastly expanded to grow this pool.

(b) Electrical engineering

A similar problem exists in this field. However, a further requirement is placed on electrical engineering departments in that at least one electrical staff member per municipality must have a government certificate of competence (GCC). In many municipalities, it has been found that no one complies. Whilst the move towards REDs (regional electricity distributors) may reduce the number of GCC-registered persons required, this level of competence is required for planning and managing complex electrical networks. Investment is required to assist those who need to upgrade their qualifications (see inset).

(c) Town planning

Similar energies need to be ploughed into addressing the complete dearth of town and regional planners in local government to ensure sound:

- Urban and regional development
- Development planning
- Land use management
- Spatial development planning

(d) Building inspectors

The number of inferior quality houses, unsafe structures, and contraventions of by-laws (to the detriment of health and safety), needs the firm control that can only be exercised by well-trained building inspectors. The ENERGYS model urgently needs to be replicated in this field.

(e) Valuers

The opportunity to expand the income base as a result of the Property Rates Act will require a much expanded team of valuers to assess all properties nationwide. Real Estate students should be harnessed and developed in conjunction with experienced valuers to perform this function.

(f) Laboratory technicians

The Department of Science and Technology reports that many science students are unable to find work. To address issues of water and effluent quality, and ensure that suitable materials are being used on projects, laboratory capacity and procedures should be rebuilt harnessing these young people, again paired with retired technicians and scientists.

(g) Artisans and operators

Perhaps the largest gaps exist with regard to municipal supervisors, operators, artisans and semi-skilled labour. This problem requires concerted education and workplace training

efforts, again under the supervision of experienced, possibly retired artisans, until a sufficiently experienced pool of new generation artisans has been built.

The most effective way to do this would be to reopen and expand the capacity of the municipal training schools that were closed in the 1990s. The old training programmes had numerous advantages. Firstly, the colleges were integrated with municipal operations and were thus able to offer intensive workplace training while at the same time meeting the needs for additional artisan's assistants in the field. Secondly, they drew their students from the local community and in many cases students went on to become permanent and long-service staff in their local municipalities. This created a stable local source of artisans. Once artisans leave their locality to train they are unlikely to return.

The LGSETA has offered to support municipalities wishing to reopen or expand their training centres and awaits business plans from those municipalities that are in a position to offer training.

CONCLUSIONS

Clearly, South Africa is too short of technical staff with local government expertise to be able to cope with the burgeoning pressures to deliver, operate and maintain infrastructure. Furthermore, those who are in the system are not being adequately supported and utilised.

In essence, what is needed is to make human capital work, that is the networks, accumulated know-how and trust that make organisations work. According to Whitney MacMillan,[71] emeritus chairman of Cargill, the following are key to making an organisation effective and have also been highlighted throughout this chapter:

- **Recruiting** – hire for aptitude and attitude
- **Training** – use the apprentice (or workplace) system
- **Values** – walk the talk
- **Networking** – create opportunities for people to share ideas
- **Decision making** – adopt common processes
- **Employment** – make a long-term commitment
- **Senior management** – keep in touch
- **Vision** – make sure everyone shares in the same purpose

Until councils and staff have the vision, passion and appropriate experience, and officials are given adequate levels of authority, service delivery will continue to follow the current stop-start patterns witnessed in most municipalities. An urgent separation of political versus official appointments is required as well as the expansion of the technical workforce in local government.

RECOMMENDATIONS

Issues to be addressed are grouped into three broad areas, namely powers and functions, systems, and capacity.

Powers and functions

- **Districts**

  Urgently review of the role of districts to optimise local government budgets and capacity.
- **Interface between politicians and officials**

  A Fundamental restructuring of the relationship between council and administration is required, to ensure an unambiguous interface between the two. Typically:
  - The Council should gather community input, develop broad strategy and monitor implementation.

- Once credible IDPs are in place, officials should have the freedom to handle complete implementation cycle.
- Senior officials should be selected by professional peers.

- **Expert politicians**

  Where politicians are selected from party ranks, rather than chosen by the community, specific skills sets must be sought to ensure that councils possess an adequate level of business, local government and service delivery expertise.

- **Municipal manager**
  - The MM must be given executive power to manage the business of local government without interference from politicians and must possess a proven track record in business for him or her to be accountable and perform adequately.
  - Selecting an experienced technical person to double as MM should be considered for smaller, low-income municipalities.

- **Authority and a chief engineer**
  - Senior engineering professionals should be involved at a strategic level.
  - A mandatory post for a technical leader (chief engineer) operating with the same authority as the CFO should be created. The incumbent should be an engineering professional with at least 15 years' experience in local government in all but the smallest of municipalities.

- **Decentralise services**

  Relieve engineering professionals from the restrictive controls of administration by setting up separate infrastructure delivery units with their own budgets, purchasing power and authority to recruit suitable staff.

- **Legislation and reporting**

  Current legislation and procedures are overbearing and offer limited benefit.
  - Critically review the PFMA, MFMA, MSA and supply chain regulations.
  - Reduce the amount of reporting required and streamline the data collection process.

- **Deliver all services and O&M**
  - Municipalities must budget and plan for both development and ongoing O&M.
  - Considerable investment in systems is required to streamline current processes.

Systems

- **Master and forward planning**

  Update master plans and develop forward plans to obtain a road map for long-term development.

- **Integrated planning**

  Adopt mixed land use and integrated planning approaches for all future developments.

- **The IDP and technical staff**
  - The IDP should be the implementation of the master plan.
  - The IDP should be formulated by a committee comprising councillors and senior officials from every department, including technical departments, to arrive at sustainable solutions for the entire municipality.

- **GIS, O&M, drawing office and IT systems in general**
  - Rebuild these systems.
  - Real-time data must be available at all times for optimum performance.

- **Outsourcing**

  Consider outsourcing where capacity constraints cannot be overcome to ensure sound delivery and O&M.

- **Supply chain**
  - The process must be revisited and control must revert to technical departments.
  - Consider relational contracting models for long-term developments and projects.

Capacity – a new staffing model

- **Develop organograms and job descriptions**
  Develop and populate detailed organograms covering all duties associated with development, operations and maintenance.
- **Increase numbers**
  Significant efforts are required to increase the number of technical staff with expertise. Local government should:
  - Offer bursaries for school leavers with aptitude
  - Offer workplace training for students
  - Employ young graduates on training contracts
  - Appoint acting staff permanently
  - Attract staff of all ages and from all sectors
  - Retain senior staff
  - Promote on ability and complexity of responsibility
  - Develop a progression scheme for technologists and technicians
  - Employ retired engineers
  - Train in-house staff
  - Review packages
- **Career pathing**
  Draw up detailed career paths for all young technical staff to ensure that they are adequately rotated, progress and can eventually register with ECSA.
- **Succession planning**
  Establish succession plans to ensure that new leaders are well trained and ready to take over when current senior staff retire.
- **Develop other disciplines**
  Develop professional skills in other fields, including building inspectors, town and regional planners, electrical engineers, valuers, and laboratory technicians.
- **Develop artisans and operators**
  Expand artisan and operator training under the guidance of experienced or master artisans to rebuild capacity.
- **Review appointment durations**
  Experienced technical staff must be appointed for longer terms, or permanently with appropriate performance criteria.
- **Limit job-hopping**
  Place a moratorium on appointing staff who have changed jobs more than twice within a limited period, such as two years.
- **Address time management challenges**
  Place a moratorium on time spent in meetings and at workshops and public gatherings.
- **Train technical staff in community liaison**
  Technical staff must be part of the liaison team working with communities to ensure that appropriate solutions are agreed upon. Technical staff should undergo comprehensive training in community liaison.

Councillor empowerment programme

Deliver councillor and official empowerment programmes nationally to inform all involved of technical complexities involved in delivering, maintaining and operating infrastructure.

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CHAPTER 6

Thinking out of the box

6.1 NOT BUSINESS AS USUAL

Wayne Clough, Rector of the Georgia Institute of Technology has said:

> *The pursuit of science and technology is just as creative a process as poetry and the arts. Both require intensely creative people who can think outside the box, look at the same things everyone else sees and imagine something more, and put the pieces together in new ways.*

Having understood the need to appoint sufficient civil engineering professionals to develop, operate and manage the service levels required, it would be foolish to believe that it would be back to business as usual! The development demand has increased dramatically and, as has been seen, the backlog in terms of unmaintained infrastructure and unacceptable levels of service has grown significantly whilst unemployment continues to challenge the country.

Efficiency, appropriate solutions and better use of local labour are essential components to improved service delivery.

Fitness of purpose and fitness for purpose have become well-known buzz words, but are not always clearly understood. Possibly the most colourful example describing these clichés is the organisation known as the 'Barefoot Pilots', which operates in the Maldives. Distances between the islands are long, making flying an essential solution for the rich and famous.

Figure 6.1 Barefoot pilots

However, few islands are large enough for traditional landing strips. The airline fleet is therefore composed of flying boats, manned by rather unconventional looking pilots – dressed in lightweight shorts and shirts, naturally with the five-star epaulettes, but always 'kaalvoet'! Fitness of purpose? Yes, the need to transport the wealthy to exotic resorts. Fitness for purpose? Yes, an efficient solution that ensures the comfort of not only the passengers, but also of those transporting them! The solution is so unique that pilots worldwide clamour to spend their summer season working for the Barefoot Pilots. (See Figure 6.1.)

In their travels the ENERGYS engineers have come across many ideas that are shared in this chapter. These represent not only fitness of purpose in service delivery, but fitness for purpose. Several alternative solutions, methods of service delivery, improved systems and approaches are outlined which could be adopted to broaden or accelerate service delivery and job creation.

The ideas are not exhaustive but simply give a glimpse of the possibilities. The topics are addressed superficially to help decision makers and inexperienced staff to widen their understanding of possible solutions and challenge all to explore new approaches to service delivery.

When designing solutions, the key considerations should be the initial cost and the cost of operations and maintenance (O&M), in other words, life cycle costing.

Since staffing costs in municipalities have generally become the biggest single expense, the aim should be to use staff more effectively. Thus to reduce the overall cost, solutions should be considered that require less maintenance and minimum operator involvement.

Current norms, standards and by-laws should be reviewed. Legislation may require modification in instances where changes in technology deliver solutions beyond the scope of current guidelines.

6.2 WATER

Clause 3 of the Water Services Act, 1997 (Act 108 of 1997) calls for the minimum standard for basic water supply services, as follows:

> *(a) the provision of appropriate education in respect of effective water use; and*
> *(b) a minimum quantity of potable water of 25 litres per person per day or 6 kilolitres per household per month –*
> *(i) at a minimum flow rate of not less than 10 litres per minute*
> *(ii) within 200 metres of a household; and*
> *(iii) with an effectiveness such that no consumer is without a supply for more than seven full days in any year*

Considering these obligations, the three most important aspects to manage in terms of water are availability, quantity and quality.

Water networks, reservoirs and pumps are well understood. Where lack of steady supplies, operation and maintenance capacity, budgets or terrain preclude the use of such systems, alternative solutions must be considered.

6.2.1 Access to water

Whilst city slickers expect to have water at the turn of a tap, rural communities have never had such a luxury. Rainwater harvesting, boreholes and small reservoirs providing isolated communities with standpipes have been harnessed.

Innovative delivery methods which deserve mentioning include:

(a) Play pumps

Every 15 seconds a child dies from a disease that came from unsafe water.[1] Invented in South Africa, 'play pumps' were devised to harness the energy generated by children playing to supply water. When the merry-go-round spins, it pumps uncontaminated drinking water from deep below the ground into a secure and clean water tank.

A few metres away from all the fun,
students in uniform turn on a tap.
Clean, cold drinking water pours out.

There are 500 play pumps around South Africa, most of them installed at schools where learners come from poor communities and resources are limited.[2] (See Figure 6.2.)

Source: www.playpumps.org

Figure 6.2 Play pumps in action

This invention has caught the imagination of the world and commencing on 22 March 2007 an initiative to install 100 play pumps in 100 days was launched to bring water to a quarter of a million Africans in rural areas. The call for participation suggested that:

Just $6 will provide one person with clean drinking water for 10 years!

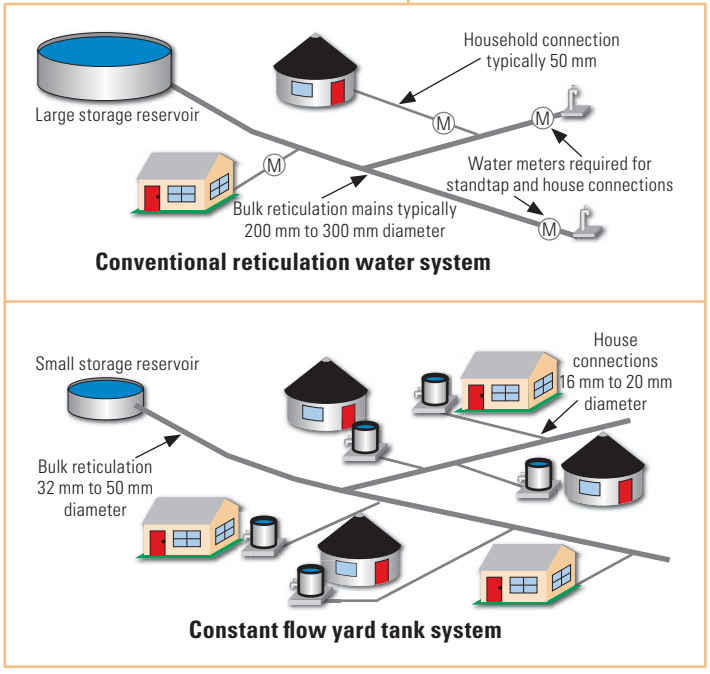
South African rural municipalities faced with the challenge of providing water to all schools by the end of 2008 should strive to have such solutions installed on the back of the many aid programmes aimed at addressing the Millennium Development Goals (MDG).

(b) Yard tank systems

Instead of individual household tanks, yard tank systems are a hybrid solution, combining a small reservoir with individual tanks.[3, 4] (See Figure 6.3.) The solution provides water at a constant rate to household yard storage tanks.

Flow in the reticulation network is independent of consumption patterns and eliminates the need to design for peak flows. Therefore, reticulation pipe sizes and main storage capacity can be reduced since peak flow is obtained via the on-site tank.

Used in Australia, New Zealand, the South Pacific and Indo-China, these systems are gaining acceptance for improved water supply in rural South Africa.



Source: *Low pressure yard tank systems* and *Final report for yard tank programme*

Figure 6.3 The yard tank model

6.2.2 Water quantity

Whilst we are chasing access to water for many, ensuring consistent supply and minimising losses are essential to ensure adequate supplies to consumers.

(a) Installation of telemetry systems

Telemetry systems, also known as supervisory control and data acquisition (SCADA) systems, are operational tools used to automate water supply and provide real-time information on the state of the system.

Systems range in cost, complexity and size. Using the latest group special mobile (GSM) logging devices has reduced the cost of data acquisition and allows such devices to be deployed throughout the network: at meters, pump stations, reservoirs and the like.

Since using telemetry ensures continuous flow and reduces the number of operators required, the long-term benefits need to be considered when determining the viability of such systems.

(b) Addressing water losses

South Africa is wasting a huge percentage of its treated water and municipalities are not earning the full income against the service they supply. Termed liquid gold, we cannot allow losses of this precious commodity! Listed below are areas that need attention.

(i) Losses

Losses result from old and leaking municipal pipes, broken valves, leaking water meters and water reticulation networks generally being in a bad state of repair.

(ii) Wastage

Wastage relates to domestic leaks, including broken taps and latrines that run 24/7.

(iii) Pilfering

Significant income is lost because of unauthorised connections.

(iv) Pressure management

Reduction of excessively high pressure will significantly reduce losses due to leaks and inappropriate usage, hence pressure management is critical.

(v) Inefficiency

Inefficient use of water is defined as the use of water that does not add any economic value. Typical examples are the washing of paved areas, over-watering of gardens and using old, inefficient machines and equipment that consume unnecessarily high volumes of water.

(vi) Billing

Billing in many areas is based on assumed consumption rather than measured consumption. This may mean that there are fewer leaks and higher consumption or more leaks and lower consumption than estimated.

Several, predominantly larger, municipalities have thus embarked on major water demand management exercises to reduce losses, repair water supply networks and offer a once-off repair service for on-site plumbing problems before installing prepayment meters. Whilst costs may appear prohibitive, several pilot and actual projects rolled out

to date report the financial improvement to be of the order of R1 000 per household per annum.

(c) Call centres

To ensure that losses owing to leaks are kept to a minimum, clause 12 of regulation 7079, volume 432 of the *Regulations Relating to Compulsory National Standards and Measures to Conserve Water* requires that:

> *A water services institution must repair any major, visible or reported leaks in its water services system within 48 hours of becoming aware thereof.*

It is therefore important to set up call centres to allow leaks to be reported to minimise losses and improve customer service. To be efficient they must:

- Answer quickly
- Initiate a quick O&M response
- Record failure details
- Track the progress of the complaint to ensure that it is resolved
- Link the centre to an engineering management system to build up an understanding of the state of the system

Municipalities should be encouraged to access credit to initiate campaigns to reduce their losses and increase their income. This will contribute to their long-term viability. Most major consultants and water boards are able to support municipalities in such exercises.

It should however be compulsory that comprehensive education programmes and engagement with communities take place before and during implementation of such a programme.

6.2.3 Water quality

According to DWAF, only 55% of municipalities in South Africa regard themselves as having adequate systems in place to deliver acceptable drinking water.[5]

Key contributors in this regard have been the lack of capacity at municipal engineering level, and the lack of awareness in those municipalities without capacity of the importance of water quality. DWAF, in collaboration with the Institute of Municipal Engineering of Southern Africa (IMESA),[6] has now developed a web-based drinking water quality management (DWQM) tool that guides water supply authorities (WSAs) on good DWQM and provides real-time DWQM information to DWAF for purposes of supporting WSAs with limited capacity. Drinking water quality must comply with SANS 241. Readings must be taken at least monthly and any non-compliance must be reported to the Director-General of DWAF.

The assessment tool investigates such parameters as:

- Status of raw water sources
- Water treatments
- Availability of laboratories
- Sample points
- Frequency of monitoring
- Skill levels
- Numbers and capacity
- Communication protocols
- Ability to interpret data

- Knowledge and application of legislation

Support is then identified for those municipalities who are perceived to have weaknesses.

The challenge now is to ensure that all are taking advantage of the new support initiative. To use the service log onto <**http://www.wqms.co.za**>.

As discussed in Chapter 4, enforcement is important. With such a system in place there should be no excuse for poor quality and now more than ever inspectors should be enforcing compliance.

6.3 SANITATION

Clause 3 of the Water Services Act, 1997 calls for the minimum standard for basic sanitation services, as follows:

> *(a) the provision of appropriate health and hygiene education; and*
> *(b) a toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, well ventilated, keeps smells to a minimum and prevents the entry and exit of flies and other disease-carrying pests.*

On a recent lecture tour, Prof Duncan Mara from the University of Leeds, UK, stated that worldwide it will be necessary to provide 460 000 new sewerage connections per day to meet the MDG. What a challenge! South Africa has reaffirmed its commitment to these goals,[7] but they can only be achieved if we embrace new approaches.

Frequently, inappropriate technical solutions are implemented owing to a lack of understanding of water resources and other requirements. Using the *Decision making framework for municipalities* and the *Introductory guide to appropriate solutions for water and sanitation,*[8] a range of appropriate solutions must be considered to determine the optimum. The discussion below briefly covers some of the options and includes many new ideas.

6.3.1 Latrines

Table 6.1 outlines the different types of sanitation available.

(a) Dry sanitation

In terms of dry sanitation, buckets, pits and other unsavoury solutions have been cited as the cause of the high mortality rate in poor communities. The introduction of the ventilated improved pit latrine (VIP) from Zimbabwe in the 1970s offered the first acceptable low-cost solution for South Africa. Referring to a discussion on sanitation problems in rural areas, an excited Wilson and Ramphele, in their book *Uprooting poverty,* proclaimed:

> *The simple but revolutionary new design, incorporated in the ventilated improved pit (VIP) latrines which are odourless and fly free has the potential … to sort out the problem.*[9]

Having adopted the solution, many problems have been identified, including:

- The need to line pits in areas with a high water table, or where the soil is unstable, for example in sandy soil
- The need to clear pits every five to ten years
- The need to move top structures to a new pit when the existing one is full if the pit is not lined

Table 6.1 Sanitation options

Latrine	Capital	Operation
Dry systems		
VIP	Increasing cost	Must be emptied every 5 to 10 years
Ventilated improved double pit latrine		Generally most successful where householder is willing to handle waste disposal. Operating costs increase where local government must offer disposal service
Composting/UD latrine		Generally most successful where householder is willing to handle waste disposal. Operating costs increase where local government must offer disposal service
Heat processed		No operating costs for 5 to 10 years
Wet systems		
Pour-flush latrine	Increasing cost	R150 to R300 per annum where subsoil drainage is available
Aqua-privy and soakaway		R150 to R300 per annum where subsoil drainage is available
Conservancy tank		Emptying required at least three times per year
Shallow sewerage – condominial		R300 to R450 assuming that all maintenance is provided by service provider. Cost drops where residents are responsible for O&M of block (not bulk) sewers
Full bore water-borne sewerage		High annual operating costs
Septic tank and soak-away or small bore solid-free sewer		R200 to R450 per emptying, depending on emptying frequency

Source: *Sanitation for a healthy nation*

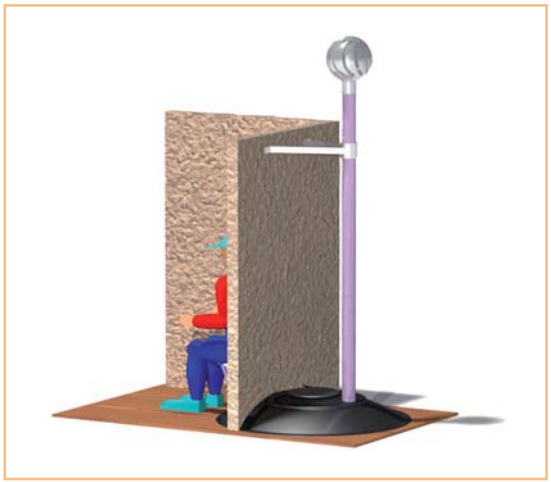
- The unsuitability of the solution where there are shallow rocks
- The challenge of limiting groundwater pollution, which has been conclusively identified as a problem related to pit latrines

These technical constraints must be considered before planning each development. To overcome them, innovative solutions have been developed and are discussed below.

(i) Ventilated improved double pit latrine[10]

This comprises a single top structure over two shallow pits side by side. Only one pit is in use at a time and each is vented by a pipe with a fly screen. Pits are generally lined and the central wall is sealed. The first pit is left to dry and is cleared out before the second pit is full. This system obviates the need to build a new top structure and is also beneficial where soil conditions preclude the digging of deep pits.

Source: eThekwini's water and sanitation programme



Left *Figure 6.4 Pawpaw trees growing at an experimental site in KwaZulu-Natal. The large trees have been grown in faecal material from urine diversion latrines*

Right *Figure 6.5 The ZERHO solution*

(ii) Urine diversion latrine[11]

In the case of the urine diversion (UD) latrine a single top structure is constructed over a sealed container with access for removal of composted waste. Urine is diverted to a soak-away and a vent pipe helps dry the faeces remaining in the container. When dry, the waste may either be used as fertiliser (see Figure 6.4) or may be carted away, the latter option increasing the O&M cost.

As no pit is required and waste is cleared regularly there is no need to move the structure every few years. This solution is most effective where communities are prepared to clear and use the waste for gardening[12] or agriculture and is ideal in poor soil conditions.

(iii) Dry or heat solutions[13]

The waterless latrine system is a sanitation system that does not require any water to function, is entirely isolated from the surrounding environment and cannot contaminate underground water resources.

The system utilises a natural biological process to break down human waste into a dehydrated, odourless, compost-like material. No plumbing is required, and there are no drains, no pipes, no water, low odour levels and usually no chemicals, making these solutions relatively light and easy to install.[14] Waste either drops into a water chamber where the organic material decomposes, or, in the case of for example the ZERHO,[15] EcoSan,[16] Enviro Loo,[17] and SolarSan,[18] into a chamber in which the waste decomposes due to the heat generated in the exposed chamber. The chamber is usually black and faces north to ensure evaporation of the liquids. Figures 6.5 and 6.6 show examples.

Figure 6.6 The biological latrine with black unit facing north

Source: Better water and sanitation

In some models, initially after installation, a packet of organic starter is put into the latrine to start the dehydration process. The advantage of these models is that they do not require maintenance for 20 years or more and can also be built into a house or larger structures, such as schools.[19]

(iv) Top structures and lining

Where communities are not prepared to deal with the logistics associated with the above solutions, VIPs should be designed so that they

Figure 6.7 Different dry sanitation systems

are easily moved once the pits are full, or should be lined to allow for them to be emptied when full

Some of the most striking approaches now being adopted include:

- **The Archloo**[20]

  The Archloo was developed in South Africa by Dr Peter Glover and others. Rather than being patented, it was placed in the public domain for the public good, on the proviso that any improvements related to the Archloo also be placed in the public domain. The Archloo makes use of material that can be sourced at any rural hardware supplier, and can be constructed by relatively unskilled labour, using the same building skills as for traditional mud structures. It is generally regarded as the lowest cost VIP solution; however, it does require careful quality control during the construction process. Constructed using temporary wooden frames, hessian cloth, cement slurry and three layers of cement mortar, it is easily constructed by communities who are au fait with plastering. The materials, comprising timber forms, bags of cement, sand and water, door frame, door and vent pipe, are easily transported to site. The oval pit, ring beam, arched pit cover and pedestal are constructed using the same materials as the superstructure. The unique arch-catenary shape forms the complete structure, which is structurally efficient, and there is no need to construct and maintain roof elements. The Archloo has proven very popular, particularly in rural areas, owing to its cool and spaceous interior and robust structure that can withstand damage from large animals and adverse weather conditions.

- **The concrete C-section**

  The concrete C-section was developed by SBA, in conjunction with Inkanyezi Rural Developments and the Ugu District Municipality. It originally consisted of four precast concrete culvert-like sections, stacked one above the other to form the walls. A door, roof, pedestal, vent pipe and toilet roll holder are fitted to the precast components to complete the latrine. The slab covering the pit is also precast. This modular design allows for efficient handling and transportation of components over difficult terrain and, when the pit is full, it facilitates easy reassembly of the latrine over a new pit. Experience has shown that even using four sections is rather cumbersome so the Mark 3 version is now being constructed using eight precast C-sections.[21] Of interest

Figure 6.8 Ugu community workers in the precast yard

in this project is the fact that communities also man the precast yards in which the components are manufactured. (See Figure 6.8.)

(v) Wedged blocks as liners

In areas where pits require lining, the construction process is tedious and at times dangerous. The lining of a pit with wedge-shaped blocks arranged in a circular layout has been imported from Mozambique. The blocks form a strong arch, and neither mortar nor brick force is required to hold them together. The pit is lined by putting the blocks in place, and backfilling and compacting the soil behind as one proceeds resulting in a much shorter time in the pit.[22]

(vi) Create a new pit only

Millions of existing VIPs are not portable and when full must be abandoned for a newly built VIP. A suggestion has been made that it should be permissible to dig a new pit and pump the contents of the old pit into the new pit, thereby obviating the need for a new VIP or for moving the top structure and slab. This option would require a change in legislation on the flow of raw sewage.

(vii) No one-size-fits-all

There is clearly no 'one-size-fits-all' solution for dry on-site sanitation. Factors that must be borne in mind include the following:

- Density of houses in settlements
- Ground conditions, including presence of high groundwater table, rock, soil condition and locality of water sources
- Topography and ease of access
- Availability of locally sourced materials
- Customs and hygiene practices of the community
- Local building skills

Clearly there are many solutions to the rural sanitation challenge. Over and above the factors outlined, the acid test in assessing these solutions is job creation opportunities in the construction phase and the choice of design and materials for long-term sustainability. Having ploughed 15 hard years into catching up on the backlog, South Africa cannot afford the repeat the financial outlay associated with inadequate solutions.

(b) Wet sanitation

The dream is for all to be connected to full water-borne sanitation. However this option is the most demanding on the environment in terms of water consumption and pollution at the end of the process.

There are many reasons why water-borne sanitation is not possible in many places, including lack of water supply in dry areas, logistics in terms of scattered settlements, and affordability. A range of solutions have evolved, as follows:

(i) Pour-flush systems[23]

Being one of the group of so-called LOFLOS,[24] these may be used as inside solutions where there is no running water. Water or wastewater may be carried to the latrine to flush. Pour-flush systems are connected to a pan fitted into the floor, which allows the effluent to drain into the sub-soil. Pour-flush systems are not widely used in South

Africa because they fail rapidly if soil conditions are inappropriate and if they are not cleared regularly.

(ii) The aqua-privy[25]

This is similar to the pour-flush solution but the liquids drain into a soakaway. The aqua-privvy suffers similar limitations to pour-flush systems and is not widely used.

(iii) Conservancy tanks

This is a nice clean solution but it is increasingly challenged with operational limitations since it relies on the availability of a municipal or private service provider to clear the tanks regularly. Accessibility is also an issue. This appears to be the standard solution for many new schools, several of which are not accessible, which means that it will only be a short-term solution.

(iv) Condominial sewerage systems

The South Americans (Brazil and El Salvador) pioneered simplified sewerage systems or condominial sewerage systems in the early 1980s. In South African terms this can be described as a community-owned, shared sewer. The sewer running between the houses is constructed and owned by the users who also maintain and operate it.

Used successfully in Durban and Johannesburg,[26] each system can serve up to 1 000 people. As pipes are shorter[27] and run between households, they can be shallower and of smaller diameter. Consequently the system costs about 50% less than a conventional network. In addition, it requires less water.

This approach requires lower design standards than are currently called for by South African local authorities, which means that standards and by-laws will need to be modified per municipality to accommodate its implementation.

(v) Water-borne sanitation

When negotiating with communities, it is essential to ensure that there is an adequate supply of water and an understanding of the incredibly high cost of the overall solution. The current MIG allocation is R9 000 per household for areas where there is no existing sewerage treatment plant and the water supply must be upgraded. However, recent estimates, which consider augmented water supply, purification, distribution and treatment, suggest that the overall cost is closer to R40 000 per household! Either the MIG allocation needs to be increased radically, or a review of the frequency with which water-borne solutions are adopted in outlying areas is required.

Success story – sanitation rolled out in Ugu

In the UGU DM some 500 000 residents still require access to sanitation. An ambitious programme to roll out 80 000 VIPs was initiated with the assistance of one of the ENERGYS engineers. Five thousand five hundred VIPs were constructed in the first seven months. Quality control, the monitoring of progress and the logging of final structures were managed by ENERGYS students.

A horrific 'before' model

Construction of a C-section precast VIP

Completed new C-section precast VIP

Five per cent of the budget was spent on larger units for the disabled

(vi) Septic tanks and soakaways

Septic tanks and soakaways offer an in-house, full-flush solution. They are similar to conservancy tanks in that they discharge into an underground chamber. The difference is that the tank into which the effluent is discharged is designed to support an anaerobic biological process to enable breakdown of the organic load in the effluent prior to the supernatent liquid being discharged into the subsoil drainage/soakaway system. In addition, the sludge is cleared from time to time.

(c) Who is responsible?

In persuading the community to adopt any solution it is also important to educate them on the cost of using the facility. The user's responsibility for clearing or moving VIPs, handling the waste products from UDs or dealing with blocked sewer pipes within an erf receiving a water-borne service all need to be understood.

(d) Long-term solutions

At the International Dry Toilet Conference held in 2006,[28] all present were challenged to find more sophisticated and acceptable dry latrine solutions. With 2,6 billion people worldwide still requiring access to basic sanitation, water-borne solutions cannot be considered across the board. Although the view at present is that the water closet is the best option, if we accept that,

> *… the problem is solved … it would be the first time in history having something really finalised … new attractive ecological sanitation systems are needed as well as incentive systems for research and entrepreneurs …*

6.3.2 Sewage disposal

There are basically four types of wastewater treatment:

- Settlement, bio-filtration of supernatent and digestion of sludge
- Activated sludge process (ASP)
- Anaerobic digestion
- Waste stabilisation ponds (WSP) (including the PETRO system (pond enhanced treatment and operation))

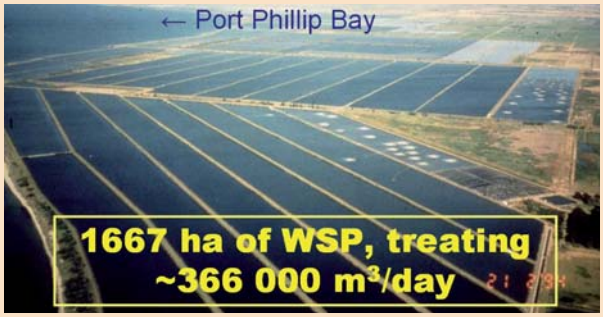
ASP plants meet the DWAF effluent compliance criteria more easily than other technologies but are the most expensive to operate. The WSP on the other hand is the cheapest to construct and the simplest and cheapest system to operate and maintain. In a recent response to the detailed MIG guidelines being developed, one of the ENERGYS engineers responded with his down-to-earth view on the practicalities of ponds saying:

> *The South Africans and Australians developed ponds as economic methods of human waste disposal. They work using a combination of enzyme, oxidation and photosynthesis to break down the solid portion of the waste, a paltry 8% of the whole. The fact is that all you need is a well-directed dozer for a few days to dig out some ponds for a community of 5 000 souls. No concrete, no machines, no smelly raking. Just dump the whole raw lot into the primary ponds. [This pioneering research was done at the CSIR by Drewes* et al circa *1968.]*

> *You can pick up the final effluent for irrigation or recycle. O&M consists of temporarily drying out the primary pond for three weeks every 15 years or so, and you can sell the sludge cake for fertiliser.*

Waste stabilisation ponds in Melbourne, Australia process 366 Ml/d

As the methods of harnessing waste stabilisation ponds have improved, so have their sizes. From Kenya to Columbia sizes have continued to increase, but the Australians have redefined the science with a series of ponds covering 1 667 ha and treating 366 Ml/d. The process consists of primary treatment for screening and grit removal followed by a series of anaerobic ponds, then a facultative pond, ending with maturation ponds. Quality control is critical to protect the beaches in neighbouring Port Phillip Bay.



You can imagine the cost difference between a few days with a dozer and the vastly complicated conventional sewage treatment works.

(a) Larger waste stabilisation ponds

With this approach in mind, treatment should not be a challenge anywhere. In South Africa however, there is currently a pond size limit of 2 Ml/day. Thus this solution can only be used for smaller communities. As it is considerably cheaper than other types of works to construct and requires less energy and capacity to operate and maintain, the limit should be reviewed for new projects. In Australia, pond sizes have reached 1 667 ha, treating 366 Ml/day, and continue to grow. (See inset.)

(b) PETRO® system

New, more stringent effluent regulations may however find some WSPs wanting. The technique of introducing secondary ponds or forcing aeration was also pioneered in South Africa and is known as the PETRO system. Existing treatment works can be expanded to incorporate these processes to ensure compliance.

The system is highly suitable for phased development in cases where temporary financial problems and issues of capacity building preclude immediate application of the system. Upgrading or green-field construction can be staged at the rate of the availability of resources.

PETRO is appropriate technology suitable for a sophisticated modern city, while still applicable for a small developing community with acute capacity building problems. It is safe to state that in terms of total treatment costs the system can be responsible for savings of up to 30% in comparison with conventional waste water treatment systems.[29]

Figure 6.9 Reed-bed – Letaba rest camp, Kruger National Park

(c) Reed-beds

We have lamented the fact that bulk solutions are often not considered, are inadequate or may be too expensive for small communities. Reed-bed systems, a purification system that harnesses natural vegetation to process raw effluent, are ideal for communities in rural areas, nature reserves, private lodges, etc where the availability of

Figure 6.10 Reed-bed for nutrient removal and final polishing – Punda Maria rest camp, Kruger National Park

electrical energy is a problem. Figure 6.9 shows one of the reed-beds in the Kruger National Park.

These systems are energy-friendly as well as environment-friendly since nature is harnessed to purify the effluent. It is a solution for water-borne sewage processing that could be utilised at a farm house, a school, a police station or in a town or village in a rural area. Any number of households can be served.

The reed-bed can also be used as the final process for enhancing effluent quality from traditional ponds, as can be seen in Figure 6.10.

The effluent from the reed-bed can be utilised to irrigate vegetable gardens or lawns. Reed-beds are used all over the world, most notably along the Nile, on Rhodes Island, in Thailand, in South Africa (particularly by South African National Parks) and in other African countries.

With careful selection of the aquatic plants effluent qualities complying with DWAF standards can easily be achieved. Specific reeds that can be used for basket weaving or making hand-made paper have been effectively used in a Cape Town system.[30]

(d) Package plants

Small towns and villages are often too far to link into water supply or sewerage networks associated with major towns and cities and in other cases existing facilities are over-extended leaving no reserve capacity for outlying villages and settlements.

Package plants are small, prefabricated, treatment plants that can easily be erected and connected without any of the long-term planning and construction associated with major treatment plants. The concept of package plants for both water treatment and waste treatment became popular during the 1990s, when NGOs were particularly active in supporting government in their drive to address the tremendous backlogs. Package plants were installed widely and can be seen alongside rivers in most rural areas. There are many good proprietary package plant solutions available, including:

- Rotary disc biofilters
- Trickling biofilters
- Activated sludge systems

Package plants can be utilised very effectively to purify effluent for recycling close to the source rather than allowing it to flow out of the water system, which can be of great benefit to communities.

Another benefit is that package plants can be installed at strategic points in a system, thereby reducing organic loading into the larger works, or they can be used to provide purification solutions in areas that would otherwise require pumping to remove sewage.

(e) Design considerations

In designing treatment works it is essential to consider waste emanating from all solutions, including the content of VIP pits, waste from UDs, conservancy tanks, etc.

In selecting the treatment consideration must be given to carting waste over long distances to a large treatment works or to constructing local pond systems.

To gain maximum benefit from gravity, treatment works are usually situated in low-lying areas that follow the riverine routes. However, this is often also where informal settlements establish themselves as these areas are generally undeveloped. Municipalities must plan their next treatment works over a 25-year horizon, and must acquire the required land and create settlement buffers around the chosen sites to allow for future development.

6.3.3 Effluent treatment and quality

Inadequate treatment of effluent poses serious health risks to those reliant on the downstream water since diarrhoea, cholera, hepatitis and typhoid are life threatening for many who contract them.

However, as with water quality, there is currently little pressure on municipalities to comply with the standards set by DWAF. As long as there is no pressure for compliance, municipalities will not invest in adequate control of their plants. The CFO is sensitive to pressure from of the PFMA and MFMA. The MM and CFO should similarly be obligated to ensure compliance on effluent and water quality issues.

The current standards are to be found on <http://www.wqms.co.za/reference?st=1&mi=5>.

Tertiary training in rural sanitation benefits communities

Seetella and Martha Makhetha, a Lesotho-born couple, are both civil engineers. They met and fell in love whilst studying civil engineering in India. Studying in a developing county offered them an insight into alternative solutions at a time when engineers in South Africa thought only of water-borne networks. Subsequent studies, for Seetella in water and waste engineering for developing countries (WEDC), in the UK, and for Martha in project management for developing areas, at Wits, consolidated their devotion to engineering solutions for developing countries. Delivering affordable, sustainable rural sanitation has become their life's work and they are well known in KwaZulu-Natal and Eastern Cape communities for delivering a number of successful projects using builders trained from the community and no outside contractors at all. The delivery was so successful that in 2003 their company alone produced 27% of all of the rural toilets constructed under DWAF's community sanitation programme.

Setella and Martha with proud owners

Setella and Martha on site

On the flip side, South Africa is one of only three countries in the world that chlorinate final sewage-treated effluent before discharging it into a water course. This, according to EU thinking, causes harm to the environment and excessive free chlorine could pose health risks. It is perhaps time to reconsider current worldwide thinking to determine appropriate standards to enforce for the future.

Furthermore, in many cases, instead of discharging the effluent into the nearest stream, it could rather be harnessed for watering street trees, parks, sports fields, verges, islands and the likes.

6.3.4 Teaching

In his very outspoken paper, Fedler[31] challenges the tertiary approach to education expressing it as 12th century teaching for 21st century living! Indeed, of great concern in terms of future progressive solutions are the approaches adopted in most tertiary institutions, which convey technology ideas that are out of date and often very conservative.

It is interesting to note that the more innovative solutions that have been implemented in South Africa, have been conceived by some of our engineers who were trained overseas where courses included alternative sanitation solutions for the developing world. (See inset on p 271.)

6.3.5 Research

Access to sanitation presents the largest of the MDG backlogs. Clearly there is a long way to go to address solutions that are acceptable, affordable and environmentally friendly.

Whilst the above section has presented many innovative approaches to sanitation, significant investment in research is required towards developing improved solutions to one of the biggest challenges facing the civil engineering profession.

Figure 6.11 Congestion on the Ben Schoeman highway

Source: *Civil Engineering*, September 2007

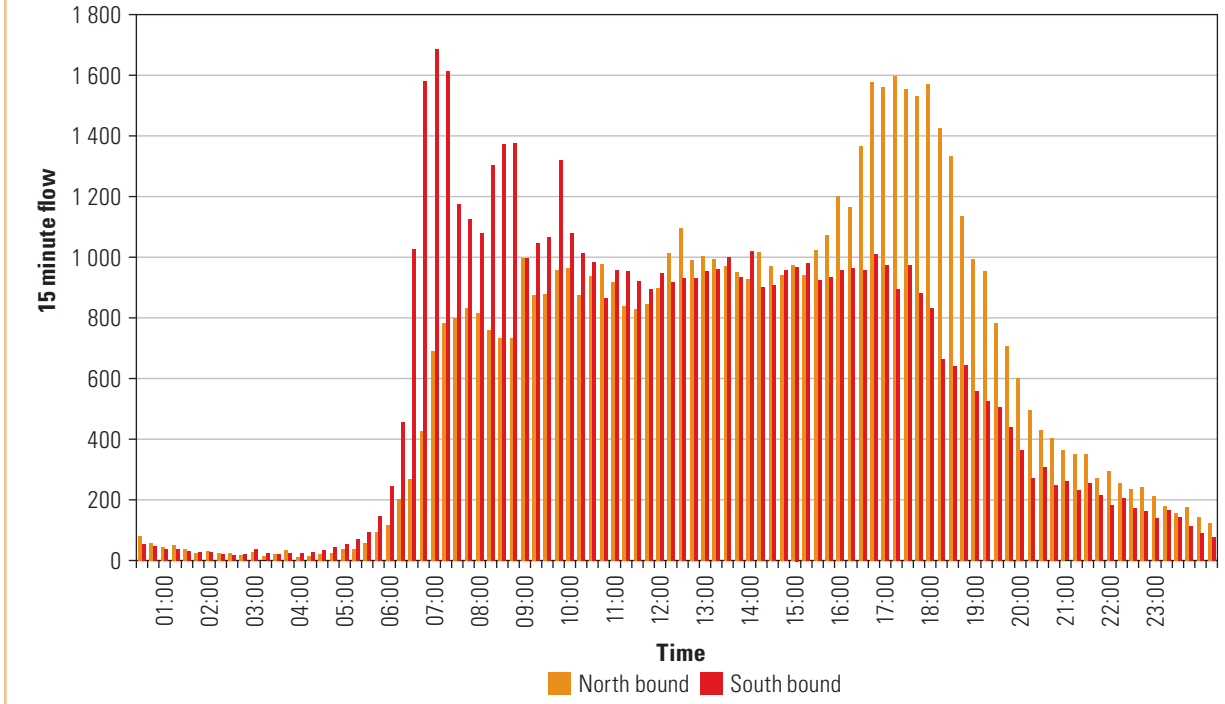
6.4 ROADS AND TRANSPORT

As shown in Chapter 5, accessibility is the backbone of both economic and social development. Barriers to movement cost the economy and citizens billions per annum.

A range of solutions is urgently needed. Public transport alone will not solve the problem nor will new roads or rail if built in isolation. In addition to planning new and upgrading existing roads, there is a range of solutions that municipalities can embark on to address access.

6.4.1 The bottleneck factor

Much has been written about congestion and the growing volume of traffic on our roads. The gridlock on the Ben Schoeman highway (see Figure 6.11) is replicated nationwide.



Source: *Demand and revenue forecast*

Figure 6.12 Traffic count on the N1 at New Road on Tuesday, 3 October 2000

However, analysis of the problems in many areas shows that there are simple solutions that would offer some relief, including:

- Implementing the *Draft national guidelines for road access management in South Africa*. This would address mobility by ensuring that roads are free of unnecessary and unwarranted robots at every development
- Replacing robots with roundabouts and four-way stops with mini circles or yields as dictated by traffic flow
- Synchronising robots
- Making robots more reliable and repairing them quickly
- Introducing slip arrows or even yields for all left turns
- Adjusting robot cycle timing
- Introducing additional phases at peak periods if detailed analysis indicates such a need
- Adjusting the layout of lanes
- Expropriating splays from properties at points of constriction to widen the road
- Ensuring that pointsmen are on duty at peak hour when robots have failed

It appears that few (if any) vehicle counts have been done for a long time. Bottlenecks associated with most of the above points could have been prevented had teams of young professionals, traffic engineers and transport planners been retained to monitor and manage traffic flow. Modest budgets would be required for these activities. Additional activities that will require more investment, but that clearly need attention are listed below:

- Expanding the carrying capacity on major routes or across freeway interchanges by providing a second bridge crossing
- Providing additional bridges or subways across major routes or freeways without ramps to reduce pressure on interchanges

Success story – gravel road upgraded in Randfontein

In Randfontein 10 km of dirt roads were converted into gravel-stabilised 'highways' by applying the latest technology in the use of polymer and emulsion agents to the gravel and compacting the material to the specification. This formed part of a research programme for Gautrans and the Johannesburg Roads Agency (JRA) and afforded ENERGYS students opportunity in material testing procedures, doing the tests in the laboratory, and being involved in contract administration.

Road before treatment

Stabiliser being applied

The completed road

Students and graduate inspect their handiwork

- Implementing intelligent transport systems (ITS) to improve the provision of public information and speed up incident detection
- Constructing additional roads

Researching past traffic statistics and flows on the Ben Schoeman highway in the year 2000, it was found that traffic was increasing at 7% per annum. The Ben Schoeman was rapidly reaching its carrying capacity for much of the day.[32] (See Figure 6.12.) Congestion on the Ben Schoeman at the time was costing over R300 million per annum and accidents in Gauteng were costing in excess of R4 billion.[33] Armed with this information alternative solutions were sought and the idea of the Gautrain was born.

Whilst such a solution may not be appropriate elsewhere, alternative solutions to address congestion are critical as some 1 500 to 2 000 new cars are coming onto South Africa's roads every working day.[34]

A seasoned traffic engineer explains that:

> *Traffic congestion grows exponentially after about 90% of capacity is reached. For each 1% increase, the journey time increases by 10%. As a rule of thumb, when demand equals capacity, the saving in vehicle operating costs, fuel and time will pay for a duplicate facility in one year. So vehicle operating costs in a six-lane freeway at capacity will pay for another billion rand six-lane freeway in one year.*

Based on estimates from various sources,[35] the cost of congestion nationwide appears to have climbed to a staggering R3 billion to R4 billion.

Congestion costs include the cost of wasted fuel and time,[36] but do not include the associated increased pollution and collisions, which are environmentally problematic, traumatic and costly. Thus, considering the longer-term implication of such an impact, it is perhaps time for National Treasury and the Department of Transport (DOT) to consider making a grant available specifically for the reduction of congestion in local government, over and above the investments that DOT and the South African National Roads Association Ltd (SANRAL) are making in the national road network. But this must be conditional to harnessing experienced traffic engineers!

6.4.2 Road maintenance

The problems related to inadequate design and little or no maintenance have been outlined. However, there are now many innovative, human-friendly solutions for which local labour can be harnessed, either using lower-cost and easier-to-apply materials or innovative small devices specifically designed to expand the scope of work that can be handled by local labour.

(a) Equipment to support the Expanded Public Works Programme

Hand-operated equipment has raised labour-intensive methods above back-breaking procedures. For instance, using a hand-operated chip spreader, labour-based methods allow quality results in repairs and maintenance as well as the surfacing of new roads, equivalent to that of machine-based methods, with no cost premium.

If every municipality in the country sets up one small road surfacing team, more than 6 000 permanent jobs and many more temporary jobs can be created and the roads would be in better condition! (See Figure 6.13.)[37]

(b) Bitumen binders or stabilisers

An interesting development in addressing routine maintenance and the continual replacement of gravel lost by erosion and traffic on South Africa's unsealed gravel roads has been the use of bitumen emulsions as stabilisers.

Bitumen emulsion, made from recycled granular plastic, is added in small quantities to stabilise in-situ gravels and soils, thereby obviating the need to open borrowpits. Bitumen-stabilised gravel roads require less annual maintenance and have a longer design life than untreated gravel roads.[38]

Bitumen stabilisation reduces cracking, improves compaction, reduces construction time, can be used with labour-based methods and is ideal for use in Expanded Public Works Programme (EPWP) projects.

This technique can also be used for upgrading gravel streets to paved streets.[39]

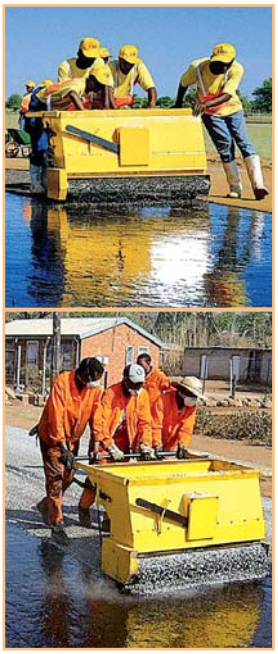


Figure 6.13 EPWP teams in action using 'Chippy'

Figure 6.14 So proud – a recipient of a bicycle under the Shova Kalula project

6.4.3 Transport

In 1998, *Moving South Africa* recognised that lack of affordable basic access left some 2,8 million urban passengers stranded. In addition, in rural areas, distances travelled on foot were extremely long. Behrens[40] in 2002 estimated that 36% of all trips in South Africa were made on foot.

(a) Shova Kalula

To improve mobility and reduce distances walked to less than 1 km, Shova Kalula (or Pedal Easy) was launched in 2001. This programme is aimed at improving the mobility of South Africans through promoting bicycles as a mode of transport.[41] It comprises low-cost, new and used bicycles and a delivery chain that includes container-based shops, a cycle repair training course and light engineering modifications to produce load-carrying work-cycles. It also incorporates a scholar programme and a women's training programme.

Cities[42] have been challenged to develop cycling master plans in answer to the Velo Mondial Conference call in Amsterdam to increase the use of bicycles as a recognised means of improving mobility and addressing congestion.

The South African challenge in this regard is targeted at some 445 000 primary and 350 000 secondary school learners who walk more than 3 km and at an estimated 573 000 urban and 472 000 rural workers who are currently walking more than 20 minutes per day to get to work.[43]

The programme has already improved the lives of people in Witpoort and Bakenberg in Limpopo, Muden and Izingolweni in KwaZulu-Natal, and in many of the flat towns in the Free State and North West. The proud user of the bicycle in Figure 6.14 illustrates the result. Cycle track upgrades have been planned in several centres and can be funded using the Neighbourhood Development Partnership Grant (see 6.8.11(c)).

So important is the improvement of accessibility and mobility that Phase 1 of the Public Transport Action Plan (2007–2010)[44] has as the second of three outputs, the goal of:

> … *mainstreaming of non-motorised and other low-technology transport solutions* …

Success story – footpath from Keurtjieskloof

The people of Keurtjieskloof had a long, steep and winding road to follow to walk to Van der Kloof, the nearest town where employment opportunities, health, education, commercial and retail facilities are to be found. After consultation with the community, it was decided to develop a foot path around the mountain. The foot path would largely follow mountain contours and would not only shorten the journey distance and make the route considerably flatter but would also remove pedestrians from the steep road, which had limited sight distance and narrow shoulders, and so make the journey much safer.

Rough terrain

Staking out the route

A footpath in the making

(b) Taxis and taxi ranks

Public transport has been hailed as the solution to congestion and an essential part of the holistic solution. Curiously, in South Africa public transport has been provided by the private sector in the form of the taxi industry. Availability and pricing is generally excellent. The problem is that this public transport has simply not been accommodated. Taxis have inadequate roads to ride on and nowhere to stop, hence taxi drivers resort to desperate measures to drop passengers and reach their destinations in time! Many cities in the world have dedicated bus lanes in peak hours and bus stops are the accepted points for collecting and discharging passengers. For many years little or no such facilities were considered for this new, private-sector entrepreneurial solution to public transport.

Source: City of uMhlatuze

Figure 6.15 An elevated walkway for a KwaZulu-Natal community

Ranks that service industrial areas and shopping centres should be planned inside these facilities to remove congestion from the surrounding roads. Traffic studies are essential to understand the flows in peak-hour traffic and plan for dedicated lanes or diversions. An increased number of lay-byes is essential. In towns that did make provision for taxis in the fledgling days of the industry, motorists and taxis coexist harmoniously!

(c) Walkways

Separation of communities in the past plus the unregulated concentration of housing in rural areas have given birth to informal suburbs that require residents to follow long and difficult paths to access social services, such as clinics, schools and pension pay points. In many instances these communities are also separated by rivers, streams or erosion gullies – all of which make movement difficult.

Many municipalities are now busy constructing walkways through difficult terrain. Figure 6.15 shows a typical solution for directly connecting two villages by bridging a marsh. The benefits of this type of connectivity are numerous, including:

- Reduced distances
- Flatter grades
- Elimination of walking through wet, perhaps insect-infested, unhealthy conditions
- Elimination of crossing standing or moving water with the associated risk of hippo and crocodile attack
- Reduced exposure to dangerous traffic that occurs when communities have no choice other than to walk on major through routes, often without adequate shoulders or walkways.

6.5 SOLID WASTE AND CLEANSING

Waste management comprises the collection, transport, processing, recycling or disposal of waste materials. The first step in managing waste is waste avoidance or minimisation, as indicated in Figure 6.16.

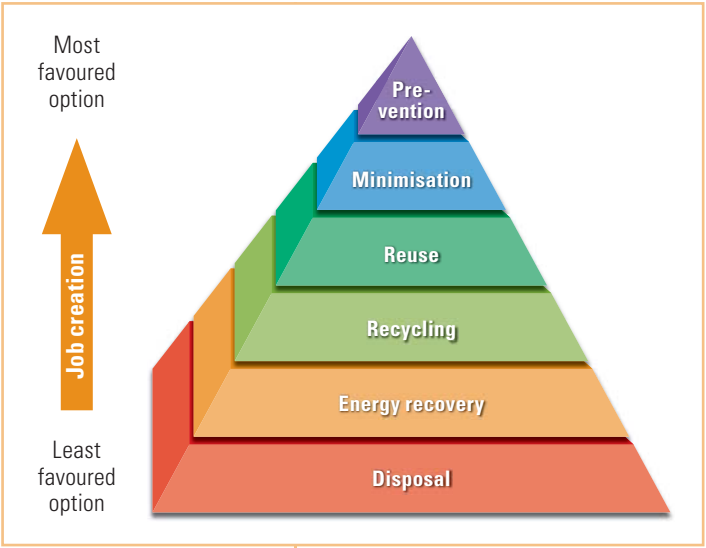


Figure 6.16 Waste management

The traditional approach is to rely on local government to manage non-hazardous residential and institutional waste, and the actual generators to manage their hazardous commercial and industrial waste. However, all waste is potentially valuable and should be isolated and recycled to the obvious benefit of the environment and those involved in such operations.

6.5.1 Landfill sites

Solid waste is associated with landfill sites, that is land allocated for the purpose of burying waste. This is currently erroneously considered to be the most convenient and cheapest way of handling waste and takes care of 95% of waste generated in South Africa.

Solid waste disposal and collection usually makes up a large slice of a municipality's budget[45] and it is important that 'the polluter pays'. Hence householders and companies need to be charged for this municipal service. A useful pamphlet has been prepared by the Institute of Waste Management of South Africa (IWMSA) to educate communities in this regard.[46]

Charges should also be made for specific deliveries, such as building rubble, garden refuse, etc. Pikitup in Johannesburg has instituted a sophisticated, yet simple method of logging such deliveries, which ensures that accurate accounts are sent to the appropriate 'polluters'. Similar such systems should be considered in other large municipalities.

Garden refuse however occupies a significant volume of landfill sites, which does not make sense as garden refuse is largely organic material and can either be used as a renewable energy source (tree stumps and branches) or converted into compost or mulch.[47] Alternative processes for handling refuse and recycling a significant portion of the material are discussed in 6.5.2 to 6.5.4 below.

6.5.2 Bioreactors[48]

Bioreactors offer a new approach to landfill design and operation and have been suggested as alternative solutions for small communities. Bioreactors are designed to quickly transform and degrade organic waste. The increase in waste degradation and stabilisation is accomplished through the addition of liquid and, in some cases, air to enhance microbial processes.

A unique patented system being introduced in South Africa uses sludge from sewage treatment works, combined with solid waste, to generate electricity.[49] Known as the Hydra system, it holds the benefits of not only generating electricity, but reducing volumes on both solid waste and treatment works sites.

6.5.3 Recycling and waste minimisation

Collecting and recycling waste is not a new concept. In Britain the rag-and-bone man was a well-known figure in the neighbourhood.[50] He would travel the streets with a horse-drawn cart, collecting old rags (for converting into fabric and paper), bones (for making glue), scrap iron and anything useful the public wished to discard, trading them for other

items or cash. A British sitcom captured the lifestyle of two rag-and-bone men, Steptoe and Son, and their schemes to eke out a living. So colourful were they that the programme became regular viewing in the 1960s and 1970s.[51, 52] (See Figure 6.17.)

Figure 6.17 The most famous rag-and-bone men – Steptoe & Son

The rag-and-bone man model died away once busy road networks made door-to-door visits impractical and when changes in technology introduced many disposable alternatives to earlier products. The use of plastic, in particular, and light-weight cans made a significant difference to the volume of valuable waste available for collection at the time. However, it has now been realised that those new materials are also valuable and must be recycled.

Thus it is time to support a new breed of rag-and-bone men – perhaps this time around they should be called packaging-and-parts collectors!

It is of such importance that waste is minimised that environmental departments and organisations are campaigning long and hard. Cities Environment Reports on the Internet (CEROI) is one such organisation. Member cities have each applied their minds to the problem and have developed their 'Make a Difference' lists. For more information, visit the CEROI site.[53]

What is abundantly clear is that it is important for municipalities to make land available for recycling projects. Overstrand Municipality has been successful at establishing recycling at source with its residents.[54] In addition, informal recycling at the transfer station yields about 50 t per month, which offers income to involved members of the local community.[55] To accommodate this, the municipality provided a level working area, proper drainage and litter control measures.

In 2005, South Africa produced 20 Mt of domestic waste. In some cities, the quantity of municipal solid waste (MSW) to be disposed is nearing a daily average of 2 kg/person, which is three to four times that in many European cities.

Today's methods of marketing have greatly increased the load on the environment in that packaging is one of the biggest contributors to the volume of waste that must be handled. Elsewhere in the world elaborate separation and collection arrangements exist to ensure that items such as:

- Cans
- Paper and cardboard
- Glass
- Plastics and polystyrene (which constitute 73% of solid waste)[56]

all with intrinsic value, do not end up on municipal waste sites, but are recycled.

Other commodities that can be recycled and that consume considerable space or are harmful when dumped, include:

- Batteries
- Used oil
- Tyres
- Electronic equipment

Whilst many still consider that waste can be dumped with little control in our wide open spaces, this is extremely short sighted since uncontrolled dumping not only harms the environment but represents a significant loss in terms of potential to earn. Efforts must be made to support job creation through more responsible handling of waste.

We need to consider waste as a resource, not as redundant rubbish[57]

We need to consider waste as a resource, not as redundant rubbish

Source: *Sawabona*, May 2007

Figure 6.18 Something from nothing – creative articles made from recycled materials

Possibly the best-known recycling initiative is Collect-A-Can. More than 37 000 collectors are collecting cans, an estimated 82% of whom would otherwise be unemployed. These collectors are however not employed by Collect-A-Can but by entrepreneurs, both small and large. Some collectors who run small business enterprises earn as much as R30 000 per month from Collect-a-Can, and in turn create jobs. As many as 65 people may work for one recovery enterprise.

A Hermanus company has developed a process that makes plastic wood from recycled plastic bags and sawdust. Products made from the plastic wood include baboon-proof public litter bins, outdoor furniture and boardwalks.[58]

Tyre recycling is another challenge. However, processes have been developed for converting used tyres into valuable commodities, including rubber feedstock, oil, carbon, activated carbon, stabilisers, and jet and diesel fuel.[59] Tyres are also being used successfully to construct retaining walls in areas that exhibit extensive soil erosion. Bitumen rubber is being used in road surfaces, creating the so called 'whisper course'. Further tips and successes for municipalities to consider are showcased on the Tyre Recycling Success website.[60]

Sawubona magazine was recently involved in encouraging recycling and developing business opportunities in this field. The April 2007 edition showcased the very creative work produced by a Section 21 company using recycled material (see Figure 6.18).

Yet other elements for which the public require help with disposal are scrap vehicles and irreparable devices, such as fridges, washing machines and computers. This is another business opportunity to be encouraged and for which specific disposal mechanisms need to be set up.

The Recycling Forum offers ideas on a range of such small business opportunities.[61]

Clearly, attentive management of recycling will afford municipalities the opportunity to support job creation, help the environment by reducing contamination of surface and groundwater, and reduce the load on waste sites.

6.5.4 Street cleansing and litter picking

Another job creation opportunity in local government is street cleansing and litter picking. Many cities have been extremely successful with the development of SMMEs in this field. For instance, in the Nelson Mandela Metro, approximately 3 000 temporary jobs are created each year including those related to the ongoing development of public open spaces. More than 1 000 permanent jobs were created by SMMEs appointed to perform cleansing functions in the period 2000 to 2005.[62, 63] Litter picking holds the added benefit of keeping litter from washing into stormwater and sewage pipes and thus preventing blockages and overflows.

For more ideas on the management and business opportunities associated with solid waste visit <**http://www.iwmsa.co.za/**>.

Major centres the world over are committed to recycling. Minneapolis has even established depots and shops where second-hand building materials **must** to be delivered for re-use.

The sooner South Africa introduces and enforces systematic recycling the better. Whilst it may be more costly than doing nothing, this view is particularly short sighted in the face of reducing resources and pollution. Just as targeted procurement and other interventions to force change are costing more than the neutral state, recycling is key. With improved education and enforcement we should no longer see abandoned broken bottles, tins and packets littering pavements, beaches, motorways, water courses or the countryside. Every handful of waste has value and if collected will further reduce the costs associated with cleaning and clearing.

6.6 ENERGY

Although energy is not the responsibility of the civil engineering practitioner, many technical services directors are in fact civil engineering professionals. Applying their minds beyond civil engineering infrastructure has resulted in their coming up with several innovative ideas, some of which will be shared below.

Of importance today is renewable energy, to address challenges related to the increasing cost of oil and natural gas, greenhouse gas emissions and the difficulty in servicing sparsely populated, scattered rural communities.

6.6.1 Wind-powered electricity

What could be more effective than harnessing wind as an energy source? In South Africa we are quite familiar with making the wind work for us in terms of the iconic windmills that we see as we travel through the countryside.

Addressing the need to develop renewable energy solutions, wind farms offer a new form of energy to remote communities for whom traditional electricity supply has not been possible.

Turbines rotating in the wind produce electricity as long as the wind speed is above 19 km per hour and increase their output as speeds increase to 56 km per hour (thereafter output does not increase).

Pioneered in Texas,[64] the solution offered new life to ailing communities that needed to attract new industries as a result of the drop in oil production.

Wind farms are now also being constructed in South Africa, one of the most notable being Klipheuwel in the Western Cape (see Figure 6.19).[65] It has a total capacity of 3,2 MW. The turbines are auto-controlled and auto-dispatching, making it unnecessary to have full-time staff on site. The turbines commence generation at winds of 11 km/h and reach full power at winds of 50 km/h.

Small turbines for home use are also becoming available and could be supplied by municipalities to remote communities where it is impractical to extend the electrical grid. Capable of generating 400 kW per month at wind speeds of around 20 km/h, they were designed in the USA and

Figure 6.19 Klipheuwel wind farm

Source: www.eskom.co.za

Success story – the value of experience dispatched to Ga-Segonyana

The ENERGYS team salutes Oom Theo for the leadership and energy he showed at Ga-Segonyana

Kgalagadi District Municipality serves the remote Northern Cape area with the town of Kuruman as the centre of commerce and industry and the seat of the Ga-Segonyana Local Municipality. Commercial farming is practised to the south and east of Kuruman and the Botswana border. The area consists of underdeveloped rural areas with a predominately indigent population and displaced former defence force families living in 23 villages and towns.

Support was provided by luring one of the oldest of the ENERGYS engineers out of retirement. His story makes interesting reading.

Oom Theo, as he is fondly known, agreed at age 73 to emerge from ten years' retirement, lock up his retirement home in Hermanus, and embark on an expedition into the hot, dry and desolate expanses of Ga-Segonyana. Like Rip van Winkel he awoke to the frightening realities of the disadvantaged living in a deteriorated infrastructural environment. Mustering all his courage and the experience gained from 45 years' service as an engineer, he arrived at Ga-Segonyana to rescue the technical department at the municipality that serves a population of 72 000 people. The technical manager, a young civil engineer, was lost behind a desk with mountains of reports and documents awaiting his response and a backlog of 560 unattended internal tasks.

Oom Theo discovered a number of deficiencies. Management of the 2006/2007 MIG process needed support. Contracts were problematic due to a combination of inappropriate design and limited contract management and supervision. Applying his experience he systematically tackled all the bottlenecks he had identified. MIG spending was taken from 4% in November 2006 to 100% by March 2007. By rolling over certain projects he ensured that MIG allocations for 2007/2008 and 2008/2009 were fully committed, with spending at 60% in September 2007. Referring to himself as '**Your Uncle in the Refurbishment Business**' he managed repairs and refurbishments to the aging waste water treatment plant, replacing 25-year-old pumps in the main sewage pumping station, vastly increasing its capacity and equipping boreholes for more reliable water supply.

He also found that the limited civil engineering capacity of the technical department had led to the implementation of inappropriate infrastructure with a low expectancy of success. After conducting a financial and technical audit of all projects he found it necessary to redesign most projects resulting in significant construction savings plus, more importantly, long-term savings due to reduced O&M costs.

No substitute for experience

This exercise serves to demonstrate that, regardless of the environment and/or institutional conditions, there is no substitute for experience and engineering acumen to ensure integrated development in terms of the IDP, the successful execution of capital projects and sustainable, appropriate service delivery.

The MM was so delighted with the Oom's support, stating in a letter that 'the Municipality applauds' his contribution, that he was prepared to offer him a permanent position. However with both their 75th birthdays looming, as well as their golden wedding anniversary, Oom Theo and Tannie Pauline decided that the whales at Hermanus were missing them after their year-long absence and so it was time to return home.

Canada to connect back to the national grid, in order to sell any excess power generated back to regional energy suppliers. See <http://www.skystreamenergy.com/skystream/>.

6.6.2 Biomass

Biomass, being organic material, can be harnessed to produce energy. In biomass conversion, the organic material is burned directly or is chemically converted to a burnable fuel.

The organic material may be derived from plants grown specifically to produce energy or from waste products for example methane extracted from landfills, agricultural waste, sawmill off-cuts and sludge from sewage treatment.

The Hydra system referred to above (see 6.5.2) is one such system being introduced in South Africa. Eskom has also constructed an alternative generator of energy in the form of the Johannsen Gasifier, which uses wood to generate gas and ultimately electricity. Similarly eThekwini Metro harnesses gas from their landfill sites to generate electricity.

Biofuels are possibly the best-known bioproducts. Internationally, the importance of biofuels is growing owing to higher oil prices coupled with uncertainty over future exchange rates. In South Africa, the state has vowed to support this industry.[66] The Biofuels Draft Strategy aims to achieve a biofuels average market penetration of 4,5 % of the liquid road transport fuels by 2013. In 2006 Cabinet stated that:

> *This will be achieved by using excess crop production and expanding production on underused arable land, particularly that of emerging farmers.*

Biofuels also have the potential to contribute up to 75 % of the country's renewable energy by 2013.

6.6.3 Solar energy

Solar energy has huge potential, as shown in Figure 6.20, and is the fastest growing energy source. However, it still provides less than one per cent of the world's electricity, in part because its power can cost homeowners twice as much as power from the electricity grid.[67] However, new panel designs are becoming more cost effective and it is expected that solar power could become the mainstream energy source within three to four years. Recent reports claim that improved panel designs offering 60 W will become available at R500 to R600.[68, 69]

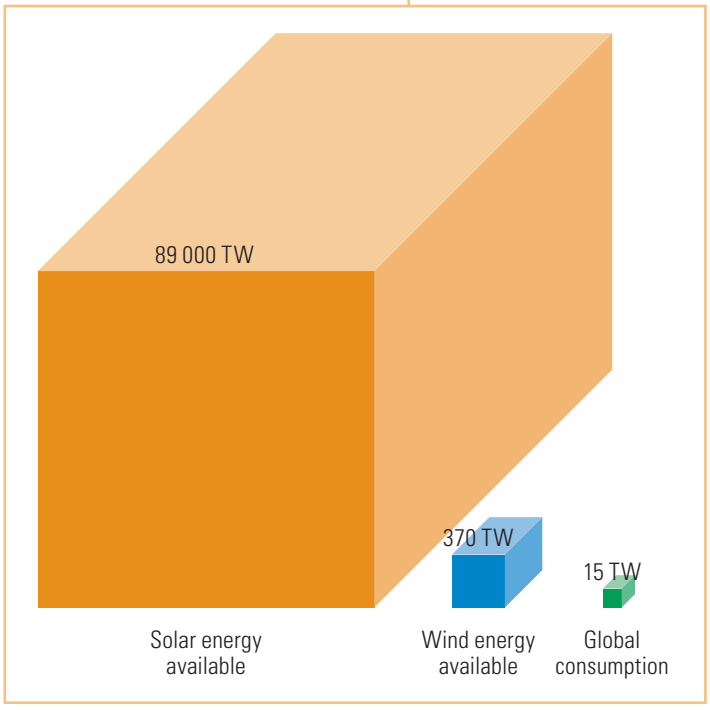
With this in mind, once proven, South Africa should set a time limit for all geysers, for instance, to be powered by solar energy rather than by electricity derived from the grid. Until the cut-off period, all should be encouraged to fit time switches to their geysers to reduce daily energy consumption.

Several NGOs have also devised simple solar devices that can form a basis of small rural businesses for manufacturing and supplying solar lanterns, cooking devices and power for schools, hospitals and community centres. Accessing funds and training through these organisations could offer the help required in the case of remote, scattered communities.[70]

6.6.4 Hydro power

To preserve the ecosystems below dams and provide consumers downstream with the volume of water they require, the National Water

Figure 6.20 Solar and wind potential by comparison with global consumption



Source: <http://www.wikipedia.org/wiki/solar_energy>

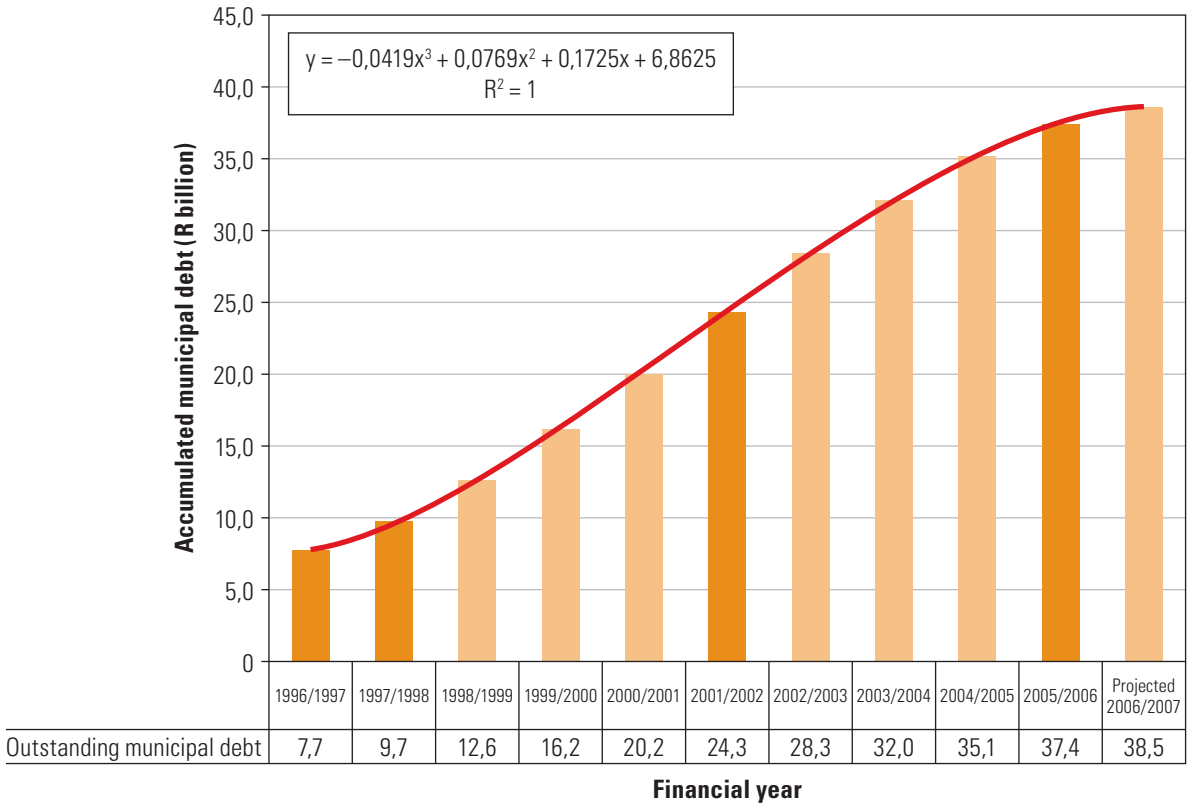


Figure 6.21 Outstanding local government debts, up to 2006

Act, 1998 (Act 36 of 1998) calls for a specific quantity of water to be released from each dam annually as determined by community needs. Harnessing the power of the water being released, small hydro schemes can be developed that will contribute to the energy requirements at each locality.

6.7 LIFE CYCLE COSTING

All too often the lowest price for a project or a capital item is accepted, without considering the life time cost. In their travels, the ENERGYS team have come across abandoned 'yellow machines' in areas where gravel roads are in dire need of grading. On enquiry they found that these machines were selected based on price, but now spares are either not available, or in the case of imported equipment, the price of spares has become prohibitive!

When selecting a solution, it is critical to consider not only the purchase or construction cost, but also the commissioning cost and the annual cost of O&M, including energy consumption, human resources, durability and performance.

These decisions should not be limited to new projects and purchases. Rather, many existing problematic services should be analysed to consider the ongoing cost of the solution. In one municipality it has been decided to replace all existing asbestos cement pipes since they cause the highest losses, require the most repairs and have a knock-on effect in that they require the most road maintenance over the excavations. The savings on O&M that will be achieved with laying new pipes will far exceed the cost of replacing the old pipes. In carrying out such an exercise the life expectancy of new pipes must be researched carefully.

Another municipality has decided to systematically replace all the light bulbs in robots as they fail with more expensive LEDs since the latter consume a seventh of the electricity and only require replacement every five years, as opposed to the present bulbs that last only three months. This represents a huge long-term saving.

However, without detailed logging of faults and associated costs, such motivations would not be possible. Thus, call centres and response crews that report and map faults accurately are key to ensuring optimum operations.

The Ga-Segonyana story (see inset) shows how both a new design and an existing system can be modified to effect a great reduction in O&M and hence life cycle costs.

Other examples include the use of concrete block paving for residential roads. Whilst the initial cost may be 20% to 30% higher than an asphalt surface, the life span is much extended and the cost of maintenance is much reduced. In addition, job creation and the development of skills during construction offer a multiplier effect to the community.[71]

Low-volume concrete roads are also an excellent alternative in certain circumstances and offer lower life cycle costs and a long service life. In Ohio a concrete road constructed in 1891 was still in use 100 years later.[72]

6.8 REVENUE ENHANCEMENT

When statements such as 'money is not a problem' are being bandied about, it is all too easy to go cap-in-hand and ask for more money without any thought and effort to improving municipal financial viability from within.

Many municipalities are reported to be technically bankrupt; the total outstanding debt in local government had grown to a record level of some R37 billion in 2006, as shown in Figure 6.21.

Business principles need to be keenly applied – the two key actions being those of cutting costs and increasing income. One of the easiest and quickest ways to cut costs is to reduce the number of senior staff – an illness which has been comprehensively discussed already.

Whilst this may result in short-term gains, it undermines the sustainability of the organisation in that crucial activities are no longer attended to. Vast sums are being left on the table as major consumers are undercharged for numerous services or are not charged at all, and contraventions are not attracting penalties.

The list of unexplored activities on this front is endless. A few of these will be discussed below and have all made a significant difference to the viability of municipalities in which ENERGYS teams have been deployed.

6.8.1 Losses

This issue was discussed in 6.2.2, but problems apply equally to electrical reticulation. Losses in some municipalities have been found to be as high as 40%.

Considering that the overall purchase price of water was of the order of between seven and eight billion rand in 2005/2006, if losses had been reduced by, say, 20% this would have resulted in savings of between one and two billion rand. Similarly, savings in the region of two to three billion rand could have been effected by reducing electricity losses by 15%. The total saving of five billion rand is of the same order as the MIG budget of that year, which implies that such savings could have doubled the spending on infrastructure rollout. The same is true going forward since consumption and the purchase price of water and electricity continue to increase.

Success story – electrical students and graduates assist with revenue enhancement

In Gauteng deployments extend beyond civil engineering and include building science and electrical students and graduates. The electrical team photographed below have spent much of their time addressing the high losses identified. Below right one of the graduates is seen recalibrating the meter box of a major consumer. As a result of their interventions under the watchful eye of a senior electrical engineer, income was increased by some R 7 million over a 15-month period.

A rewarding part of mentoring are the precious notes received from mentees. A note to this mentor read:

Men like you are really needed at this time. I really enjoy every moment and I have seen what you want us to be tomorrow. God bless you.

6.8.2 Increasing income for ongoing services

The silo nature of local government structures means that technical departments seldom have a feel of collections and finance departments do not have a feel of what they should be earning from the user base in terms of water and electricity.

In several municipalities, ENERGYS engineers have analysed collections versus the purchase price paid to bulk suppliers and identified gross undercharging of end users.

Several interventions are discussed below.

(a) Major consumers

Major consumers have either not been charged, or have been charged the same tariffs over a number of years, or have faulty metres. Given the 80/20 principle, by putting a little effort into analysing the accounts of major consumers, significant improvement in income can quickly be achieved. Adjustments to rectify undercharging and address tardiness in updating annual tariffs earned just two municipalities an additional R4 million in electricity and R6 million in water within two months of the engineers getting started. Doubtless most municipalities should be carrying out similar exercises.

To address the problem of faulty meters, systems are being put in place to assign dedicated meter readers to large consumers. Knowing the order of magnitude that the readings should be, they pick up deviations and investigate immediately whether there has been a change in production, or whether the variation is indeed the result of a faulty meter.

(b) Faulty meters

Meters do not last forever. Under-reading costs local government dearly each year. Monthly comparisons of readings are essential to pick up faulty meters. Furthermore, a system of planned meter replacements offers the optimum solution to ensure accurate charging and

cost recovery. One of the most successful local municipalities in meter management and revenue collection is Steve Tshwete LM.[73] Here meters are replaced every eight years as they become unreliable. Bulk water meters are also monitored. If there is a discrepancy between bulk readings and the total water meter readings, immediate action is taken to identify the point(s) of loss.

(c) Accounts are not being issued to newly connected consumers

In some instances, entire townships, although receiving services, had not been incorporated into the accounting system. In these cases students were deployed to visit houses, hand over title deeds and sign up consumers. Whilst this move is not popular with the consumers concerned, it is essential in terms of municipal viability!

(d) Ignorance

Many who have not received services in the past are blissfully unaware that it costs money to provide services. They require education on the concept of rates and on the need to pay regularly for services they receive. If cut-off policies are not enforced, such consumers run up large outstanding debts that they are unable to pay when confronted with the reality.

(e) Unwillingness to pay

In many areas the outstanding debt is significant, even from consumers who have the capacity to pay. In some municipalities major campaigns have been mounted to chase outstanding debt. Flat-rate settlements or discounts have been offered to encourage all to clear their debt in exchange for extended or improved services.

In their drive to address massive water losses and low or no water pressure, the Greater Giyani LM[74] mounted a community awareness campaign. This addressed water usage, payment for services and gaining an understanding of community aspirations, which included the extension of the water network. With cooperation on repairs, leaks, meter installation and settling of outstanding debts (with a write-off of 50%), income increased and consumption reduced, allowing the municipality to expand its service. The intervention resulted in the monthly average income for water improving from R102 000 to R720 000 and the consumption in high-demand areas reducing from 97 kl to 45 kl.

Prepayment meters are being introduced in many areas, but there is a need to educate communities well in advance to gain acceptance and avoid demonstrations or vandalism.

(f) Registering indigents

Without having established the distribution and magnitude of the indigent population it is impossible to determine who should be expected to pay and who should be on the cut-off list in the case of consistent non-payment! Further, having validated the indigent list, it is often found to be significantly larger than registered in the DORA. Registering the indigent population will thus increase the value of the Equitable Share allocation.

The Steve Tshwete LM[75] has adopted a unique approach to indigent management. The municipality decided to make indigent status self-regulatory. It reasoned that any household that manages with a 20 A circuit breaker should qualify as indigent (electricity is prepaid and each household is free to set its own limit). This way, says the MM,

… nobody has to lie …

All households receive 6 kl water free of charge per month. When indigent households use more than 15 kl per month a flow restrictor is installed. 'Non-indigent' consumers are expected to pay for the additional services. With this innovative approach Steve Tshwete achieved a 98% payment rate for the 2005/2006 financial year!

(g) Metered supplies

Determining the size and distribution of the indigent population will also help municipalities to identify many consumers who can afford to pay but are not paying. This information will inform the prepaid metering strategy.

(h) Cut-off

This hard-line approach is generally met with absolute disdain, even in areas where people can afford to pay. It is time that this problem is tackled head on.

South Africa is not alone with this problem. In studying the introduction of property taxes in local government a World Bank researcher noted that mayors who are more devoted to populism than to long-term goals might try to avoid the collection of taxes owing to the political cost involved. Consequently, poor performance in this regard also reflects local government's greater vulnerability to local political pressures.[76]

Municipalities must urgently apply their minds to reversing the problem of outstanding debt because if left unchecked it will continue to grow.

6.8.3 Tariffs

The need for support from their communities has held many councillors and councils back from increasing tariffs for fear of recrimination. Both water and electricity tariffs appear to be below the purchase price in many municipalities which if increased to market rates, could substantially improve their viability.

Those who are of concern in terms of loss of voter support are often those who do not consume much water and are recipients of 6 kl of free basic water per month. At the time of writing, a kilolitre of water cost around R5. Should a poor household exceed its 6 kl, the excess is unlikely to be more than another 2 to 5 kl, that is, a monthly bill of R10 to R25. Increasing the kilolitre rate by 5% versus 10% will cost the home owner an additional 50c to R1,00 for an extra 2 kl or R1,25 to R2,50 for an extra 5 kl. This difference is minimal in terms of the bulk of households, but the difference between 5% and 10% when considering households, businesses and institutions that consume fifty, a hundred or thousands of kilolitres per month is substantial and could make the difference between breaking even and running at a loss.

Rates also seem to be a problem, with increases being held back year after year. National minimum tariffs should be considered annually and municipalities should be supported to increase their tariffs to a sustainable level.

6.8.4 Management of debtors

When interviewed on their success in managing debt, the Steve Tshwete LM shared their secrets for achieving their 98% payment rate in 2005/2006.

These included:

- Sending bills on the same day each month
- Invoicing for actual consumption – no estimates
- Ensuring meters were in working order

- Immediately replacing broken or stolen meters
- Issuing clear and understandable accounts
- Taking immediate action upon receiving complaints
- Having accessible pay points open at convenient hours
- Employing friendly staff
- Adopting a zero tolerance approach to those who do not pay
- Educating communities on the importance of paying and rewarding communities with facilities such as public swimming pools or more regular refuse removal

Inspired, yet simple, these approaches should become part of the culture of local government nationwide.

6.8.5 Increasing income from development

The thrust over the past 10 to 12 years has been the development of basic services. This has impacted negatively on income streams in many municipalities. Investing only in development for the poor is extremely short-sighted, as it precludes municipalities from the opportunity to improve their income. Attracting industry and affluent private consumers is essential to cross-subsidise basic services. In one smallish local municipality alone (population ~100 000), it was estimated that the annual increase in income from new rate payers would be R50 million if infrastructure were put in place to support development. This represented a 16% increase in annual income!

Spatial development plans, identifying new industries and industrial zones, and attracting more rate payers should be high on the agenda. The need for planners, developers and economists to work with each and every municipality in the country to attract investment has never been greater. If developers are not romanced and their needs are not met, they will simply move their interests elsewhere and, sadly, in several instances investments have not been transferred to neighbouring municipalities but rather offshore.

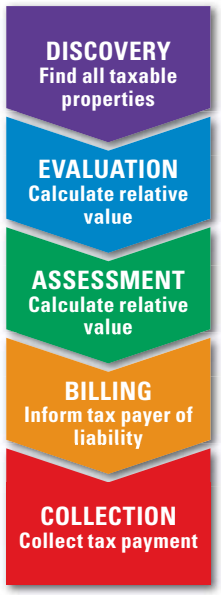
6.8.6 Increasing income from the Property Rates Act

Property tax can offer a significant source within the revenue toolbox for municipalities. Property tax yields in developing countries are significantly lower than in more developed countries.[77] The average property tax in the UK, USA, Korea and Japan is in excess of 10% of tax revenues, in OECD (Organisation for Economic Co-operation and Development) countries it is around 4%, in transitional countries around 2% and in Latin America it is less than 1%.

The Municipal Property Rates Act, 2004 (Act 6 of 2004) paved the way for expanding the municipal income base. Farm lands, government properties, properties with land tenure rights, permission to occupy, etc will become newly rateable properties. (See Figure 6.22.) Furthermore the value of buildings and land can be incorporated into the asset base on which rates are charged.

Municipalities may charge rates for any property over the value of R15 000. In calculating new rates care must be taken not to create rate

Figure 6.22 A householder who has created an asset



Source: *Urban property tax reform*

Figure 6.23 Sequence of property tax administration

'shocks'. It may be necessary to reduce the cents charged per rand value in areas where rating has changed from the land value only to land plus buildings.

When introducing similar legislation in Tanzania, the valuation exercise identified almost half a million rateable properties, at a time when just over 100 000 properties were registered on the voters roll.[78]

Before we get too optimistic about this source of funding, notes of caution from the Tanzanian experience must be considered.

The process, which is complex (see Figure 6.23), requires a new and extended breed of trained valuers, control systems, expanded billing systems and time, as the initial assessment and evaluation phase is lengthy, taking several years in Tanzania. The use of university students of architecture, building science and valuations offered much of the capacity required to carry out the initial assessments under supervision of seniors.

Thus, a project similar to the ENERGYS project, but for valuations, should be considered in South Africa. Using national diploma students studying real estate would offer the required capacity, and paired with experienced valuers, this would also give these young people the requisite experiential training to allow them to graduate.

Clearly, it is critical that municipalities budget for the process of surveying and valuing properties and assisting owners with registration where necessary in order to be able to earn from a much extended rates base in the future.

Revolving credit or use of a grant should be considered to support municipalities with this exercise.

6.8.7 A pot of gold in the by-laws

The Constitution (section 156) states that:

> *A municipality may make and administer by-laws for the effective administration of the matters which it has the right to administer.*

Few municipalities have comprehensive by-laws covering all the opportunities to earn income, and those that do, seldom enforce them. It is essential that by-laws are developed and enforced. The list of income generators is endless, a few of which are listed below:

(a) Contribution to bulk services by developers

Because of the lack of technical staff to evaluate applications for development, developers have taken the gap and in many instances have tapped into the already overloaded bulk services. In several instances ENERGYS engineers are negotiating with developers and/or writing the appropriate by-laws to ensure that all developers contribute towards the expansion of bulk services in future. National clauses and rates should be agreed on and should apply across the board to prevent this loss of earnings from continuing.

(b) Income from users who are overloading or abusing municipal infrastructure

Many municipalities have no by-laws to penalise consumers who overload or abuse the system, such as industries discharging dangerous effluent into water courses, or householders discharging waste into stormwater mains, or pool water into sewers, etc. Monitoring and fining is essential to prevent this type of behaviour and ensure that adequate funds are raised to handle the more complex treatment required where transgressions persist.

Table 6.2 Chargeable services to be defined in by-laws

Department	Activity
Parks	Tree felling and trimming
	Garden refuse removal
	Developing and managing gardens for educational, health and ecclesiastic institutions
Water	Leak detection for business and private consumers
	Fire pressure testing for business
Sewage	VIP and conservancy services for remote businesses and institutions
Roads	Constructing of scoops and driveways
	Developing sidewalks
	Developing or patching parking areas for businesses and shops
	Road markings for parking lots, churches, etc
	Installation of bollards and barrier fencing
	Erecting signage
Solid Waste	Collecting industrial, hazardous and medical waste
	Safety inspections
Buildings	Plan preparation and approval
	Building inspection and inspection of illegal buildings
Licensing	Pets
	Businesses
	Billboards, etc
Levies	Bulking levies

(c) Increasing income for additional services

As consumers become more sophisticated they require levels of service beyond the primary needs of shelter, water and electricity. Generally, these are required to improve their lifestyle and enhance their properties. By growing capacity and skills in O&M, municipalities could offer several services (see Table 6.2) to increase their income. These services should be included in the by-laws.

It should be clear from the above that a good set of by-laws and staff with sufficient knowledge of their implementation and enforcement are critical to the viability of all but the smallest of municipalities. A national suite of such by-laws should be developed for all to adopt and/or adapt and appropriate personnel or external service providers should be trained in their application, implementation and enforcement. National Treasury should perhaps consider a small grant and roll out strategy to get such an initiative off the ground.

Table 6.3 Conditional grants as listed in the DORA 2005/2006

Grant	Purpose	Deparment	Closing date
Comprehensive Agricultural Support Programme	To expand the provision of agricultural support services and promote and facilitate agricultural development	Dept of Agriculture	28 September
Land care programme grant – Poverty Relief and Infrastructure Development	To optimise productivity and sustainable use of natural resources to ensure greater productivity, food security, job creation and better quality of life for all		
Provincial Infrastructure Grant	To supplement capital finance for basic municipal infrastructure for poor households, micro enterprises and social institutions To provide for new municipal infrastructure and rehabilitation and upgrading of existing ones To eradicate the bucket sanitation system mainly in urban townships	**dplg**	30 August
Municipal Infrastructure Grant			
Bulk Infrastructure Grant	To develop regional bulk infrastructure for water supply and link such water resource development with the local bulk and local distribution networks on a regional basis cutting across several local municipal boundaries. In the case of sanitation to supplement regional bulk collection as well as regional waste water treatment works.	DWAF	End of February
Integrated Housing and Human Settlement Development	To finance the implementation of National Housing programme and to facilitate habitable, stable and sustainable human settlements	Dept of Housing	
Mass Sport and Recreation Participation Programme	To fund the promotion of mass participation within disadvantaged communities in a selected number of sport activities and the empowerment of communities to manage these activities	Sports and Recreation SA	
2010 FIFA World Cup Stadiums Development Grant	To fund the design and construction of new designated stadiums or the design and upgrading of designated existing stadiums and supporting bulk services infrastructure in the World Cup Host Cities.	Sports and Recreation SA	
Municipal Systems Improvement Grant	To assist municipalities in building in-house capacity to perform their functions and stabilise institutional and governance systems. Includes reviewing IDPs and implementing the Municipal Systems Act	**dplg**	30 November
Local Government Financial Management	To promote and support reforms to financial management and the implementation of the Municipal Finance Management Act	National Treasury (NT)	
Local Government Restructuring	To support municipal restructuring initiatives of large municipalities considering financial, institutional, developmental and changes relating to restructuring		
National Electrification Programme	To implement the national electrification programme by providing capital to subsidise municipalities to address electrification backlogs of permanently occupied residential dwellings, the installation of bulk infrastructure and rehabilitation of electric infrastructure	Dept of Minerals and Energy (DME)	Mid- September
Public Transport Infrastructure and Systems	To provide for accelerated planning, establishment, construction and improvement of new and existing public transport and non-motorised transport infrastructure and systems	Dept of Transport (DOT)	Mid-October
Neighbourhood Development Partnership Grant	To provide municipalities with technical assistance to develop appropriate project proposals for property developments in townships and new residential neighbourhoods that include the construction and upgrading of community facilities, and where appropriate attract private sector funding and input	National Treasury (NT)	
NOTE : Check the DORA each year for terms, conditions and closing dates			

Source: DORA

6.8.8 Increased income from municipal properties

Another rewarding experience of the ENERGYS project has been the 'discovery' of many municipal properties for which the municipality has no records. Whilst this may attract more O&M expenses, locating municipal assets has assisted municipalities in that they:

- May have inadequate office space and can now expand or open depots
- Have not received rentals or increased rentals for many years, in the cases where properties are let out
- Will be able to raise substantial income where it is possible to dispose of properties no longer suitable for municipal purposes

In the municipalities investigated at least 50% more properties have been found than were recorded. This is not a new phenomenon. When a national department in the new government commissioned an enquiry into the number of properties it owned, it was found that they owned almost double the number recorded by the old dispensation!

6.8.9 Accessing funds from the various charters

The banking and mining charters, in particular, call on their sectors to commit significant funds to infrastructure development and improving the environment in which their communities live. The ENERGYS engineers are negotiating the release of several million rands worth of these funds and there is no reason why each and every municipality should not be engaging with the banking and, where appropriate, the mining sector to access additional funds.

6.8.10 Negotiating better terms and conditions with mining houses, state-owned enterprises and others for transfer of assets

Several mining houses and state-owned enterprises (SOEs), such as Transnet, are looking to hand their privately established towns and communities over to local municipalities. This is presenting challenges as few such communities or villages are self-sustaining and taking them on would add a burden to already stretched municipalities. It is essential that the potential burdens of all such transfers are assessed prior to hand-over to determine the level of fees that should be paid to receiving municipalities to take over the responsibility and build sustainability. It seems wrong that the balance sheet of companies or instruments of state be improved at the expense of municipalities.

Whilst it may be claimed that the present owners could simply level the towns or villages and restore the areas to their original condition, this is also costly. Such funding should rather be transferred to the municipality taking over the assets. A national strategy and guidelines are urgently required on this matter.

6.8.11 Grants

The issuing of grant funding has proven to be something of a mystery to both the ENERGYS team and the municipalities in which they have been serving.

Recognising that many municipalities do not have the income base to attend to service delivery and system development, as well as designing and setting up structures for long-term sustainability, the DORA outlines many grants available to support development.

Table 6.3 lists the grants published in the 2005/2006 DORA.

Unfortunately, apart from MIG funding, few municipalities or provinces take advantage of these grants, and funds remain unspent at the end of each financial year.

The process for accessing grants differs slightly for each grant, but basically works along the following lines:

- The planning process should start in July/August since most municipalities would have reviewed their IDPs at this stage
- Municipalities should develop business plans aligned with each of the grants and have these approved by council or in some cases by the MM (this varies per grant)
- Once approved, the grant applications, together with the business plan, should be submitted to the appropriate department for the allocation of funds for the following financial year
- Departments receive these applications from September to November, depending on the grant, after which they are captured, assessed and forwarded to National Treasury for pre-approval
- Municipalities are informed of the pre-approval process and are requested to confirm their applications in order to secure their allocations
- Final approval of allocations takes place in January and the DORA is enacted around February, which means that municipalities know of their allocation before the DORA for the next financial year is published
- In April municipalities can start requesting funds and implementing their projects
- The process is repeated again in July/August while municipalities are implementing current projects that will be completed by the end of the financial year in the following March

Municipalities should study Table 6.3 to understand the number of funding opportunities available to them and should make a determined effort to access each of the grants.

Ideas as to how these grants could be utilised are given below, and it is suggested that those who are serious about making their municipalities work should be in touch with the appropriate contact persons to determine exact closing dates and the format required for business plans. Since it is generally required that such plans be approved by council, it is important that the application process be commenced well before the closing date for each grant each year.

As the forms, proceedings and guidelines vary tremendously, a centralised and streamlined approach needs to be adopted to assist with accessing these funds.

(a) Municipal Infrastructure Grant

Possibly the best known grant is the MIG (Municipal Infrastructure Grant), which has been used to roll out billions of rands worth of basic infrastructure.

Business plans must be prepared for new developments, must be approved by council and must be registered with the MIG unit by 31 August each year to be included in the national funding cycle for the following year.

(b) Municipal Systems Improvement Grant

Many municipalities have requested support with system development. The MSIG (Municipal Systems Improvement Grant) is ideally suited to development of the many systems required in technical departments. These include, but are not limited to, the following:

- Revenue enhancement/control systems
- Water demand management systems
- Meter management systems
- Effluent management systems
- Pavement management systems

- Stormwater management systems
- Bridge management systems
- Asset management systems as a whole
- Communication systems and telemetry
- Building control systems
- Geographical information systems
- CAD
- Engineering design systems

Business plans should be developed and submitted to the MM for approval prior to being submitted to the **dplg** for inclusion in the next funding cycle.

(c) The Neighbourhood Development Partnership Grant

This is a relatively new grant aimed at growing integrated businesses and facilities within local communities. It will support partnership projects that bring together investment by private businesses and public (government) money to build new and improved community facilities, such as multi-purpose community centres, libraries, public parks and recreational areas, bus stops, taxi ranks, tourism, sports, cultural and educational precincts, trading facilities and revitalising existing trading nodes.

(d) Mass Sport and Recreation Participation Programme

Few rural municipalities have adequate sports facilities. In the build-up to 2010 it is important that soccer facilities are upgraded for all aspirant players to be able to play on home grounds and view their heroes at TV kiosks throughout the country. This grant strives to ensure greater mass access to sport and recreation and to achieve greater demographic representation at all levels.

(e) Local Government Financial Management Grant

Although not in the domain of the technical department, technical staff should encourage their municipalities to build capacity in their financial departments so that they can better support technical departments. The following activities are typically supported by this grant:

- Modernising financial management
- Building in-house capacity to implement multi-year budgeting
- Producing quality year-end reports
- Linking IDPs to budgets

Excluding funds from grants and charters, literally billions of rands are being left on the table and could mean the difference between make or break, develop or do nothing, maintain or neglect, employ or continue with vacuums. It is within each municipality's own reach to improve income streams. Urgent attention must be given to implementing all the above ideas. Accessing grants and charters would bring about further improvement.

6.9 JOB CREATION

When appointed Mayor of New York, Rudy Guiliani took responsibility for the biggest city in the USA and it was bankrupt! Just over a million people were receiving welfare from the city, whilst the streets were filthy and infrastructure, public spaces and buildings were in a shocking state.

Success story – job creation in Pixley ka Seme

At 102 592 km^2 the Pixley ka Seme DM was the largest of the areas that the ENERGYS team served. It is a sparsely populated farming area that is difficult to develop and maintain because of the vast distances between settlements. Unemployment in rural communities is high. The ENERGYS engineer, a graduate and a student were involved in road and stormwater maintenance and rehabilitation where necessary. SMME development was key to much of this work. Here is the story of Hans from Petrusville, who benefited from the SMME development programme.

Hans, in his late 30s, lives with his wife Dina and kids in a corrugated iron shack in 'Die Plakkerskamp'. Dina complains about how bitterly cold it is in the tin house, but she keeps the house scrupulously clean and sweeps the yard every morning. Hans cannot read or write, but can 'draw' his name: H A N S. He has a bakkie and a cell-phone. He was introduced to the engineer for the job of clearing the road reserve of a two-kilometer section of road between Petrusville and Colesberg.

The thick thorn trees were a contributing factor to storm damage to the road during the heavy rains early in 2006. Jacques, a qualified agricultural economist with whom Hans had grown up, spent a lot of time with Hans helping him prepare a quote, and eventually Hans and his team of seven men and one woman (to operate the spray pump for treating tree stumps) were awarded a two-month contract.

Hans and his team got stuck in and completed the job in three weeks to an eminently acceptable standard. He was paid according to his quote and, after settling with his workers, Hans had money in the bank and bread on the table to feed his family. Hans confided in the engineer that he had never before entered into a contract, and was very pleased with the outcome.

He summoned his inner team to a brainstorming session on how to create jobs, reduce welfare expenditure and improve the condition of the city. The team emerged with a list of 1 000 possible job descriptions and set about matching those on welfare with the localities and specifications of each job or project. Within six months, 600 000 were employed and within 12 months the city once again appealed to tourists who had stopped visiting the Big Apple.

The magnitude of South Africa's unemployment crisis is such that in September 2003, 4,6 million people were unemployed in terms of the strict definition and 8,3 million in terms of the broad definition.[79] Government's response has been multi-pronged, including driving economic growth in order to create more job opportunities, improving the education system in order to enable more people to take up semi-skilled and skilled posts, which are on the increase, and looking at expanding employment opportunities in public sector projects.

The new landscape of local government has also recognised this need for job creation. The main thrusts in this regard have been the Expanded Public Works Programme (EPWP) and local economic development (LED). The two are distinct in that the former refers to

support of specific people or enterprises, whereas the latter is an enabler, referring to the creation of a suitable 'climate' for entrepreneurial activity.

Considering the former, there is much that can be achieved in local government. This includes not only labour-intensive construction of capital works, as initially envisaged by the EPWP, but a host of opportunities in terms of O&M, which offer long-term income earning opportunities.

As was outlined in Chapter 3, maintenance comprises three elements:

- Planned upgrades and capital works
- Routine maintenance
- Response to breakages and failures

Looking at each element in turn will give a sense of the magnitude of job creation opportunities.

6.9.1 Planned upgrades and capital works

The construction and upgrading of a significant portion of municipal infrastructure, such as roads, water and sewer pipelines, stormwater drainage and dry sanitation (particularly in rural areas), lend themselves to labour-intensive methods and are the areas where the majority of additional work opportunities can be created.

Labour-intensive construction methods involve the use of an appropriate mix of labour and machines, with a preference for labour that is technically and economically feasible, without compromising the quality of the product.

In order to develop contractors and local skills, projects to the value of one third of the national MIG allocation must be designed using labour-based methods.

As a result, approximately 37 000 km of roads, 31 000 km of pipelines, 1 500 km of stormwater drains and 150 km of urban sidewalks will be constructed using labour-intensive methods over the five-year period from 2004 to 2009.[80] The overall EPWP job creation target is employment for one million people by the year 2009.

(a) Developing emerging contractors

Of particular importance in labour-intensive projects are the following:

- Understanding how best to balance the use of labour and equipment
- Developing appropriate construction skills
- Providing training to assist labour in accessing future employment opportunities
- Managing labour and cash flow

Before labour-intensive projects are awarded to SMMEs it is essential to ascertain that they have received training in labour-based construction and management.

The Construction Education and Training Authority (CETA) has developed learnerships to equip emerging contractors with the necessary skills. Municipalities should thus assist contractors in their jurisdiction to qualify for this type of work. The Gundo Lashu programme in Limpopo is one such success story. Twenty four

Figure 6.24 This is not job creation – the community looks on while a 'yellow machine' does the work!

Table 6.4 Areas in which labour-intensive and community labour can be used in construction, operations and maintenance

Discipline	Area	Activity
Rural roads	Road reserve	Clearing vegetation (trees) and cutting grass
		Removing litter
	Drainage	Cleaning and removing debris from culverts
		Constructing and/or cleaning mitre drains
		Stone pitching – loose or grouted
	Gravel roads	Filling potholes
		Removing rocks
		Small-scale regravelling
	Bituminous surfacing	Repairing potholes
		Sealing of cracks
		Repairing shoulders by regravelling
		Resealing
	Traffic signs	Erecting of new signs
		Repairing and/or re-erecting damaged signs
		Washing and/or repainting posts
	Guard rails	Erecting new guard rails
		Re-erecting and/or repairing damaged guard rails
		Painting guard rails
	Structures	Cleaning and painting culvert headwalls
		Cleaning and painting bridge railings
		Patching damaged concrete
	Fencing	Erecting new fences
		Replacing weathered fences
		Refurbishing worn gates
Urban streets	Unsurfaced streets	Watering to lay the dust
		Grading with animal-drawn equipment
		Regravelling of potholes
	Kerbing	Concrete kerb manufacture
		Laying kerbs
		Replacing damaged and/or worn kerbs
		Installing drop kerbs at vehicle entrances
	Sidewalks	Cleaning sidewalks
		Regravelling sidewalks
		Watering trees

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contractors and six engineering consultants were trained and subsequently provided work for 2 400 people who had had no income.[81]

Amadiba Road in the Eastern Cape was in such poor condition that it took eight hours to traverse 44 km in a 4x4! Driving over rocks and through water, communities at the end of the road were virtually cut off from the outside world. An EPWP project to upgrade the road provided 1 700 jobs over a 20-month period. Now some 100 vehicles a day allow communities to travel in and out of the area and more children are able to attend school. Income in the area has increased as access has allowed communities to sell excess crops. In addition, each household along the road is now paid a small fee by the municipality to maintain about 300 m of the route.[82]

(b) Utilising and developing local labour

Given that many living in rural communities have never been exposed to employment opportunities, the EPWP requires that contractors, whether established or emerging, plan their projects to utilise and train local labour. Thus, when the projects are complete, communities will have increased their capacity to earn an income in the future. For instance, those who have gained experience in road construction could find employment on farms, mines and in industry when access roads require upgrading. People from a local community standing and watching while a 'yellow machine' digs a trench (see Figure 6.24) should be a thing of the past!

6.9.2 Routine maintenance

From the above it is clear that construction can make a significant contribution to job creation. However, criticism of the EPWP has been that skills are developed for a particular community project and, once complete, there is no further opportunity in the area to use the skills so developed.

Rural communities, in particular, have no access to industry or business where these skills can be used. However, in local government, extensive O&M effort is required to prevent premature failure of infrastructure.

From the work of the ENERGYS team, it is clear that job creation should be aimed at O&M, as this offers ongoing employment opportunities and sustainability in terms of infrastructure, labour, community-based organisations (CBOs) and SMMEs set up for these activities.

Table 6.4 indicates the huge range of essential activities that could be carried out by local communities, or SMMEs using local labour.

(a) Developing emerging contractors

SMMEs are often the vehicle by which entrepreneurs from all socio-economic levels gain access to economic opportunities and consequently develop further labour capacity.

The ENERGYS engineer in the Pixley ka Seme DM ploughed considerable effort into SMME development. Many communities now earn a consistent income for the first time and the condition of the infrastructure is improving.

In Eden EPWP projects continue to improve the quality of district and provincial roads.

In several other municipalities SMMEs are given a tool box and instruction on how to fix leaks. They are dispatched to townships to fix leaking meters, taps, latrines, pipes, etc and report major leaks that they are unable to attend to themselves.

Again SMME training is essential. A particular barrier is that of literacy and the inability to fill in and submit tenders or calculate realistic prices.

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Discipline	Area	Activity
Urban streets	Bituminous surfacing	Repairing potholes
		Sealing cracks
		Resealing
	Traffic signs	Repairing and/or re-erecting damaged signs
		Cleaning or painting traffic sign posts
		Repainting street markings
	Structures	Cleaning and painting bridge railings
		Patching damaged concrete
Stormwater drainage	Streets	Cleaning streets and side channels of debris and deposits after heavy rains
		Cleaning kerb inlets of deposits and debris
	Drainage network	Repairing/replacing damaged inlet grids
		Replacing damaged inlet covers
		Cleaning stormwater pipes
		Replacing damaged stormwater pipes
		Clearing drainage channels of large vegetation and debris
	Manholes	Concrete manhole manufacture
	Water courses	Building or strengthening bridge approaches, culverts, gabions and removing reeds, trees, etc
Water	Water meters	Locating, cleaning and painting meter boxes
		Reading water meters
		Locating leaking meters and initiating repairs
	Valves	Locating, cleaning and painting valve boxes
	Hydrants	Locating, cleaning and painting hydrants
		Resealing
	Taps	Locating leaking taps, replacing washers, etc
	Latrines	Locating leaking latrines and Initiating repairs
	Pipes	Locating leaking pipes and initiating repairs
Water	Small dams	Construction and clearing
	Community education	Creating awareness on the need to address leaks
Security	Sites	Accessing control and night watchmen
Sanitation	Waste ponds	Removing grass and reeds to limit mosquito breeding habitat
Environment and culture	Waste	Establishing waste sites
		Separating waste
		Clearing litter

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Success story – roads repaired using local labour in Van der Kloof

In the remote but expansive Pixley ka Seme DM, where job opportunities are scarce, maintenance projects carried out on EPWP principles offer much needed income for local labour. Here labourers, under the watchful eye of an ENERGYS student, are working on a stone pitching project to enhance the condition of the road's edge and improve drainage. The project was conceived and managed by the ENERGYS team.



(b) Utilising and developing local labour

Routine maintenance suggests regular activities. The EPWP objectives stress that utilising local labour should not displace existing permanent jobs, or attract workers away from permanent employment.

Discussions throughout this book highlight the fact that little or no routine maintenance takes place. Hence a new model for re-introducing many routine maintenance exercises could indeed be adopted by the EPWP.

Local labour may be employed directly by the municipality for specific projects, or may be employed by CBOs or SMMEs contracted to handle specific maintenance contracts.

CBOs should not be confused with SMMEs.[83] They are not-for-profit organisations set up by a defined community to provide a specific municipal service for that community on behalf of the municipality. They require a simple constitution, and all members of the governing body and employees must be permanent residents in the community.

CBOs are particularly appropriate in small, isolated communities who have their own supply system, such as a borehole, and who can control service provision with some technical support from the authority or an overall service provider. Thus even in this innovative approach to service delivery, technical capacity is still required!

Use of this mechanism may assist the community in creating an income base, and ensures that as much of the money as possible goes back into the community.

In Alfred Nzo Municipality, for instance, CBOs are established in each village in respect of the many rural water schemes, based largely on borehole supplies.

The model works equally well in larger municipalities. Msunduzi LM[84] has embarked on employing NGO groups and CBOs to carry out routine maintenance and clearance activities, including road sweeping and stormwater clearing, household solid waste removal, litter picking, grass planting, etc.

They are employed seasonally, in line with higher and lower maintenance periods, but on one-year fixed-term contracts. This has been found to be a cost-effective approach to

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Discipline	Area	Activity
Environment and culture	Land development	Clearing alien vegetation
		Rehabilitating wetlands
		Burning fire breaks
	Recreation	Clearing/cleaning rest areas and stopping places
	Community education	Creating awareness of the need to recycle and manage litter

maintenance that also addresses unemployment. It is estimated that one job could be created for every 100 households serviced in this way. The need for comprehensive supervision, management and leadership is however key to successful community buy-in and implementation.

6.9.3 Response to breakages

As has been seen, maintenance has been sorely neglected. The Local Government and Sector Education and Training Authority (LGSETA) reports that skills plans submitted by many municipalities indicate few or no elementary workers on the staff. This problem has also been identified by the ENERGYS engineers. As a result there is no capacity to carry out daily clearing or cleaning and basic repairs, which rapidly results in undesirable conditions or failures.

Furthermore, if failures are not attended to quickly, the severity and cost of later repairs tends to increase. Typically, if drains are blocked or pipes are leaking, properties may be flooded; when roads are damaged by unusually heavy rains, potholes will rapidly increase in size if not attended to.

It is essential that municipalities revisit their organograms and at least develop a core team to address daily O&M needs and responses to breakages.

Many municipalities will claim that they cannot afford more employees or to expand their O&M budgets. However, the old adage of 'you cannot afford not to' holds true when one considers the cost of premature failure. Much of the damage caused in the August 2006 floods resulted from blocked drains and culverts, vegetation in pipes, logs in watercourses, and no protection to bridge piers.

In the UK, potholes are now systematically being repaired nationwide, as research has shown that annual claims from motorists for damaged rims, accidents, etc as a result of pothole neglect far exceeded an annual pothole repair programme![85] ALARM, the acronym for the Annual Local Authority Road Maintenance survey, tells its own story!

6.9.4 Operations

Opportunities abound to use small contractors to assist in operations. The most significant of these is in the handling of waste, as alluded to in 6.5 above.

Activities that can comfortably be given to SMMEs include:

- Weekly removal of domestic waste and garden refuse
- Collection of left-over food from hotels and restaurants
- Collection of business waste, as required
- Weekly clearing of litter from streets and open areas
- Removal of waste resulting from illegal dumping
- Educating community members on recycling and discouraging them from littering and illegal dumping

6.9.5 Identifying, locating and classifying small, medium and micro-enterprises

To ensure that all who are eligible are offered opportunities, it is necessary to identify, locate and classify SMMEs. Developing databases to ensure inclusion is an important aspect of poverty reduction.

To encourage municipalities to consider more job creation opportunities, councils must be helped to understand that by employing more locals, they will be able to pay their taxes – a win-win situation all round!

6.10 LOCAL ECONOMIC DEVELOPMENT

Local economic development (LED) has been recognised as a key to job creation and the alleviation of poverty.

However, looking narrowly at one or two activities that can be implemented in a municipality would be short-sighted. A comprehensive economic strategy is required of which specific job creation activities would be a subset. Developing this strategy should be a joint exercise by the municipality and the community, including NGOs and CBOs and business.[86]

6.10.1 An enabling environment

It is essential to create an environment in which all can flourish. The biggest asset in any business or municipality is its people. It is necessary to invest in whatever it takes to make them productive, including:

- Transportation and infrastructure that moves people, goods and information
- Education and workforce development that makes people more skilled and innovative
- Research and technology to generate new ideas, products and processes that are highly valued

Success story –kerb manufacture at Vosburg

Desmond from Smartietown at Vosburg was successful with his labour-only quote for producing concrete kerbs for the proposed street works in the township.

Forty welded steel forms, concrete aggregates (stone and sand), cement water and tools were to be provided by Kareeberg LM. Desmond's team consisted of thirteen workers, nine of whom were women.

When the ENERGYS engineer arrived to inspect the first few batches of concrete it was obvious that something had gone horribly wrong. It transpired that the incorrect coarse aggregate (stone) size had been provided to Desmond, and in his frantic efforts to produce a workable mix, the resultant cube strength was well below the required standard of 25 MPa.

Once the correct size coarse aggregate had been ordered and the prescribed mix adhered to, cube crushing strengths were much improved but continued to be monitored for the duration of the contract, courtesy of the Rocla and Grinaker laboratories in De Aar.

With crushed dolerite coarse and fine aggregate of superb quality produced by De Aar Stone Crushers, the correct mix proportions and careful monitoring of cube strengths, the kerbs produced by Desmond and his team, right up to the final batch of 4 500, were comparable to the best found anywhere in South Africa.

Many major road building contracts are planned in these areas, and Desmond and his team are well placed to be employed in concrete work on further projects.

- Health and safety to make the environment suitable for living, working and visiting
- The physical and cultural environment that makes places more attractive, life more rewarding, and people more motivated to work and study hard[87]

In Poland,[88] the decentralisation of service provision to local government was seen as the most effective method of improving service delivery. However, it was found that funding was inadequate for the development required in the many under-serviced low-income neighbourhoods. In Lublin, a partnership was struck between residents and the municipality to encourage community prioritisation of needs, private development and private investment. One of the cornerstones of this agreement was to

… empower citizens to pursue their own self-improvement …

The situation is no different in South Africa. A number of issues that must be addressed to create such an enabling environment are discussed below.

(a) Infrastructure

Much of what has been listed above relates to the adequacy of service delivery, and therefore sound planning, infrastructure development and O&M are key to local economic development.

Figure 6.25 Municipalities need to provide facilities for traders to offer their wares. These ladies are true entrepreneurs – what better place to sell beer than outside the men's!

(b) Accommodating home-based enterprises

In terms of planning, it is perhaps time to review the strict rules currently limiting home-based enterprises (HBE). Insufficient employment opportunities in the formal sector force people to set up enterprises in the only space that they can afford – their homes.

Small outlets involved in selling household products to those with no refrigeration, the production of clothing, small parts repairs and assemblies, etc should be encouraged to support both the household involved in the business and the neighbourhood in need of such localised services.

International research[89] has shown that the normal objections to HBEs, such as increased traffic, excessive noise, and threats to health and safety are largely unfounded, and should be managed on a case-by-case basis rather than a blanket prohibition on trading in residential areas.

(c) Street trading

Street traders should be given appropriate space to conduct their businesses, although planners typically pay little attention to such economic ventures. Street trading has become a way of life. Where authorities have demolished kiosks, for example in Mombasa, there has been a significant increase in crime because the network for controlling the area has been removed and households find themselves without income.

(d) Licensing

Reducing the costs and complexity of business registration is important. In a municipality in Lima, Peru, enterprise registrations trebled after 45 steps were cut to 12 steps and processing time was reduced from 70 days to one!

(e) Marketing

The key to assisting the urban poor is to be more proactive. With licensing restrictions removed and as many businesses as practicable registered, the opportunity to market local businesses within the community (by means of local directories or pamphlets) and to international markets is greatly increased. In the Lima municipality referred to above, the mayor initiated a census of formal and informal businesses in low-income areas. The information gleaned from marketing campaigns, both local and international, saw many businesses vastly expanded.

eThekwini has developed a comprehensive policy to specifically address poverty in the informal economy. One of the important components is securing the participation of formal businesses to assist with micro-finance and training. See <http://www.streetnet.org>.

(f) Advice and training

Submitting a tender, entering into a contract and accessing micro-finance at affordable rates are just some of the numerous hurdles faced by would-be entrepreneurs. Training and advice centres are an important source of support.

6.10.2 Local economic development opportunities

LED job creation initiatives range from those developed in municipal engineering departments in support of capital works and O&M to many other enablers for communities to spend or earn locally. The importance of addressing economic leakages (that is, income earned in the area being spent outside the area) is key to expanding local earnings. The opportunities are limited only by the imagination. The most widely recognised fields are discussed below.

(a) Construction materials

There are many simple products that can be produced by local communities, including bricks, blocks, kerb stones, concrete manhole covers and other precast elements, burglar bars and gates. As has been seen, precast units are used in VIPs (see 6.3.1) and the concept is also under consideration for rapid housing development.

(b) Infrastructure-related businesses

The previous sections have outlined the numerous business opportunities associated with capital works, O&M, energy and recycling.

(c) Retail centres

There is a desperate need for each municipality and, in urban areas, for each suburb, to have its own retail centre. All too often the elderly and poor must travel great distances to make their purchases and pay their accounts. By developing local retail centres even those with limited means are likely to spend more as the shopping experience becomes easier and less costly in terms of time and transport.

For major retail outlets to be developed, good infrastructure is required and, in particular, adequate access by road or rail.

The availability of shop frontages allows entrepreneurs within communities to open their own small enterprises. Secretarial and administrative services are needed on an ad hoc basis by almost everyone – photocopies of certificates, and help with CVs, business cards, filling in forms and making posters are some of the simple yet unavailable services in many areas.

Employment centres or agencies, computer training, second-hand furniture outlets, repairs, driving schools, and hair dressing are other examples of the many services that would be welcomed in the local context.

The development of spaza areas (see Figure 6.25) is essential to allow entrepreneurs to sell fresh produce and products they themselves have made, as well as to offer services locally in order to keep money within the community.

(d) Local currencies

The need to keep money within in the community is so critical that several experiments have been launched with local currencies. In Orania in the Karoo, a currency known as the Ora has been developed. Using the Ora entitles customers to a discount on all purchases made in the area, thus encouraging local purchases.[90]

In Johannesburg a novel form of currency, called Hopes, aims to inject a healthy dose of hope into Joubert Park by encouraging homeless and indigent people to work for their meals. Since August 2006, they have been rewarded with Hopes vouchers for planting vegetable gardens or sweeping the dirty streets. Hopes vouchers can be used in local businesses and exchanged for food, clothing or even a hairdo, thus once again spending the money on services offered by the community.[91]

The concept is widely established from South America to the USA and Europe and has brought relief for many communities.

So successful have many of these ventures been that Venezuela's President Hugo Chavez announced in early 2007 that his government would introduce local currencies in their communities,[92]

> *… to help their development and alleviate poverty. Local currencies will allow people to exchange goods and services without needing the national currency to enable such transactions.*

Margrit Kennedy,[93] who has written and lectured extensively on the topic, says:

> *Money can be made to serve rather than to rule, to be used rather than … profit-oriented … and to create abundance, stability, and sustainability.*

She goes on to say that while

> *… money is one of the most ingenious inventions of mankind … [it has] the potential to be the most destructive or the most creative.*

(e) Industrial zones or nodes

In order to create jobs and increase income in a region, it is crucial to expand the industrial sector.

Critical analysis of transport networks, raw materials, access to labour and many other factors is required per municipality to determine the types of industry to be encouraged.

Furthermore, clustering of companies complementing each other can strengthen the competitive advantage of the municipality or regions where they are located.

Planning development nodes or zones is therefore important to increase the economic base of each municipality. However, once again municipal infrastructure and good access is critical to the success of such development.

(f) Tourism

Tourism has been labelled the world's fourth largest industry after chemicals, automotive products and fuels. It is a major job creation industry: it provides one job for every 12 tourists who arrive in South Africa. Given the beauty of our country, this is a figure that could well be improved. It is therefore crucial for municipalities to engage with the Department of Tourism and with experienced consultants to assist with developing tourist sites and the associated publicity campaigns.

The range of resulting job opportunities is endless and includes guides, transport, security, information, reception, catering, refreshments, laundry, cleaning, maintenance and leisure activities. Job opportunities in the supply industry will also increase as the demand for products increases.

In addition, job opportunities will be created at the inception stage of clearing or preparing sites and the construction associated with new resorts or sites.

Whilst game and nature reserves, mountains and beaches immediately spring to mind there are significant opportunities in developing activities associated with our history, traditions and cultures.

In May 2007 the Tourism KZN website reported that three emerging entrepreneurs had introduced new historical and cultural tours in KwaZulu-Natal. Siphiwe Kunene initiated his township tours from Durban to KwaMashu township. Kunene's tours include a visit to a shebeen (local unlicensed tavern), meeting a sangoma (traditional healer) and being diagnosed by an inyanga (herbalist). The tour is rounded off by lunch at a township restaurant.

Two newly-qualified tour guides, Bethuel Manyathi and Dudu Manyathi, launched tours to the famous Anglo-Zulu War battlefields, but from the Zulu point of view. In addition to the battlefields tours, they take tourists to visit an unusual sangoma who communicates with his ancestors by whistling, and to visit the local Shembe church.[94]

This kind of entrepreneurial spirit needs to be encouraged.

However, it rests with municipalities to create the enabling environment for these tours to take place. Publicity and infrastructure are of critical importance.

Case studies in the UK highlighted the need for publicity:[95]

> *There is a need to provide an effective voice for tourism in rural areas at regional and sub regional level. It is important to invest time in emphasising the special needs of rural areas, which can easily be overlooked in favour of the big players when tourism issues are being debated …*

Poor or lack of infrastructure, impassable roads, sewage in streets and other inadequacies will not be conducive to long-term sustainability of such ventures.

Says Rogerson in his study of small enterprise development:[96]

> *One critical factor blocking ... transformation of the tourism economy is the lack of essential infrastructure, which has been the block on tourism*

Job creation through handwork

Dr Carol Hofmeyr is an accomplished artist and a medical doctor who has taken both professions to the poorest of the poor in the Eastern Cape.

She established the Keiskamma Art Project to nurture the innate artistic creativity of the community, engender a new sense of pride and hope for the future and to generate a small income for the members. Not only has this community created the monumental Keiskamma Tapestry, a 120 m embroidery artwork that depicts the history of the Eastern Cape and now hangs in the South African Parliament, but their work is now internationally renowned and displayed. Other than alleviating poverty and promoting self-esteem through art, Dr Hofmeyr also brings high-quality care to people living with HIV/AIDS at the residential HIV treatment centre she established in the Hamburg area.

Source: Shoprite Checkers/ SABC 2 Woman of the Year 2007. Photograph Tanya Jordaan

entrepreneurship in many areas of urban and especially rural South Africa.

South Africa has often been described as a world in one country. The beauty and range of attractions is such that the number of tourists per capita, and jobs created per tourist should be of the highest in the world.

However, according to the Department of Tourism,[97] we lag behind the USA and Kenya. In 2005, one job was created for every seven tourists arriving in the USA; in Kenya the figure was even better with one job created for every five tourists, whilst in South Africa one job was created for every twelve tourists who arrived in the country.

Thus local government's fundamental role in tourism should be the development and maintenance of appropriate infrastructure and enhanced publicity.

(g) Curios, produce and handwork

The affluence of the developed world has led to many cartoons and slogans referring to their need to shop. Accepting the fact that most foreign tourists fall in this category, much support needs to be given to rural communities on tourist routes to develop their own small businesses to address tourist needs and wants. Typical products include:

- Baskets, pots, artefacts, jewellery, etc
- Carvings, ornaments, beadwork and wire art
- Needlework and crochet
- Local brews, fruits, preserves and herbs

All too often the rows of roadside stalls sell the same products with little or no differentiation. Support is needed in these areas to help traders expand their product ranges.

Traders also require assistance with exporting their unique wares, but once again transport networks are critical to the success of such ventures.

The success of Eastern Cape women in exporting needlework through the assistance of Dr Carol Hofmeyr, the 2007 Shoprite Checkers/SABC 2 Woman of the Year in Arts, Culture and Communication, is showcased in the accompanying inset.

(h) Agriculture and forestry

Agriculture is the backbone of any developing economy. It is the sector that is able to create the most sustainable jobs, absorbing even unskilled and semi-skilled workers.

Not only should the expansion of job opportunities on large commercial farms and forests be encouraged, but communities should also be assisted with small-scale farming activities.

Job creation through agriculture

Linda Nghatsane, a public health practitioner from Mpumalanga, turned farmer three years ago in response to women who challenged her while she taught good nutritional practices. These women said although they acquired useful nutritional knowledge they remained challenged by poverty and unemployment. That is when Linda bought a ten-hectare farm, De Hoop, in the Crocodile River Mountain conservancy near Nelspruit. The land was overgrown with Lowveld vegetation and most of the bush clearing had to be done by hand. There was no infrastructure on the farm, in other words, no house, no electricity, no water and not even a road leading to the piece of land that she has since turned into a flourishing farm. Today she rears broiler chickens in an operation with a capacity of 25 000 chickens, and produces oyster mushrooms, strawberries and a variety of vegetables.

The farm turnover per year is about R2 million. Linda bought the farm without government assistance in a commercial transaction. Her successful farming also includes involvement in community development where she conducts training on planting vegetables in bags, poultry and oyster mushroom production, as well as care and support for orphans and vulnerable children. She is a self-driven person who does not believe in hand-outs but in hard work.

Tending the vegetables

Tending the chickens

Source: Shoprite Checkers/ SABC 2 Woman of the Year 2007

Determining suitable high-yield cash crops that require little attention and limited growing area would be the number one prize. Whilst this may sound idealistic, before hurricane Ivan hit Grenada in September 2004, many small farms of fives acres or less, produced the lion's share of the world's nutmeg.[98] Sold through cooperatives, rural farmers with limited skills and little or no business experience had access to markets in some 30 countries.

Lamented Godfrey Hariman,[99] who farmed five acres.

> *Nutmeg paid the bills and brought in some cash. I also grew cloves and vegetables, but nutmeg was my main crop.*

The need to assist rural farmers with methods of selling their crops is an essential element of support. In Malawi,[100] 85% of the labour force is involved in agriculture. The first democratically elected government of 1994 set about transforming this sector through the Smallholder Agribusiness Development Project. This allowed smallholders to collectively address transport, storage and marketing of their crops.

Curitiba's transformation

In the 1970s and 1980s, under the enlightened administration of Mayor Jaime Lerner, many progressive projects were introduced in the city of Curitiba, Brazil (population two million) around transport, food, health and pollution. At the time, food security, disease and rubbish collection were major issues.

Community gardens

Some 980 community gardens were established in Curitiba. These gardens were especially successful in providing work and income for people who had been pushed out of the countryside and into the city because of economic considerations and who, upon arrival, struggled to find suitable work. These people hold a wealth of agricultural knowledge that has been applied to growing food in the city. With increased production many innovations around food security have been implemented.

Rubbish clearance

In exchange for rubbish, people receive food, good quality excess staples such as corn bought from local farmers that would otherwise be ploughed under. Approximately 200 kg of trash can be exchanged for 10 kg of food. This programme was implemented in slum areas located far from town centres and without rubbish collection services. Anybody can be a collector with a truck coming to the communities every 15 days to collect rubbish followed by another truck delivering food. Now that rubbish is collected and recycled, disease rates have dropped because of the cleaner environment, people have more food and farmers have more options to market their produce.

Subsidised supplies

The city has also set up subsidised grocery stores where low-income households can buy good quality staple foods at wholesale prices. The produce is purchased in bulk by the municipality who is also responsible for strict quality control. The shops are placed on 'citizenship streets', suburban centres where government services, banking, training advice, small-business support, etc are easily accessed after it was identified that these services, like food, were difficult for people in poorer communities to access.

Citizenship streets

At present there are nine 'citizenship streets'. To access these services, citizens are assessed by local social workers to determine eligibility, which is usually based on family earnings. There is also a limit on produce per family, which prevents people from selling on the cheap produce for a profit. Community workers say Curitiba is not rich, but people are committed to building a fair and environmentally sustainable community and that creativity, not money, has been the key to doing it. Curitiba's programmes have become models for other cities: 'Plant it in Curitiba and it grows!'

Many rural communities in South Africa could be harnessed to augment the country's food production if cooperative transport were available to collect and purchase crops on a regular basis.

Linda Nghatsane, 2007 Shoprite Checkers/ SABC 2 Woman of the Year (see inset), clearly demonstrates that with determination and drive, it is possible to develop a solid business in agriculture while addressing job creation for local people.

Curitiba's[101] innovations with regard to market gardening, making fruit and vegetables available to the poor at reduced rates, or in return for cleaning and other services, also needs to be considered. (See inset.)

A further problem besetting the potential to earn from agriculture is the availability of land and, in some cases, the issue of land tenure.

Clearly, expertise in this sector is required at a strategic level to determine suitable solutions for each municipality, including not only crop production, but legal, land and commercial issues. People such as Linda Nghatsane should be harnessed by the Department of Agriculture and should be funded to form NGOs to share their models and expertise in other municipalities and even other provinces, and act as advisors for many more such ventures.

It goes without saying that road networks and transport systems must be in place to allow income to be earned from increased production.

(i) Mining

Mining is another area that could offer significant job creation opportunities, not only by increasing capacity in the formal sector, but by helping with SMME development.

Many mines that were established by the big mining houses are no longer economically viable when using expensive processes. These lend themselves to SMME development, employing cheaper, often labour-based extraction techniques.

Furthermore, many small deposits or outcrops offer acceptable yields provided that overheads are modest, for example the small gold mining projects in the Giyani and Murchison sequence greenstone areas.

Quarrying and the production of stone for the building industry also offer job opportunities throughout the country.

Once again, local transport networks are essential for these commodities to find their way to end users.

6.10.3 The bottlenecks

Whilst all the above sound like simple, common-sense options for job creation, implementation is not that simple.

(a) Infrastructure

In all cases, infrastructure, particularly economic infrastructure, has been identified as the key to success. We must however remind ourselves of the fundamental problem that is the basis of this book – the shortage of experienced civil engineering professionals and funding directed at developing, operating and maintaining municipal infrastructure – bottlenecks that must be addressed to increase LED opportunities.

(b) Expertise

The other bottleneck is expertise. Each of these areas requires specialist skills. On the whole, municipalities are dabbling in many areas in which they do not have expertise. Such activities either require the appointment of additional staff or harnessing of consultants or NGOs with appropriate expertise.

These activities will not earn the municipality increased funds, but rather favour communities, thus there will be little income to offset the increased cost of municipal staff employed to address LED.

In the Philippines,[102] the dynamic mayor of Cebu developed a set of interlinked partnerships with NGOs, CBOs and the private sector to assist with addressing urban poverty. Implementation of this approach has achieved remarkable results.

Our own Municipal Systems Act, 2000 (Act 32 of 2000) states that:

> *Local government is not directly responsible for job creation. Rather, it is responsible for taking active steps to ensure that the overall economic and social conditions of the locality are conducive to the creation of employment opportunities.*

In looking at all the areas covered, it would seem sensible to set up expert teams in each national and provincial sector department to analyse local economic opportunities specific to their sector in order to assist communities in developing their full potential.

Typically, the Department of Agriculture, with its network of extension officers, should be harnessed to assist with agricultural development, the Department of Trade and Industry (DTI) to assist with the development of retail centres, the Department of Environmental Affairs and Tourism (DEAT) to increase tourist potential, the Department of Sport and Recreation to develop sport and recreation attractions, and the Department of Minerals and Energy (DME) to develop mining and quarrying opportunities.

The dedicated MIG unit in the **dplg** has taken just three years to get most municipalities educated on and aligned with their guidelines and development objectives. Similar grants

and national and provincial capacity should be made available by each of the sector departments to address the development of job creation in their sectors.

Other departments that should be driving initiatives include the IDT and the Department of Social Development with their Poverty Programme. The SETAs should of course be closely involved to provide the training required in each of the fields outlined.

LED has been added to the ever growing list of local government responsibilities. In accordance with good practice in the private sector, municipalities should focus on their core business, namely to provide infrastructure in support of LED, rather than try to develop local businesses themselves.

(c) Sounding the rally cry

Vision and energy are needed to drive LED. Although as outlined in the previous section, expertise should largely be sourced externally the need to lead and coordinate is crucial. This again is a stumbling block owing to limited in-house capacity. The success stories outlined above materialised largely as a result of private sector involvement. Sector departments should be working closely with experts in the private sector to drive LED.

In the late 1990s Washington DC engaged in a massive effort to create a strategic economic development plan. They learnt the following lessons during the exercise:[103]

- Think positive – provide people with a positive vision for the future
- Involve everyone – leaders, communities and expert teams
- Take action and produce results – 'Just Do It'
- Build on fundamentals
- Grow the private sector
- Link business and job growth to neighbourhood stabilisation and community reinvestment

All need to be involved in LED, not just the LED appointee in local government!

CONCLUSIONS

The range of solutions and innovations outlined above highlight the creativity and resilience of those who call themselves South Africans. However, without engineering skills and experience, innovation in service delivery is unlikely.

Sector infrastructure departments have a role to play in scanning for innovative solutions, both locally and across the globe, and in creating enabling conditions for their adoption. This may involve changes to legislation, guidelines and education.

Local government leadership must bite the bullet and take a firm hand on the issue of losses and debts. Many municipalities are potentially viable structures that are struggling financially for no other reason than lack of control.

In terms of local economic development, the range of opportunities is endless. However, the expertise to initiate lies with national sector departments and to support implementation lies with the private sector, both of which should be harnessed to expand the business of local government.

LED support will only be meaningful if local government infrastructure is adequate.

RECOMMENDATIONS

Recommendations cover the four main aspects of this chapter, as follows:

Improved technical solutions

- **Best practice and lessons learnt**
  Several case studies have been carried out by WIN-SA and others on successful and in many instances innovative solutions that have been adopted. A major campaign should be mounted to gather as many good practices as possible in all disciplines and to distribute them to all technical staff in local government and to all consulting firms working in the sector.
- **MIG to offer guidelines**
  Where innovative solutions are approved or are preferred by sector departments, such details should be included in the annual MIG guidelines to ensure good practice in service delivery.
- **Better use of resources**
  Use of alternative energy, recycling, biofuels and many other innovations need to be refined and adopted as national norms. Recycling in particular is largely a matter of education and should urgently be addressed.

Revenue enhancement and efficiency

So much money is being left on the table that revenue enhancement initiatives should be mounted in each and every municipality.

- **Seed money for water demand management**
  A revolving fund should be made available for municipalities to initiate activities such as:
  - Loss assessments and rectification
  - Setting up call centres
  - Driving debt collection and adjusting tariffs
- **A grant to address traffic bottlenecks**
  The cost to the country of current bottlenecks is enormous. The appointment of traffic and transport planners is essential nationwide to ensure smoother traffic flow. A grant spanning two or three years should be considered for the larger centre to address the current gridlock.
- **A grant to address recycling**
  Clearly, recycling processing and education are critical to the long-term wellbeing of the country. A national campaign needs to be put in place.
- **Determining optimum dry sanitation solutions**
  Although there are numerous solutions involving dry sanitation, several appear to be unsustainable. Research should be carried out to determine which solutions offer the best return on investment and national guidelines should be published to root out past bad practice.
- **Uniform national by-laws**
  Few municipalities have developed (in the case of new infrastructure) or updated (in the case of existing structure) their by-laws for many years. The duplication of effort seems unnecessary. A comprehensive set of general by-laws should be issued to all municipalities to customise as required.
- **Accessing grants**
  It may appear that there are too many instances of municipalities pleading poverty or of more grants being called for, at a time when municipalities are not accessing existing grants. Whilst the DORA clearly articulates the many grants, guidelines and access to all except MIG seem to be a mystery. A national, easy-to-use website that lists all grants,

together with standard-format business plans, application forms and procedures, needs to be set up.

Job creation

The success of the ENERGYS team in assisting small businesses to get off the ground should be expanded by appointing a team of retired staff to specifically explore and develop such opportunities.

Local economic development

Local economic development grants should be made available for each sector department able to develop projects within the ambit of their specific expertise.

NOTES

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Source for figures and table

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PART IV
CONCLUSIONS

Contents

CHAPTER 7

Numbers and needs

7.1 INTRODUCTION

It is clear from the preceding chapters that many of the new approaches to local government have not been as successful as envisaged. There is a tendency to copy what is done elsewhere in the world, whether relevant or not. Indeed, many decisions are founded on the mere fact that they follow modern international thinking. Sadly, many modern approaches have failed the world over, as outlined in examples throughout this book.

Internationally, infrastructure is failing owing to lack of maintenance expenditure and the trend to reduce the number of technical professionals taking care of infrastructure in the public sector. Interestingly, a large survey carried out in the USA to probe for the most significant challenges that will face the civil engineering profession by 2025, yielded the following results, ranked in order of seriousness with 1 being the most serious:

1. Maintenance of existing infrastructure
2. Dealing with natural disasters
3. Having an adequate number of civil engineers involved in the decision making process for infrastructure
4. The importance of the engineering licence in the practice of civil engineering
5. Engineering ethics and business practice ethics

We need to be looking at our own challenges, and designing our own solutions. There is a desperate need for more technical staff in local government to attend to all aspects of municipal engineering.

Indeed, in developing the *Guidelines for infrastructure asset management in local government*,[1] in preparation for the Government-wide Immovable Asset Management Act (GIAMA), to be enacted shortly, it was recognised that one of the challenges to progress in this area will be the lack of staff with the appropriate skills and time to attend to these assessments since they have so much on their plates already.

It is now necessary to consider the number and mix of civil engineering professionals required in local government. Various problems related to quality and non-delivery in every sector are a clear indication that the problem is very complex, that there is a definite shortage and the load being carried by those remaining in office is unsustainable. In addition, there is much pressure on local government to transform as fast as possible.

Whilst manpower planning is frowned upon since it has the tendency of developing too many candidates for a particular field, local government is now so short of experienced civil professionals that it is essential to put mechanisms in place to start addressing shortages. Without a supply of quality professionals, South Africa cannot hope to deliver and maintain the MDG at the current pace of progress.

7.2 VACANCIES

Research carried out in 2004 and 2005 indicated that there were 83 municipalities with no civil engineering professionals at all whilst the rest indicated that they were suffering from vacancies against their existing organograms of the order of 40% to 60%. The

What's happened to the future? Let's start thinking long term

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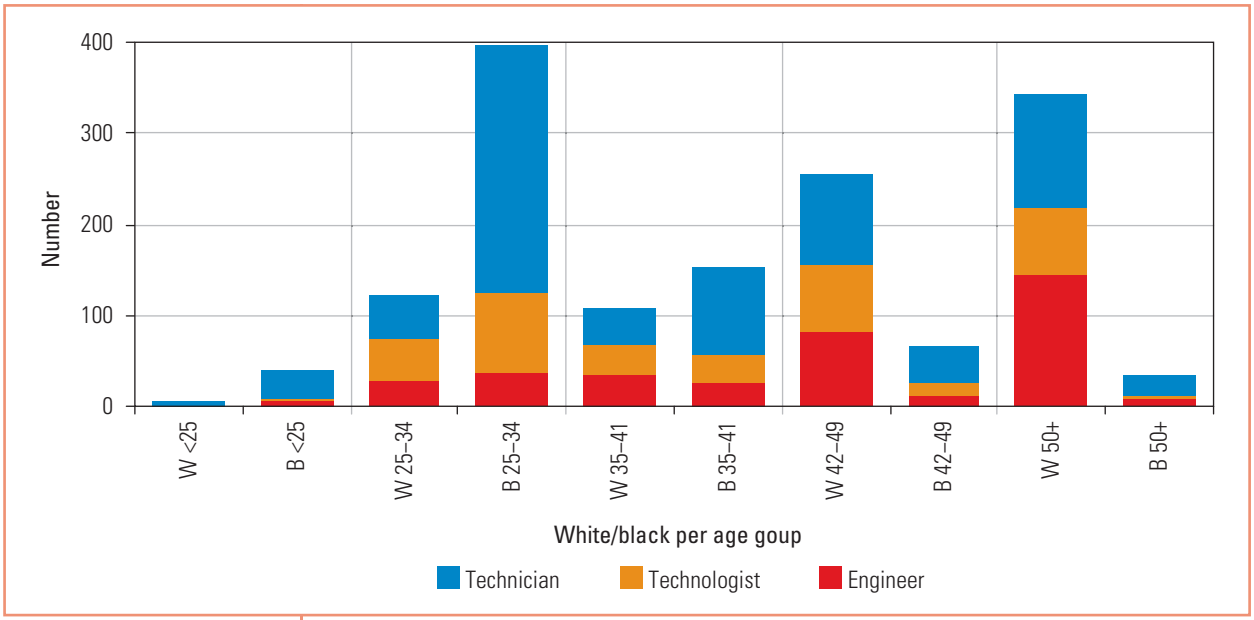


Figure 7.1 Civil engineering staff in local government, April 2005

demographics are shown in Figure 7.1. Based on these figures, it would seem that approximately 1 000 civil engineering professionals would be required. Subsequent to this research, losses have continued, as indicated in previous chapters.

Using the formulae given in Chapter 5, considering only household needs, and using a figure of 12 million households, suggests that the country needs at least 2 400 civil engineering professionals. If one were to make adjustments for urbanisation, the additional load of servicing non-residential properties and coping with vast areas would seem to suggest that a total of 2 500 to 3 000 would be more appropriate.

7.3 HOW MANY NEEDED?

In order to determine whether the numbers suggested by organograms (and assuming the associated vacancies) are realistic, it is necessary to look at the functions to be performed per sector, the extent and type of services nationally, rule-of-thumb guidelines of capacity needed per service, and international benchmarks.

7.3.1 The technical services director

As previously outlined, in all but the smallest of municipalities a civil engineering professional is required to attend to day-to-day activities. In municipalities of 10 000 households or thereabout the technical director would be devoted to running the technical department and working at strategic level, which means that some 200 civil professionals are required to fill these posts plus a further 100 assistant directors for the bigger centres.

7.3.2 Project management

In terms of project management alone, it has been found that at least one civil professional is required to manage per R30 million to R40 million worth of projects at today's prices. The 2006 MIG budget of R6,6 billion therefore required PMUs to have more than 200 technical staff for works funded by MIG capital. Additional capacity would be required for capital projects associated with other subsidies, own funding, loans and other sources of

funding, including donations. According to National Treasury figures, the value of capital projects over and above MIG and excluding electricity and specialised vehicles, was of the order of R15 million in 2005/2006, indicating the need for a further 400 to 500 staff. At the current rate of development, some 700 project staff are therefore required in local government to take care of all projects.

(a) Backlogs

In going forward, it is important to note that existing backlogs related to the MDG are massive. Significantly extended teams and funding will be required to meet the targets.

7.3.3 Initiating projects – forward and detail planning, scoping, evaluation and adjudication

Clearly, in all but the smallest of municipalities, at least one technical person per municipality is required to initiate projects. Metros and large municipalities have dedicated planning and design departments. Thus, at least 200 to 300 civil professionals would be required to handle these aspects of the project cycle. In very small municipalities this function would possibly fall to the technical services director.

7.3.4 Traffic and transport planning and management

The *South African road traffic signs manual*[2] recommends the number of engineers, technologists and technicians required to manage traffic signs. Based on the present number of traffic lights in local government (approximately 14 000), 220 civil professionals are required to address this vexing challenge.

Planning is another important aspect of traffic management. Metros and large cities require at least one dedicated in-house person to plan and manage service providers appointed to assist with planning. Districts also have a role to play in regional planning and hence additional planners are required for each district. This suggests that at least 60 to 70 dedicated planners are required.

As an aside, the *South African road traffic signs manual* also indicates that some 220 electrical and electronic personnel are required to maintain traffic lights – a number well beyond current capacity, which explains the abundance of failed traffic lights.

7.3.5 Operations and maintenance

Operations and maintenance (O&M) have been neglected so badly that it has turned into something of a nightmare.

Rules of thumb offered by 'wise old men' suggest that the number of civil professionals required to manage water and sanitation networks is of the order of one civil professional per 600 to 800 km of water pipes and one per 800 to 1 000 km of sewer pipes. A rough estimate arrived at national totals of 400 000 km of water pipes and 300 000 to 350 000 km of sewer pipes. In addition, staff are needed to manage some 2 500 to 3 000 water and waste water treatment works nationwide. Realistically, in large centres one civil engineering professional cannot manage more than seven to ten works. Thus at least 650 and 450 civil engineering staff are required to manage water and sanitation infrastructure respectively. The current numbers in service are significantly lower than this (the total of 1 100 being only slightly less than the entire complement of civil engineering staff currently employed in local government), which explains to some extent the poor service levels described in earlier chapters.

Table 7.1 Civil engineering staff per function required in local government against 2005/2006 expenditure

Service/activity	Number required
Technical directors and assistant directors	**300**
Planning and new works	
Planning, scoping, evaluation and adjudication	200
Project management	700
Traffic and transport planning and management	
Traffic and transport planning	60
Traffic signals	220
Operations and maintenance	
Roads and stormwater	400
Water distribution and treatment	650
Sanitation conveyance and treatment	450
Minimum total: civil engineering staff required in local government (Estimated number of civil engineering staff employed in October 2007)	**2 980** (~1 300)

Road norms and standards have not been that easy to come by, but suggestions have been made by various maintenance contractors and provinces that one civil staff member is required to manage the maintenance of every 400 to 500 km of surfaced roads or 800 km of unsurfaced roads. There are some 68 000 km of surfaced roads and 100 000[3] km of gravel roads in local government. Furthermore, there are thousands of kilometres of unproclaimed roads that need attention from time to time. It is suggested that one person per 3 000 to 5 000 km would be adequate for unproclaimed roads. This suggests that at least 350 civil engineering staff are required to manage contractors to whom road maintenance has been outsourced. Municipalities with in-house maintenance crews would require more hands-on management, so an additional allowance of 50 civil engineering staff is included in the summary, bringing the total for roads and stormwater management to 400.

The overall estimates of civil staff required for our towns and cities are given in Table 7.1. In the absence of detailed research, these represent a rough estimate of the extent of each service and the number of civil professionals needed.

(a) Rehabilitation

The neglect and failing infrastructure that have resulted from the lack of skills and investment in O&M will require additional funds and skills to rehabilitate.

7.3.6 The overall effect

Considering the current rate of development, the above figures suggest that at least 3 000 civil engineering staff are needed for civil engineering infrastructure – a figure of just over 6 per 100 000 population. If one were to include civil staff involved in housing, municipal buildings, amenities, dry sanitation and solid waste, the target should possibly be 7 to 8 per 100 000 population.

(a) Increased workload

National sector departments are currently expressing concern over the rate of delivery in terms of the MDG. DWAF recently announced that current efforts would need to be trebled in order to achieve the targets in the required time. DOH is also lamenting the slow rate of delivery whilst transport networks continue to present a challenge.

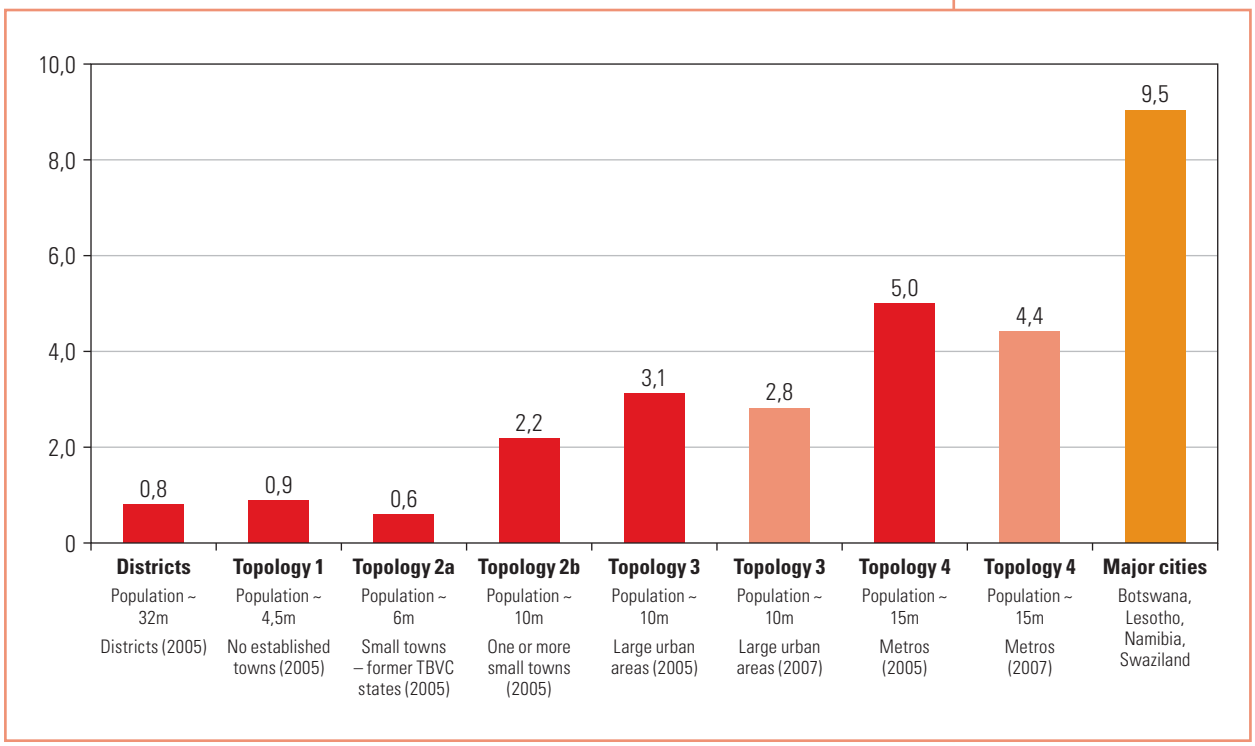
In his budget speech of March 2007, the Minister of Finance allocated a significant increase towards infrastructure development. Whilst this addresses the issue of funding, it does not address capacity constraints. Significantly more civil engineering staff will be required to spend this allocation, and future allocations if the rate of development must double or treble.

Furthermore, as more infrastructure is rolled out, the O&M burden will increase, requiring yet more staff within local government. This increased workload seems to imply that a higher ratio must be planned for in the short to medium term. Whilst a target of six would be a good starting point, a target of nine or ten should be set for the medium term.

Clearly, the current number of 1 400 civil engineering professionals, or two to three per 100 000 population in local government, is totally inadequate.

In Figure 7.2 the breakdown of these numbers is stratified further by topology regimes defined by the Municipal Demarcation Board. Sadly, it is the very people who most desperately require the support of civil engineering skills who fare worst in the analysis – generally, the poorest of the poor, in dispersed rural communities and small towns in the former TBVC states. It is also concerning to note the very low numbers in the districts, which confirms their weakness once again and supports suggestions for disbanding or repackaging district services.

Figure 7.2 Civil engineering staff per 100 000 population in various municipal structures



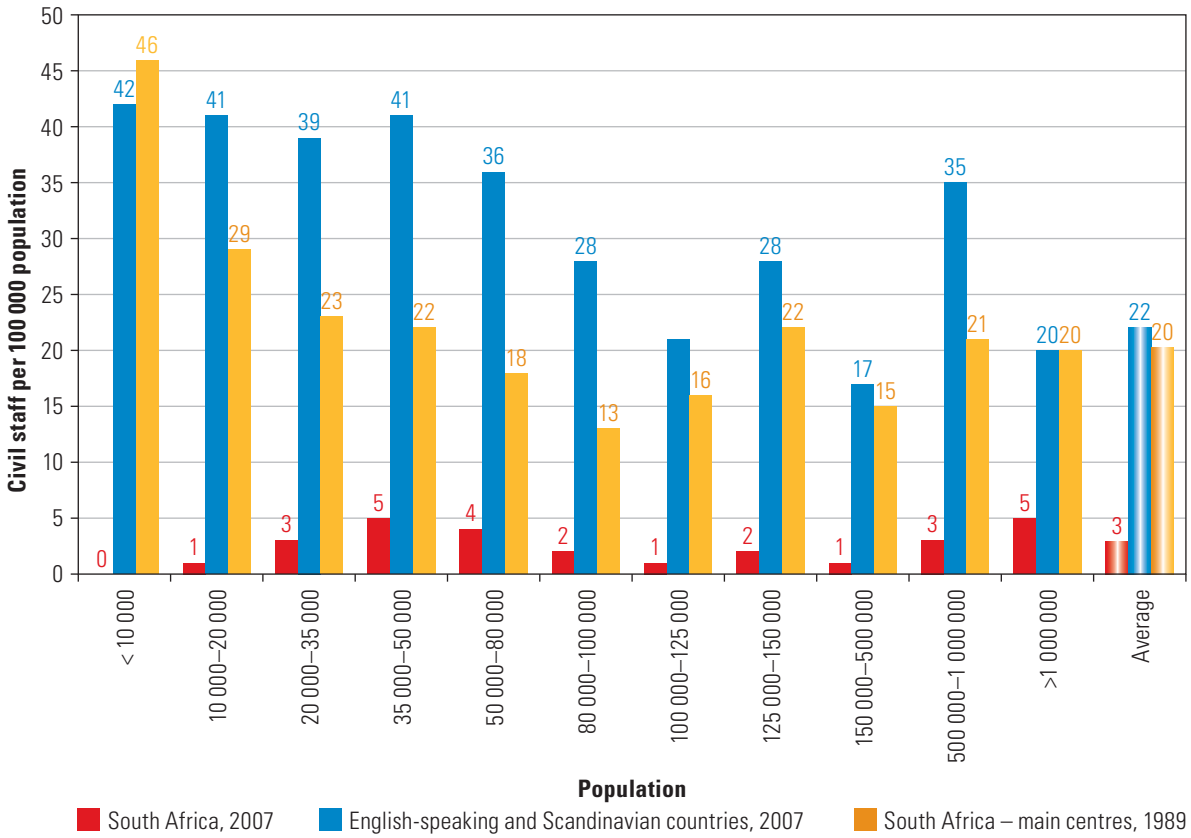


Figure 7.3 English-speaking and Scandinavian versus South African municipalities: civil staff per 100 000 population

The ratios in the larger municipalities are also low considering the complexity of work and the burgeoning demand to deliver new services. Surprisingly, current numbers lag behind those of municipalities contacted in neighbouring states.

We should not however be content with achieving African norms, but should set our sights on those of the developed world in order to support our strong and growing economy.

7.3.7 International benchmarks

To arrive at an understanding of international norms, data was collected from many centres in the north Americas, UK, Europe, Australia and New Zealand. Small, medium and global cities that responded ranged in size from a small Swedish town with a population of 9 500 population to San Francisco that is home to seven million.

The following information was requested:

- Population served
- Number of households
- Number of qualified engineers
- Number of qualified technicians/technologists
- Designs handled internally or externally (%)
- Construction handled internally or externally (%)
- Forward planning handled internally or externally (%)

- Maintenance of water treatment works handled internally or externally (%)
- Maintenance of sanitation treatment works handled internally or externally (%)
- Maintenance of water distribution networks handled internally or externally (%)
- Maintenance of sanitation collection networks handled internally or externally (%)
- Maintenance of streets and roads handled internally or externally (%)

In the larger cities the number of civil engineering staff per 100 000 population ranged from 15 to 35, depending on the percentage of outsourcing (see Figure 7.3). Interestingly, even in big cities where major services are outsourced, a large contingent of senior strategic, planning and management staff are employed.

Auckland City (as opposed to Greater Auckland) is home to 500 000 and has a civil engineering staff of 175. The city boasts 15 civil staff involved in transport, strategy and policy, as well as numerous engineers involved in policy and regulation in other disciplines over and above those involved in projects and O&M. It was curious to find that there are more civil engineers looking after infrastructure in their zoo than there are in 243 (that is, 86%) of all South African municipalities! Another amazing finding was that San Francisco, with a population of around seven million, employs as many engineering staff as the whole of local government in South Africa.

In small centres it was found that the number of civil engineering staff as a whole ranged from 20 to 58 per 100 000. The higher figures were found in countryside municipalities where the bulk of functions were handled in house. Lower figures were found where service providers carried out design and construction functions. Few small centres outsourced O&M. It is interesting to note that where big cities also provided details of the utilities responsible for operating services, a further 20 to 30 staff were employed per 100 000 population, taking the total to some 35 to 65, which resembles the profile for small towns where much of the work is carried out by in-house staff.

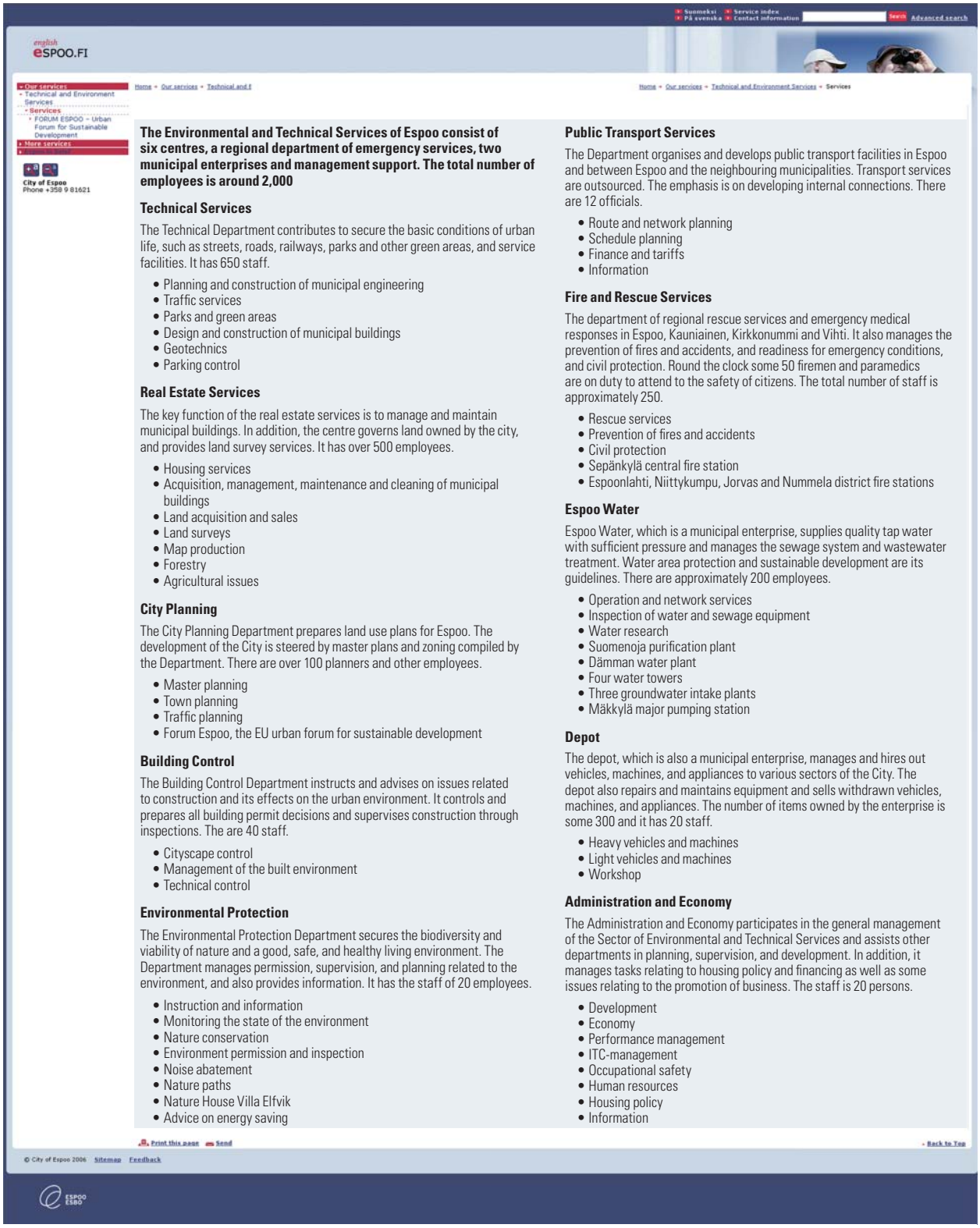
The neatest local government website visited, that of Espoo in Finland, captured all the roles of technical departments, as shown in Figure 7.4.[4] The total population of Espoo is 235 000 and the total number of staff in civil engineering-related departments alone is 2 000, which is significantly more than would be found in total in any present-day South African town or city of similar size.

The trends evident from the international models reflect those in established South African centres in the mid to late 1980s, with smaller towns boasting more capacity per 100 000 than larger centres. The numbers then being considerably closer to international figures, would explain how the level of infrastructure of that era was achieved. It is therefore quite unrealistic for us to expect the current two to three civil engineering staff per 100 000 to achieve all our targets.

Whilst it is recognised that 21st century technology should be harnessed to streamline processes and operations and minimise maintenance, various activities should be outsourced, and the private and third sector should be involved as much as possible, capacity constraints abound in all sectors and strategic direction and control should remain within each municipality. If we are going to take service delivery seriously, civil engineering capacity in local government must be rebuilt to some extent!

Adopting a model of 5 to 8 civil professionals per 100 000 seems somewhat modest against the figures found elsewhere in the world, but would nevertheless require 2 700 to 3 700 civil staff – a significant increase compared with current numbers.

Before looking at ideas to achieve this increase, it is necessary to look at current staff movements.



The Environmental and Technical Services of Espoo consist of six centres, a regional department of emergency services, two municipal enterprises and management support. The total number of employees is around 2,000

Technical Services

The Technical Department contributes to secure the basic conditions of urban life, such as streets, roads, railways, parks and other green areas, and service facilities. It has 650 staff.

- Planning and construction of municipal engineering
- Traffic services
- Parks and green areas
- Design and construction of municipal buildings
- Geotechnics
- Parking control

Real Estate Services

The key function of the real estate services is to manage and maintain municipal buildings. In addition, the centre governs land owned by the city, and provides land survey services. It has over 500 employees.

- Housing services
- Acquisition, management, maintenance and cleaning of municipal buildings
- Land acquisition and sales
- Land surveys
- Map production
- Forestry
- Agricultural issues

City Planning

The City Planning Department prepares land use plans for Espoo. The development of the City is steered by master plans and zoning compiled by the Department. There are over 100 planners and other employees.

- Master planning
- Town planning
- Traffic planning
- Forum Espoo, the EU urban forum for sustainable development

Building Control

The Building Control Department instructs and advises on issues related to construction and its effects on the urban environment. It controls and prepares all building permit decisions and supervises construction through inspections. The are 40 staff.

- Cityscape control
- Management of the built environment
- Technical control

Environmental Protection

The Environmental Protection Department secures the biodiversity and viability of nature and a good, safe, and healthy living environment. The Department manages permission, supervision, and planning related to the environment, and also provides information. It has the staff of 20 employees.

- Instruction and information
- Monitoring the state of the environment
- Nature conservation
- Environment permission and inspection
- Noise abatement
- Nature paths
- Nature House Villa Elfvik
- Advice on energy saving

Public Transport Services

The Department organises and develops public transport facilities in Espoo and between Espoo and the neighbouring municipalities. Transport services are outsourced. The emphasis is on developing internal connections. There are 12 officials.

- Route and network planning
- Schedule planning
- Finance and tariffs
- Information

Fire and Rescue Services

The department of regional rescue services and emergency medical responses in Espoo, Kauniainen, Kirkkonummi and Vihti. It also manages the prevention of fires and accidents, and readiness for emergency conditions, and civil protection. Round the clock some 50 firemen and paramedics are on duty to attend to the safety of citizens. The total number of staff is approximately 250.

- Rescue services
- Prevention of fires and accidents
- Civil protection
- Sepänkylä central fire station
- Espoonlahti, Niittykumpu, Jorvas and Nummela district fire stations

Espoo Water

Espoo Water, which is a municipal enterprise, supplies quality tap water with sufficient pressure and manages the sewage system and wastewater treatment. Water area protection and sustainable development are its guidelines. There are approximately 200 employees.

- Operation and network services
- Inspection of water and sewage equipment
- Water research
- Suomenoja purification plant
- Dämman water plant
- Four water towers
- Three groundwater intake plants
- Mäkkylä major pumping station

Depot

The depot, which is also a municipal enterprise, manages and hires out vehicles, machines, and appliances to various sectors of the City. The depot also repairs and maintains equipment and sells withdrawn vehicles, machines, and appliances. The number of items owned by the enterprise is some 300 and it has 20 staff.

- Heavy vehicles and machines
- Light vehicles and machines
- Workshop

Administration and Economy

The Administration and Economy participates in the general management of the Sector of Environmental and Technical Services and assists other departments in planning, supervision, and development. In addition, it manages tasks relating to housing policy and financing as well as some issues relating to the promotion of business. The staff is 20 persons.

- Development
- Economy
- Performance management
- ITC-management
- Occupational safety
- Human resources
- Housing policy
- Information

Figure 7.4 Extract from the website of the technical services department of Espoo municipality, Finland

7.4 STAFF MOVEMENTS

7.4.1 Gains

Research carried out early in 2007 indicated that:

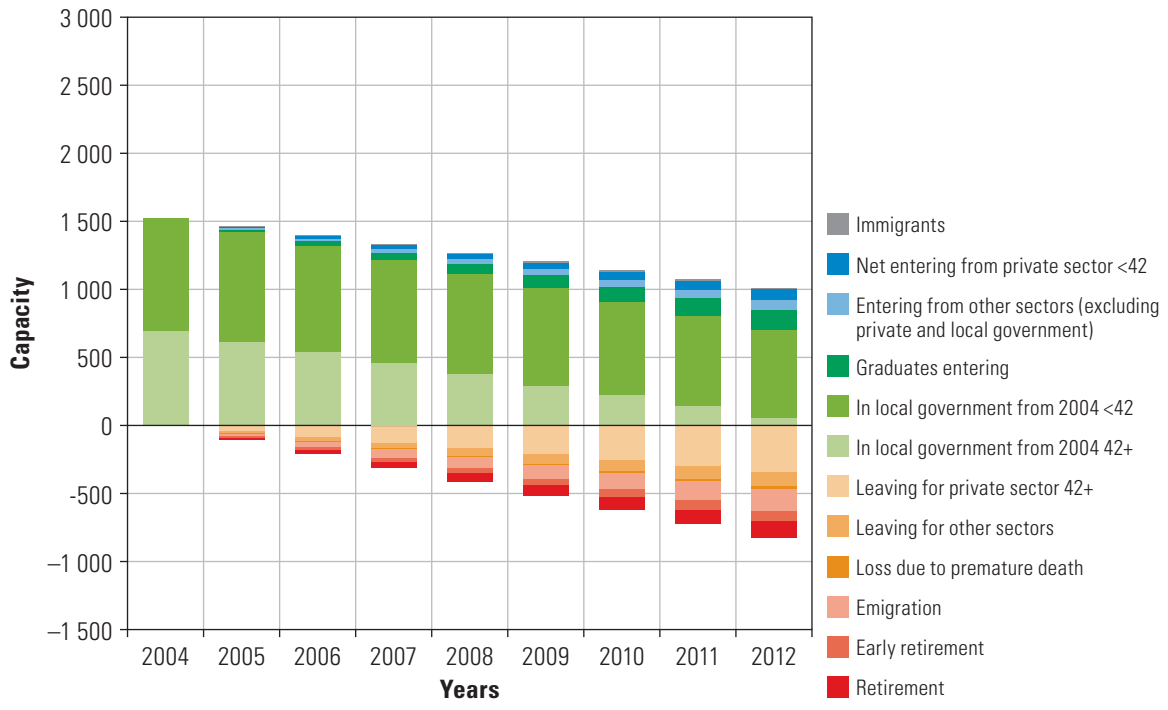
- Few university qualified civil engineering graduates enter local government upon completion of their tertiary studies unless they have municipal bursaries. Being so short staffed, local government advertisements generally call for a minimum of five years' experience
- Only some metros and a handful of large municipalities offer bursaries in the field of civil engineering
- Each year some 110 civil staff take up positions in local government
- Few staff enter local government for the first time after the age of 28. Employment equity is a limiting factor to employing experienced staff
- Fifty per cent of staff movement into local government involves young, mostly African technicians who have worked in the private sector for a short period
- The average number of years of experience in local government of all new appointments in the past two years was 2,2 years

7.4.2 Losses

Losses have continued unabated for many years and initially resulted from amalgamations and restructuring. But, even with amalgamations and restructuring out of the way, they continue!

- Some 190 civil staff vacate their posts annually – a turnover of roughly 12%
- The average number of years of experience in local government of those leaving permanently is close to 17 years

Figure 7.5 Civil engineering staff projections – 'do nothing' approach



- The net staff loss per annum is around 80

Whilst this number was determined as the average movement from data received for the last two and a half years, if one considers that there were at least 2 500 in the system at the end of the eighties, the average loss over 17 years is around 70 per annum. With such low numbers already in the system, this continuous bleeding does not augur well for long-term capacity. (Figure 7.5 shows movements of those younger and older than 42 to various sectors.)

The reasons cited for leaving include early retirement, retirement, frustration, the lure of the private sector and emigration, all of which will be discussed below.

(a) Early retirement

As mentioned before, the phenomenon of early retirement continues. In the interests of short-term savings and to make way for transformation, senior public sector staff are encouraged to take early retirement at age 55 and several senior staff have indeed accepted this offer over the past 12 months.

As outlined in Chapter 5, this approach is not unique to South Africa. Unfortunately we have not learnt from those who have come to recognise the folly of this approach. Netherlands-based multi-national transformation and team building specialist, Willem de Liefde explains:

> *Young people with more up-to date knowledge replace those with 'old knowledge'. This creates a pattern of forcing people out of the system … In this approach work experience and wisdom are undervalued and the accumulated knowledge of the collective is lost. Such a policy results in a climate … of distrust and fear about social security. Authentic knowledge and experience is needed to inspire young people.*

Reading the testimonials from young people on the ENERGYS programme, many have been inspired by those with knowledge.

On the other side of the Atlantic, in an article headed, 'The quiet crisis in municipal engineering', Arthur Dukur stated the following with reference to municipal engineering in the USA:

> *The out-of-balance workforce in municipal agencies is more than a product of demographics, however. In California, many public agencies encourage retirement after 30-plus years with attractive pension programs that make it financially desirable to leave an agency. Public agencies – like many private sector counterparts – have been weak in leadership transition to grow the next generation of public workforce leaders. At a recent League of California Cities leadership seminar, participants identified a number of barriers to hiring qualified managers to replace those who are choosing early retirement, including*
>
> - *few incentives to move up*
> - *lack of succession planning programs*
> - *civil service restrictions on designating heirs apparent.*

When HR was the domain of sector departments, the undocumented but well-understood system of training young people and allowing them to grow into positions was in place. As outlined in Chapter 5 we are now in the same position as the public sector in the USA, where one can only progress up the system by moving from one post to another. A major rethink on career pathing and early retirement is urgently required.

(b) Retirement

The aging workforce problem is well known and has been covered in Chapter 5. Most of the senior staff in local government are now over 55 and will be leaving in the next five years. The US experience is no different.

Recognising the age wave, many European countries are now considering extending the retirement age. Germany (who invented retirement in the first place), is proposing a six-year extension. The Germans were also the pioneers in tapping into the wisdom of their seniors when they set up their Senior Experten Service in 1983.[5] This organisation makes seniors available primarily for capacity development and to help organisations with strategic and system development.

Similar structures exist in the USA, Canada and Australia. (See details of the Senior Corps Tech Center on **http://www.seniortechcenter.org/tech_planning/**)

In the UK, a retirement age of 72 has been suggested! Whilst this may seem excessive, South Africa should consider a three- to five- year extension for the next few years. Instead of talking about early retirement, a new offer, the 'late retirement' package, needs to be initiated.

(c) Frustration

Frustrations of staff at all levels have already been discussed and should never be underestimated. Much more decisive delegation of duties with the commensurate authority, is required to motivate technical staff.

(d) The lure of the private sector

The skills demand exists in all sectors. The construction sector with its challenges to complete 2010 work on time and with no penalties, and the business sector desperately short of experienced managers to cope with growth are offering huge salaries. Indeed, a recent survey found that experienced managers in South Africa were now earning the highest disposal income in the developed world![6]

(e) Emigration

Frustrated, being encouraged to take early retirement, and being undervalued and underpaid are the reasons public sector staff heed the calls from foreign public sector organisations. After years in local government many prefer to remain in the public sector and move abroad, rather than move to the private sector and stay in South Africa, although their overall preference would be to stay here. Recently emigration across all racial groups has become evident.

The large overseas salaries offered abroad entice our best staff. South Africa has lost many experienced staff to Canada, Australia and New Zealand. However, a new competitor for our staff emerged as a result of the 2012 Olympics being awarded to London; salaries of £75 000[7] to £100 000 plus car and benefits for civil engineering project managers are adding pressure in terms of retention of our civil engineering capacity.

7.4.3 Staff movements

(a) Job hopping

Some 60 of the 110 taking up positions annually are staff moving within the local government sector – the 'job hoppers'. A few move as a result of the expiry of their contracts, and the balance move to take up more senior positions, often beyond the level of their experience.

(b) Contract appointments (Section 57)

To ensure quality and performance, senior staff in all departments are, according to Section 57 of the Municipal Systems Act, appointed on contract. There are downsides to this:

- To ensure that their contracts are renewed, many contract employees do not apply their skills objectively in the face of conflict, but rather comply with the wishes of their 'masters', to the detriment of sustainable service delivery
- Although many incumbents perform well, the temptation exists not to renew their contracts in the hope that next time around 'better' applicants will be found!

South Africa, wake up – we are so short of experienced civil engineering staff that a good performer must be kept at all costs!

7.4.4 The net effect

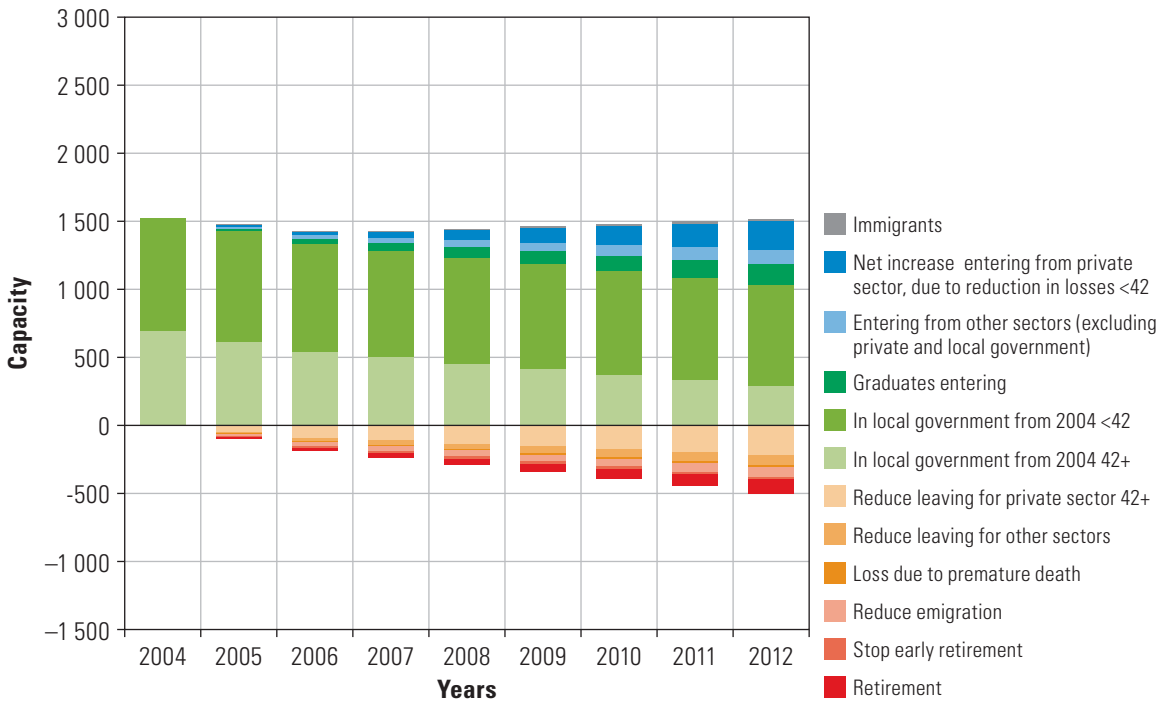
Figure 7.5 showed the civil engineering employment profile in 2005, with future projections based on the changes seen over the past two and a half years.

Looking at the inflow and outflow and assuming that no interventions are put in place, there will be a continual loss of experience until the collective understanding of infrastructure delivery processes will be totally inadequate in all but (perhaps) a few centres.

7.5 THE NUMBERS TO BE ATTRACTED AND RETAINED

Assuming that we are trying to build the municipal workforce up to 2 700 civil engineers, technologists and technicians (that is, 6 per 100 000 population), a number of actions will be required.

Figure 7.6 Civil engineering staff projections – 'reduce losses' approach



7.5.1 Addressing losses

Figure 7.6 shows the effect of tackling the losses. It is essential that the tides of emigration, those leaving the sector, contract terminations and early retirement be stemmed.

It is assumed that early retirements would be halted for the next five years, emigration halved and that the number leaving the sector can be halved, thereby reducing losses. This will stabilise numbers but will not build capacity.

7.5.2 Attracting all

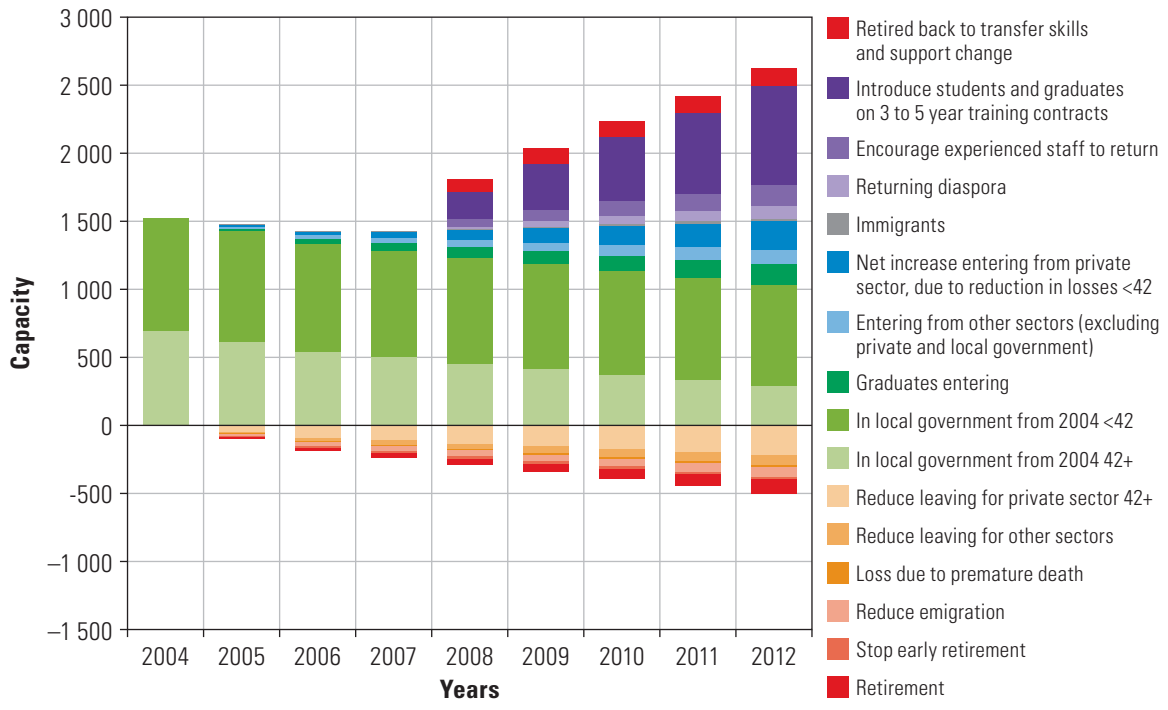
Figure 7.7 shows the increases necessary to attain 2 700 or more in the next five years. This comprises taking on many more technician and engineering graduates under supervision (and expanding this stream through offering more bursaries); encouraging those who have left to return; encouraging retired municipal and contracts managers to assist with project management; and making local government a career of choice, even for senior engineers who by virtue of employment equity would not have applied for public sector posts in recent times.

South Africa will not be alone in such initiatives. Sarasota Council in Florida, USA with a population of 325 000, was experiencing problems in serving its growing population. By 1990, the number of professional engineers in the council had dropped to seven and alarm bells were ringing.[8] To meet their objectives, they initiated a Professional Engineer Development Programme (PEDP) to attract, train and retain staff under the guidance of the remaining experienced engineers. Such was the success of the programme that by the year 2002 there were 33 professional engineers. Twelve of the original 14 trainees taken on at the outset have remained with the council.

... Civil engineers are the Leonardo Da Vincis of the 21st Century ....

Thabo Mbeki, 2003

Figure 7.7 Civil engineering staff projections – actively attract capacity and transfer skills to trainees



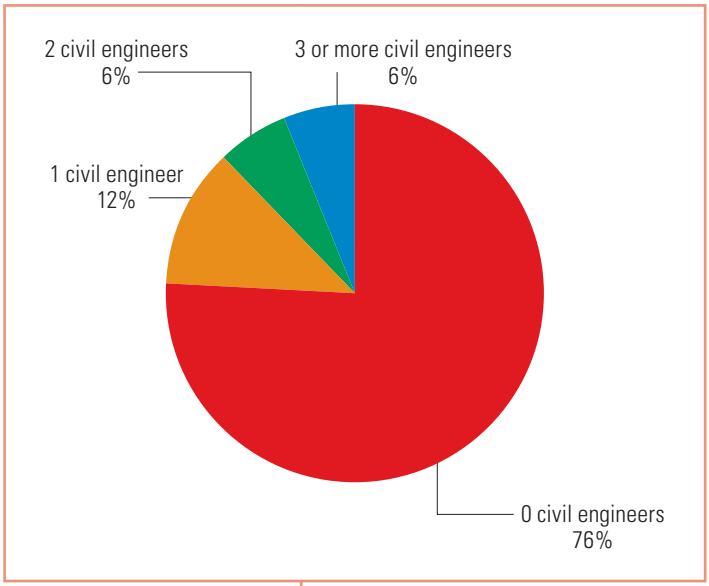


Figure 7.8 Percentage of municipalities per number of civil engineers, April 2005

The Institute of Public Works Engineering Australia (IPWEA) have been so taken with the programme that they are formulating a strategy to role out a similar programme nationwide to address their skills challenge. Tanzania's SEAP, described in Chapter 5, is another such initiative.

The workplace training programme developed for ENERGYS students and graduates and based on the ECSA guidelines is similar to this approach. However, offering increased workplace training will require more capacity in the sector. Thus a critical addition to the short-term capacity in Figure 7.7 should be the deployment of 100 to 200 retired civil engineering professionals for a five-year period to supervise and coach students and young graduates who have had inadequate training and are unable to pick up the current load.

A Marshall plan is required in which municipalities themselves step up technical appointments, the public sector offers support and the private sector offers capacity by way of secondments until internal capacity has been rebuilt. Major campaigns need to be mounted to attract as many as possible back into the sector. Cape Town Metro launched such a major initiative early in 2007 and received thousands of applications from engineering personnel alone, both locally and internationally and spanning all age groups. They are currently busy with a major placement programme.

7.5.3 More engineers

As was seen earlier, in the functions to be performed by technical staff, several areas require the signature of a professional engineer. The number of municipalities currently

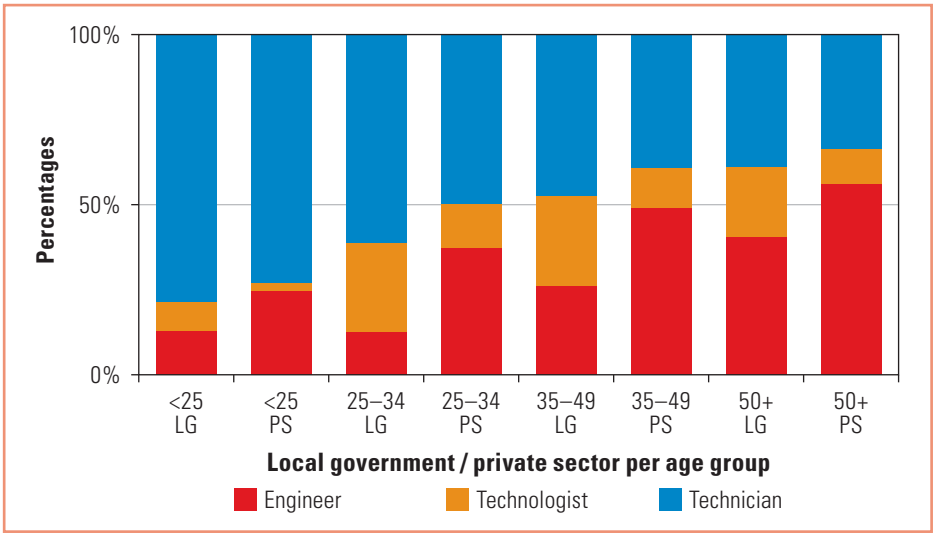


Figure 7.9 Split of engineers, technologists and technicians in local government (LG) versus the private sector (PS)

Table 7.2 Suggested targets for placement of black civil engineering professionals

Percentage targets for black civil professional staff, per age group				
	Trainees and junior staff	Production staff	Managers	Directors and advisors
Age	< 30	30–37	38–45	> 45
Engineer	35%	30%	20%	10%
Technologist	75%	40%	25%	15%
Technician	80%	50%	40%	20%

employing professional engineers is now pitifully low, as shown in Figure 7.8.

Furthermore, strategic planning is largely the domain of those with an overall perspective of all engineering services. Figure 7.9 compares the distribution of engineers, technicians and technologists with those in the private sector. The private sector employs many more engineers of every age group than does local government.

A concerted effort is needed to increase the number of engineers, not only by offering bursaries, but also by creating an environment conducive to the utilisation and sharing of engineers' knowledge and expertise.

The paper referred to above,[9] reveals that local government in Australia is hurting owing to the lack of experienced engineering staff capable of directing and making strategic decisions on infrastructure. In their strategy and action plan to address the shortage of engineers, IPWEA looked at the root causes of the problem and found them to include:

- *Deprofessionalism and increased use of technicians to fill what was previously the role of professional engineers*
- *Outsourcing of traditional public works programs and a focus on the bottom line*
- *A lowering of community awareness of the roles and responsibilities of public works professionals*
- *Reduced student intake because of exciting careers in other areas*

Table 7.3 Suggested targets for placement of female civil engineering professionals

Percentage targets for female civil professional staff, per age group				
	Trainees and junior staff	Production staff	Managers	Directors and advisors
Age	< 30	30–37	38–45	> 45
Engineer	20%	10%	5%	2%
Technologist	20%	10%	5%	3%
Technician	20%	15%	10%	5%

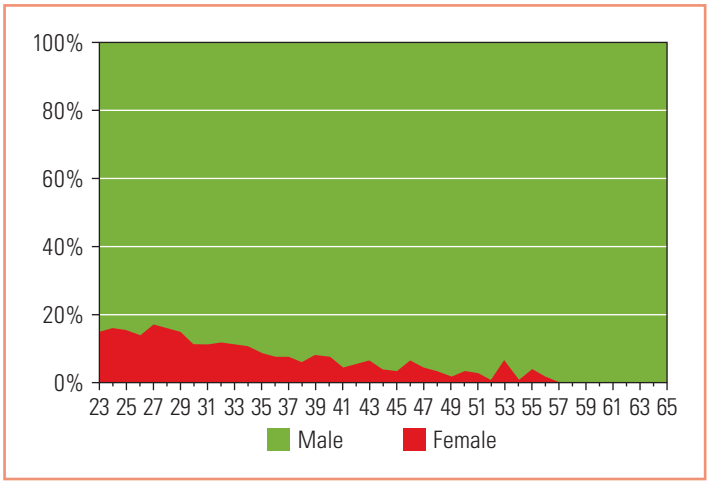


Figure 7.10 Gender distribution – civil engineers

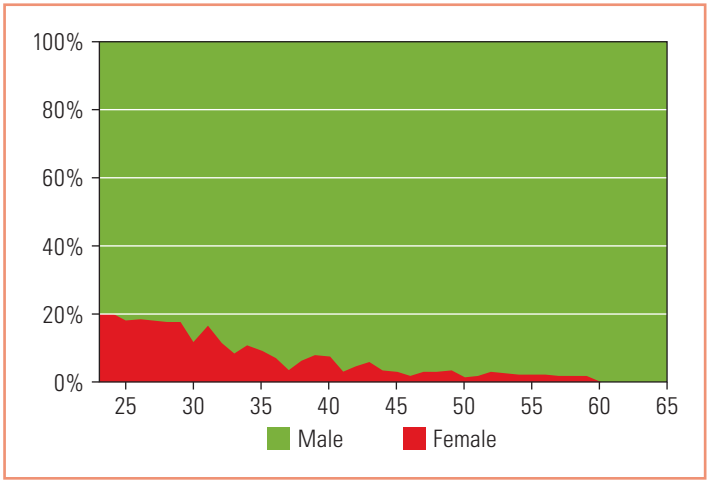


Figure 7.11 Gender distribution – civil technologists

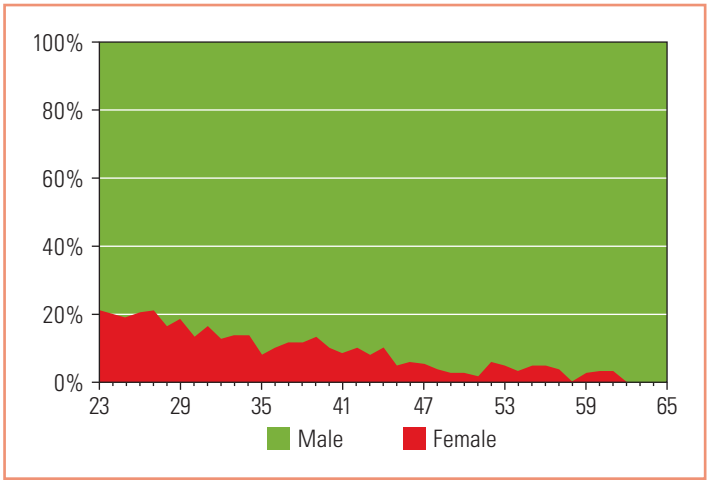


Figure 7.12 Gender distribution – civil technicians

7.5.4 Women

In canvassing for more entrants to the profession, it must be remembered that women are grossly under-represented and offer a virtually untapped pool of resources.

7.5.5 Realistic equity targets

Of particular concern is the number of posts that have been vacant for a long period. One of the main reasons given is the unavailability of suitable black or female candidates to fill these posts in order to honour municipal equity targets.

Given the shortage of engineers, it is extraordinary that in the year 2007, politicians still persist in the belief that white engineers who had the opportunity of employment in the sector in the past should be moving on to make way for those who were previously disadvantaged. **All** engineers are required, and then some!

There should be no threat to job security for any engineering staff in the public sector. It should not be a matter of one or the other. Teams must comprise the full range of experience, from junior to those who developed experience over many years in local government. Indeed, many young technical directors who are finding themselves overextended in terms of technical knowledge, management experience and workload have contacted the ENERGYS office asking for retired staff to guide and support them. They ask expressly for experienced engineers and not simply for additional younger people with some experience to lend a hand.

The shortage of black and female technical staff will continue to be a problem for many years, as the education and training process for engineering professionals is lengthy. Figures 7.10 to 7.15 show that transformation is indeed taking place, particularly when considering the racial split, and to a lesser degree with regard to gender. It would therefore be more realistic to set engineering equity targets based on the demographic profile of civil engineering professionals than on the country's demographics. Targets are suggested in Tables 7.2 and 7.3. At present, the only way to achieve the targets is by reducing the number of white civil engineering staff, and this at a time when skills shortages abound and a wave of young

people are coming into the market who require workplace supervision and training. Figures 7.10 to 7.15 clearly show that continued pursuance of this policy will simply deprive municipalities of access to a significant pool of skilled personnel.

Furthermore, the Employment Equity Act,1998 (Act 55 of 1998), expressly states that the measures suggested:

> *… includes numerical goals, but excludes quotas.*

It continues to state that:

> *… nothing requires a designated employer to … establish an absolute barrier to the prospective or continued employment or advancement of people who are not from designated groups.*

Understanding the skills transfer imperative, the Act calls for measures to:

> *… develop people from designated groups and to implement appropriate training measures.*

Unless experienced personnel are retained, such training and development cannot take place.

It seems that as part of their performance contracts, equity targets for the municipality as a whole have been set for municipal managers. Performance contracts should therefore be reviewed to accommodate the engineering bottleneck, otherwise the bleeding will continue at the expense of service delivery with the poor once again bearing the brunt of ideology. Performance contracts should rather be directed at improving the ratio of civil and other technical staff per 100 000 population by building teams that take the availability of black, white, female and male technical staff into account.

7.6 THE TURNAROUND STRATEGY

Since the tried and tested structures have been dismantled over the years, much effort is now required to rebuild capacity to manage, operate and develop municipal infrastructure.

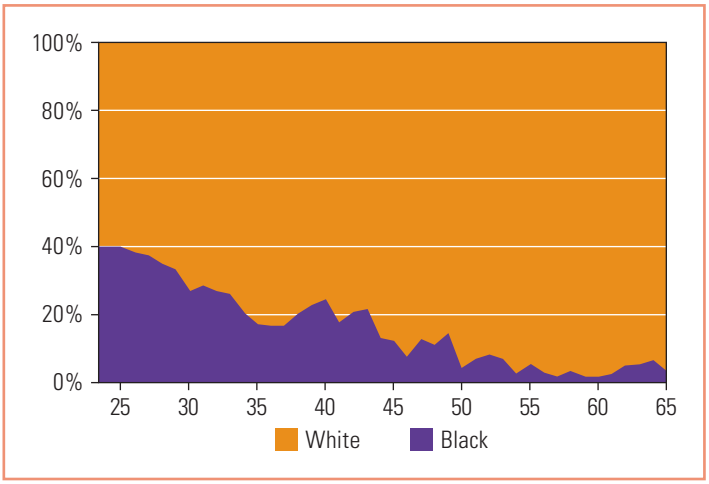


Figure 7.13 Transformation – civil engineers

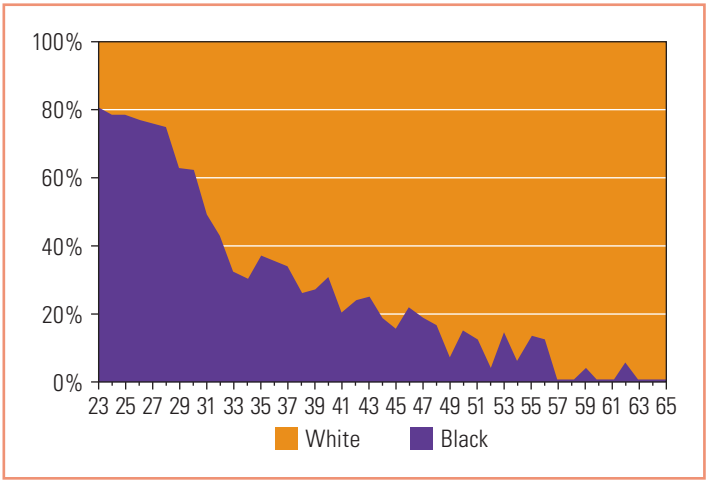


Figure 7.14 Transformation – civil technologists

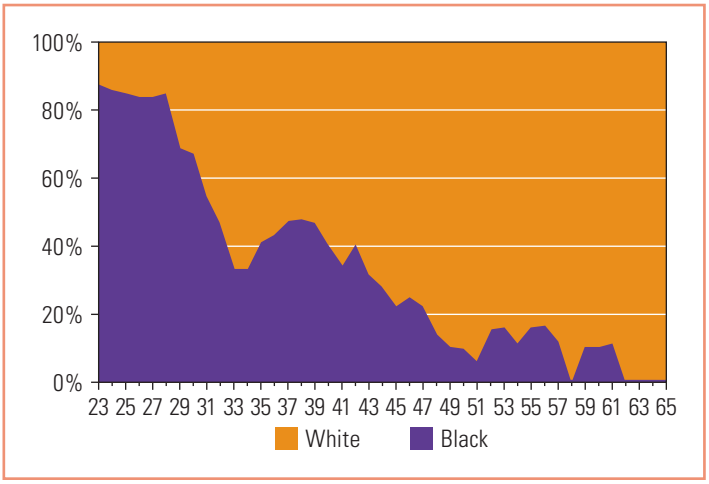


Figure 7.15 Transformation – civil technicians

Figure 7.16 'Retired wisdom' at a site meeting with contractors on one of the 20 priority township projects (PTPs)

In working with the subset of local and district municipalities that were nominated for support, it has become clear that support of some sort is required in almost all municipalities.

The **dplg** has also come to realise this imperative. Minister Mufamadi recently explained that as part of the Department's Five-Year Strategic Agenda,[10] his department would:

> *… mainstream hands-on support to all 283 municipalities.*

Cabinet supported this expansion.

The DG expanded these ideas in her presentation to mayors in 2007[11] when she outlined the strategic interventions for 2007, 2009 and 2012, including:

- Development of a deployment framework and guidelines for hands-on support
- Development of proposals on recruitment and retention strategies for local government
- Ongoing stakeholder mobilisation to augment capacity in targeted municipalities

It is in this spirit that this publication has been compiled with the current chapter paying particular attention to the mechanisms of support.

It has also been recognised that in most instances support takes time to develop meaningful results. Describing the experiences of service delivery facilitators the Project Consolidate Report cited above stated that:

> *It takes at least six months for the [service delivery facilitators] to establish a solid working relationship with the municipality …*

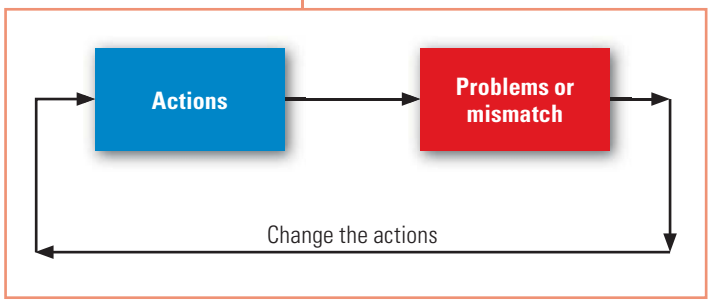
and to be:

> *… seen as part of the [municipal] team.*

7.6.1 What type of support?

Challenges abound. The difficulty lies in determining what type of support is required. Looking at symptoms only can be misleading. In his book, *Overcoming organisational defences*, Argyris[12] explains how organisations engage in either single- or double-loop learning.

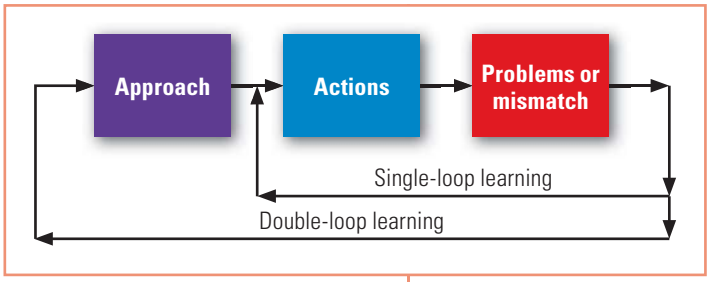
Figure 7.17 Single-loop learning – symtoms being addressed



Source: *Overcoming organizational defenses*

In the single-loop approach (see Figure 7.17) the company responds only to the symptoms. Actions are initiated to resolve immediate problems and to get all involved 'out of trouble'. Since these are generally short-term solutions, problems soon recur, a scapegoat is identified to bear the brunt, is censured and then someone else is rushed in to fix the same problems yet again. Management is not prepared to admit to a systemic problem because that would be admitting

to failure on their part. In Argyris's words, interventions are 'face-saving actions'. He continues to explain that because so many individuals employ face-saving solutions so frequently, they become organisational norms. In a later book[13] Argyris explains that organisational defence routines are anti-learning, over-protective and self-sealing and result in the organisation entering a spiral of self-fulfilling failure.



Source: *Overcoming organizational defenses*

Figure 7.18 Double-loop learning – organisational culture and causes being addressed

Double-loop learning, on the other hand, requires the company to look at the problem in the context of the entire business process (see Figure 7.18). First of all, governing values need to be addressed to allow people to overcome organisational defences and be confident to question the status quo. It also means:

> *… coming to grips with skilled incompetence, skilled unawareness, fancy footwork and undiscussables …*

Once all are involved and committed, a very different route may be embarked upon: one that will arrive at a long-term solution because the causes rather than the symptoms are addressed. Argyris suggests that single-loop learning is based on the wrong design assumption as to how the business should be operating.

It has become clear that the design assumptions on the mix of technical and non-technical, line and support functions are incorrect. As long as we persist with the current structures and mindset we will only chase backlogs and continue to think engineering staff are temporarily required until targets have been met.

From observations throughout it is clear that basic, rate earning and economic infrastructure must be developed and adequately operated and maintained. If adequate technical staff were in place to manage development and O&M, the private sector would have been used far more extensively in project roll-out to date and the quantum of backlogs that we are facing could very well have been significantly smaller.

It is therefore time to redesign the business of local government.

7.6.2 Re-engineering the business

In business terminology one talks about 're-engineering' a business. In 1993, when Al Gore commissioned an investigation into future models to improve national efficiency, the ensuing report entitled, *Transforming organisational structures,*[14] suggested that they should:

> *… direct agencies to reengineer work processes to shift emphases to service delivery.*

The following critical questions are asked in business re-engineering exercises:

- **What** is done? **Why** do it?
- **How** is it done? **Why** do it that way?
- **Where** is it done? **Why** do it there?
- **When** is it done? **Why** do it then?
- **Who** does it? **Why** that person?[15]

Unfortunately the answer to the first of most of the above is unconvincing. The what, how, where, when and who urgently need addressing.

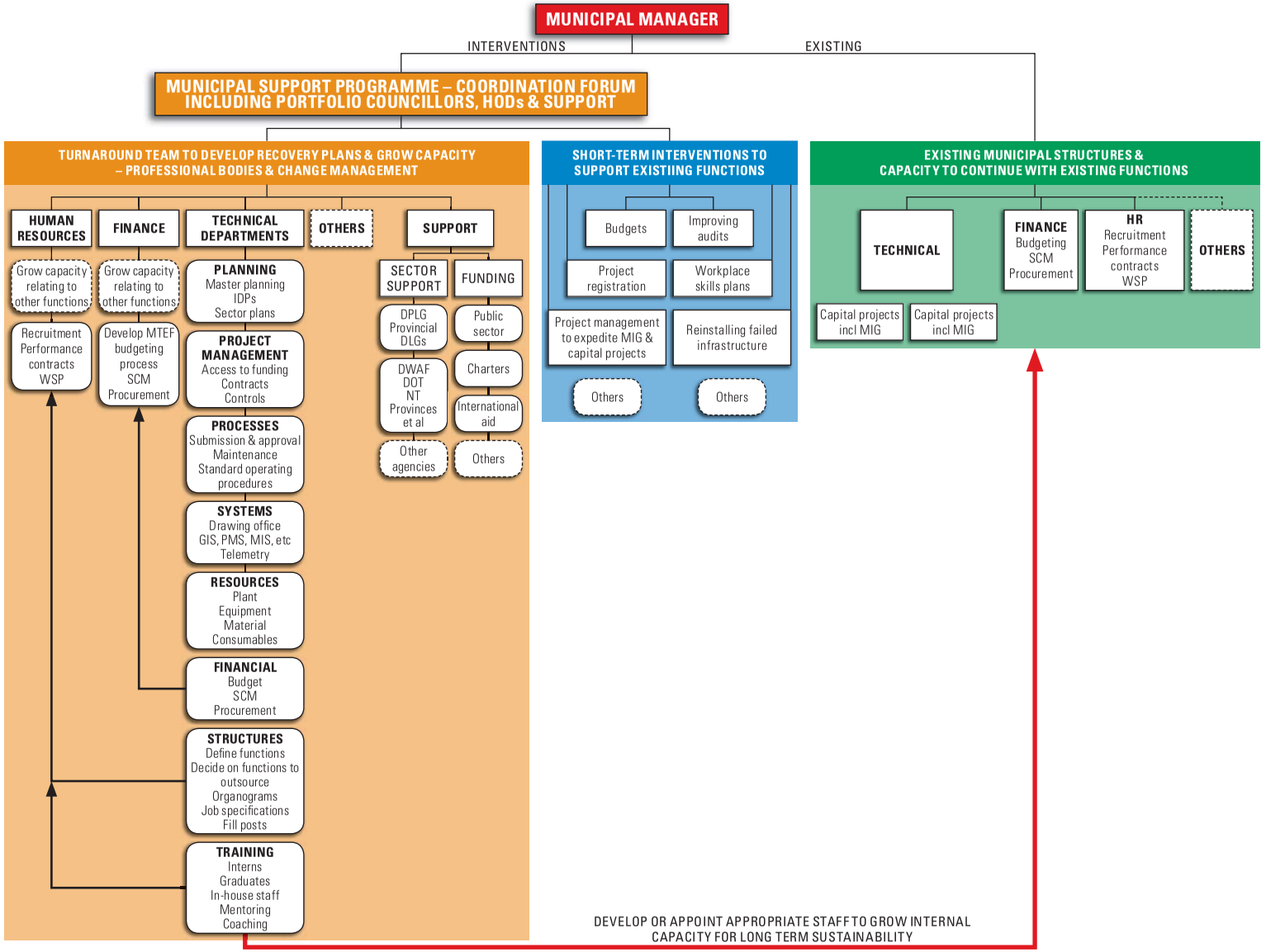


Figure 7.19 The turnaround strategy

Attention to detail is required in all departments. Master plans must be updated or developed from scratch, and long-term, holistic views must be integrated into IDPs to turn them into credible documents. Organograms must be developed to suit the actual needs of departments, and staff must be appointed and offered workplace training. Career pathing and direction must be given to each employee. Lost data must be located. Systems and operating procedures must be developed, including those related to HR and procurement. Losses must be addressed and performance must be driven at every level.

Classical management theory advocates the need for dedicated staff to manage restructuring and change management exercises. It suggests that senior line function staff should move out of their posts and be dedicated to managing transformation.

As already outlined, those currently employed in civil engineering infrastructure are overloaded, fighting current fires, attending eternal meetings and writing reports! Few have sufficient time or, sadly, knowledge, experience and authority to effect many of the above changes. In the words of Albert Einstein:

The significant problems we have cannot be solved at the same level of thinking with which we created them.

The experience of the current ENERGYS initiative has been that many seniors have been drawn in to handle line function roles, including repairing pumps, addressing sewage spills and water quality issues, project management, etc. Whilst this is clearly necessary, a subset of these experienced people should be appointed to drive turnaround strategies in each municipality.

Such people should be working directly with the municipal manager and existing structures to assess, make recommendations and implement the changes required to bolster technical departments, without disrupting their already delicately balanced day-to-day operations.

In some instances this would simply mean assessing existing staff and structures and advising the municipal manager on permanent appointments, promotions, and junior staff who should be brought in to support existing staff. In other instances this would in fact be a 'reinventing' exercise where an entire department would need to be built up from scratch, including systems and processes, as outlined above.

Figure 7.19 depicts three parallel streams of activities. The block on the right features current municipal structures, with their vacancies and various weaknesses. The middle block describes the activities that need to be handled by short-term, 'fire fighting' interventions. The block on the left features the activities of a turnaround team in engineering departments who would systematically work through every activity, system and process in order to identify gaps and rebuild systems, procedures and capacity.

This type of effort is required not only in civil engineering but in all engineering and built environment professions, including electrical engineering, town planning, building science (to address the building inspectorate and housing needs) and valuations.

Other disciplines are also lacking in expertise. Indeed, the finance MEC for North West[16] Province recently expressed her concern about inadequate financial skill saying:

We must improve our systems and policies and must appoint people with the right skills for the job.

Professional input is needed. It is clear that there is a limited understanding of any of the professions, including:

- Professional standards
- Professional procedures
- Professional training
- Professional registration
- Professional expertise

This is to the detriment of service delivery and financial control.

(a) Detailed analysis required

A noticeable feature of the new modus operandi of local government is the procession of national, provincial and contract personnel doing investigations, writing reports, making policy proposals on technical functions – all without any technical input and frequently without understanding the technical issues.

Fly in-fly out visits are perfunctory at best and offer little more than a superficial understanding of the problems of service delivery. It is difficult to understand that cogent technical input is not a prerequisite for such plans, or that these are not drawn up by technical people. This approach may however explain why the plethora of plans, initiatives and reports have had limited impact.

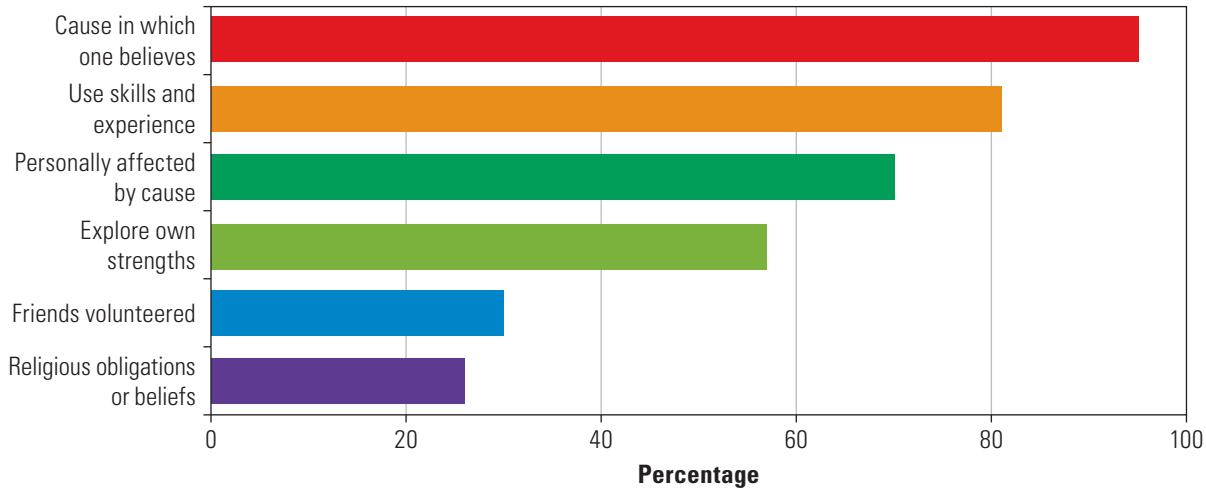
Municipal support plans are currently being developed, largely by holding one-day workshops per municipality. Whilst this offers some guidance regarding quick fixes, many municipalities are simply not capable of quantifying their own weaknesses adequately or driving the changes required.

In the ENERGYS experience, a detailed understanding of what is required to engineer a complete turnaround has taken several months of working within the municipality and getting to know all staff, systems, projects, backlogs and associated mismatches.

(b) A medium-term support team

It is suggested that the current model of seconding senior engineers into local government should be extended for a five-year period to manage a turnaround strategy, and help develop capacity and competence in all engineering structures. Furthermore, it is suggested that the model be expanded to incorporate seniors from other local government

Figure 7.20 Reasons for returning to 'active service'



Source: 2000 NSGVP

professions to assist with turnaround strategies. Whilst there may be some reservations at using 'grumpy old men' to play this role, the ENERGYS experiences showcased throughout the book give a clear indication of what has and can be achieved with a small group of highly experienced staff.

Researching the use of retired staff to bolster capacity, the Canadians identified that older people found it difficult to slow down and missed being able to contribute (see inset). Figure 7.20 shows the reasons cited for coming out of retirement.[17]

Interviewing the ENERGYS engineers revealed a great desire to plough back the knowledge and expertise they had accumulated during their illustrious careers and to share with young people. The fact that each **offered** his services ensured that all the retired engineers who entered local government did so determined to make a difference.

The US Corps of Engineers offer support related to many engineering challenges. Chief of Engineers, Henry M Robert, who is best known as the author of *Robert's rules of order*, says:

> *As in its earliest days, the Corps of Engineers still thinks of itself as an organization ready to help build the nation's infrastructure. However, today "infrastructure" means more than just internal improvements and transportation systems … It means developing management techniques, new approaches, and new technology to use our resources more efficiently and to reduce resource depletion.*

In the same way a South African 'corps of engineers' comprising the full range of built environment and engineering professionals should be established to support a nationwide turnaround campaign.

This support network could also be expanded to offer roving, telephonic or on-line support for design and documentation reviews or pay visits to sites where younger technical staff feel that they require a second opinion.

(c) Secondment

As building the requisite capacity is going to take time, the private sector should be harnessed

Harnessing older adults – experiences in Canada and Australia

Canada, Baby Boomers and volunteerism – challenge and response

Change – unprecedented change – is on the horizon. As we move into the 21st century and the population ages, Canada will be home to more seniors than ever before. In 2002, five million Canadians were over the age of 50. By 2006, they will be almost 15 million strong.

This group of mature yet energetic people are more active and involved than any other generation of older adults we've ever seen. Overall they are better educated, possess stronger voices and have higher profiles and skill levels than members of previous generations. Most importantly, as author and economist David Foot points out, 'sheer numbers separate the Baby Boomers from other groups of Canadians'. Baby Boomers presently account for well over 30% of the Canadian population – and this percentage is growing. For those recruiting this group the potential is profound – a large pool of highly skilled, capable, active people many of whom have now retired from the work environment, many more who are preparing for retirement or gearing down their professional obligations. What could be better?

A look at the full picture, however, tells us that current strategies for recruiting from the ranks of Canada's 50+ age group will need to be re-thought if non-profit organizations are going to capture the interests and accommodate the needs, desires and ambitions of this group. We need to keep our eyes firmly fixed on the future aspirations and abilities of the country's Baby Boomers.

Source: *Volunteer connections: new strategies for involving older adults* [online]. Available at <http://www.volunteer.ca/volunteer/pdf/OlderAdults-Eng.pdf> [accessed 13 July 2007].

Also of interest is research that proves that seniors remain healthier if they continue to be involved. See: <http://www.volunteer.ca/volcan/eng/content/older-adults/canada_adults_report_printable.htm> and <http://www.spra.sk.ca/knowledge/Resources/olderav.htm>.

Australian Businees Volunteering (ABV)

ABV contributes to poverty reduction, sustainable development and good governance by providing Australian expert volunteers who, through sharing their skills and experience, assist businesses and organisations in developing countries to grow and thrive. They focus on people in South East Asia and the Pacific. Their aims are to help reduce poverty and create sustainable development. Promoting good governance is also an important goal of the aid program.

Source: <http://www.seniors.gov.au/internet/seniors/publishing.nsf/Content/Australian+Business+Volunteers> [accessed 13 July 2007].

to second staff who have local government experience to municipalities to deal with day-to-day needs.

Where municipal departments are unable to train young people in all stages of the project cycle, contractors or consultants should be called upon to offer training in their organisations for an appropriate period.

(d) Adopt-a-town

Private sector involvement should also be harnessed to address backlogs, refurbishment of dilapidated assets, development of bulk infrastructure and address institutional and financial sustainability. In much the same way as DWAF used the Build Operate and Transfer model to break the back of huge backlogs that had to be tackled after 1994, **dplg** should consider appointing 'design and construct' teams per municipality. Their responsibility should not be limited to designing and constructing infrastructure, but building systems and capacity both in house and in SMME contractors and communities.

7.6.3 Lessons learnt from support initiatives

In supporting some 70 municipalities, the ENERGYS team has become very aware of the number of disparate support programmes across all departments. Several financial support programmes are looking at costs, losses, controlling debtors, accounting practices and producing unqualified audits; HR support is offered in many municipalities to assist with workplace skills plans (WSPs) and setting up systems; several performance assessment initiatives have developed an impressive array of KPIs and measures for assessing success; water demand management initiatives are aimed at reducing losses and increasing income; teams are involved in field surveys to develop asset registers and numerous engineers and project managers have been deployed to handle project management and accelerate service delivery.

Most initiatives are excellent and should continue, however for maximum benefit the three 'Cs' should be addressed:

(a) Lack of capacity development

Few initiatives include a capacity development component. Some municipalities simply have no staff to train and many are not amenable to assigning in-house staff for development. Others cannot afford to or are not interested in taking on staff to be trained to fill the many vacant positions. Support staff thus end up handling line functions and when they withdraw the problems they addressed tend to recur.

Of great concern is the lack of long-term, big-picture thinking and forward planning in terms of capacity in most municipalities. The idea of hands-on support for the next five years will only yield results if capacity development is planned and driven from the outset.

(b) Lack of internal cooperation

Many initiatives are thrust on municipalities or are treated with suspicion. Where initiatives are 'tolerated' rather than fully supported, the benefit is minimal. The most successful sites in the ENERGYS project were those where the municipal manager actually requested support and worked hand in hand with the team to identify and address challenges and build long-term capacity. Where municipal senior staff have no idea or interest in support initiatives few meaningful tasks are initiated and support teams are simply used to perform line functions.

It would be tempting to suggest that support should be given only where a municipal manager or a head of department submits a request. However, as has been highlighted,

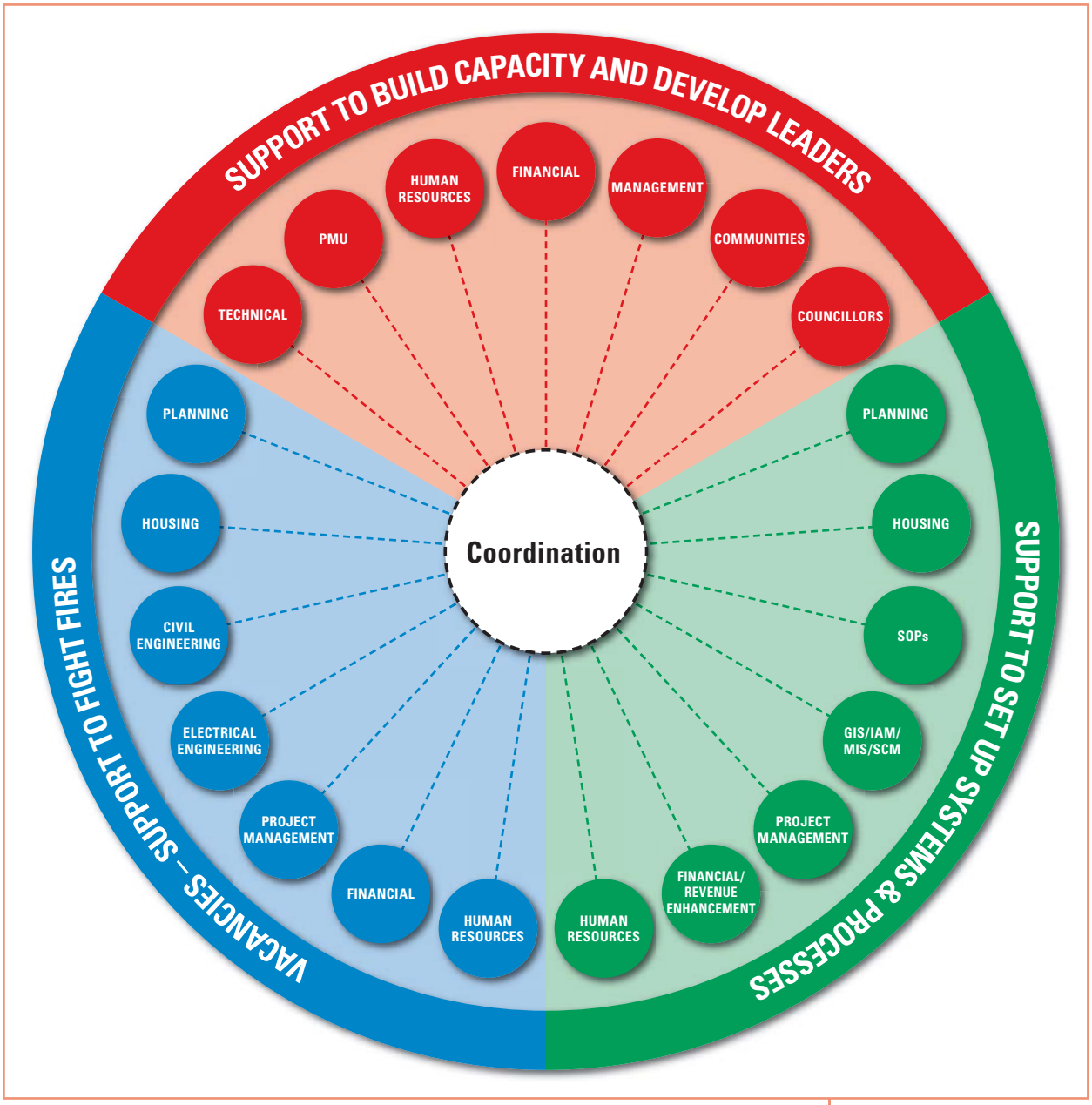


Figure 7.21 Many support initiatives are underway but few are working together or being coordinated nationally or at local government level

many technical issues are overlooked by non-technical staff, to the detriment of the municipality.

Therefore, offering support is essential but it should not be given without the full backing of the municipal manager and senior staff in whose department it is offered.

(c) Lack of coordination

Much benefit is lost as a result of the lack of coordination. For instance, if financial and engineering teams worked together they could feed each other valuable information. Figure 7.21 outlines the many areas in which fire fighting is currently taking place and others

Table 7.4 Guidelines for a successful turnaround strategy

	Successes	Failures
1	Quick assessment of problems	Taking time on assessing problems
2	Clear vision and turnaround methodology	Turnaround left to chance (no clear action plans)
3	Experienced resources to implement turnaround	Making use of inexperienced resources
4	Effective turnaround manager with strategic mindset	Manager lacks strategic mindset
5	Inspire people to make everyone pull together	Manager does not have the ability to inspire people to work together
6	Focusing on all drivers who impact the current situation	Focusing on financial side only and retrenching staff
7	Providing information of current state to all staff members	Not involving staff and providing them with information on current state
8	Changing the culture and work environment	Leaving the culture and work environment to chance
9	Facing the problems	Not facing the problems and leaving them to chance
10	Planning	Not planning

Source: Louis Allen Africa, slide from presentation

that require bolstering in the long term. Many initiatives are taking place but there is little or no coordination and, sadly, in some instances there is duplication and competition between support agencies. A central coordinating unit, represented by the dotted circle in Figure 7.21, is currently missing.

7.6.4 A change management strategy

The ideal solution would be for all support initiatives to combine in each municipality to form a turnaround team under the direction of the municipal manager, to set up sound structures, capacity and systems. This is the approach depicted in Figure 7.19.

Striving for financial viability should be the number one activity because this will give municipalities the means to employ staff.

Having determined appropriate organograms and job specifications it is essential that municipalities employ the required staff sooner rather than later to give the new incumbents maximum time to settle in and develop functioning departments with the assistance of those offering support.

(a) Rebuild, not restructure

The problems outlined may tempt those in authority to once again consider restructuring to 'remove' the problem. Reducing technical capacity any further would be suicide. It is critical that we grasp the nettles and develop strategies to rebuild environments conducive to delivery. Turnaround teams would do well to pay attention to the Louis Allen turnaround guidelines listed in Table 7.4. We must accept that experienced engineering

personnel are required in local government to deliver services and we must plough all our energies into building appropriate capacity.

In considering the trend of ongoing attempts at restructuring, when in fact restructuring may not be necessary, the British experience has been no different from our own. At the 2003 conference of the professional body, the Association of the First Division Civil Servants, participants complained that the pace at which government was attempting to drive reform had caused such pressure that it was becoming difficult to persuade people to take up senior posts.[18]

In their search for solutions to address this problem, it was suggested at senior government level that there should be a moratorium on any more reform to give the service time to consolidate. The turnaround strategy suggested here refers to consolidation in terms of building capacity, systems and long-term viability.

Source: dplg

Figure 7.22 The phases of local government transformation

(b) Commitment

It is clear that municipalities should be casting bad practices aside. In order to qualify for hands-on support and various grants, municipalities must commit to attending to revenue enhancement, chasing debts, raising tariffs, reviewing their organograms and appointing appropriate staff early on in the support cycle so that they can be developed.

Simply receiving support because it is available and making no attempt to improve the municipality in the long term has been an ongoing problem with support to date. Municipalities must commit to leading the change. The well-known change management model ADKAR[19] signifies:

- Awareness of the need to change
- Desire to participate and support change
- Knowledge about how to change
- Ability to implement new skills and behaviours
- Reinforcement to keep the change in place

This gives a good indication why many support initiatives have not been successful. Without awareness, desire, knowledge or ability little can be achieved. National and provincial departments should invoke their rights to intervene in struggling municipalities who must commit to the turnaround or run the risk of being taken into administration as catered for in Clauses 100 and 139 of the Constitution.[20, 21]

(c) Time for action

There is no need for more analysis. The facts and figures presented throughout outline the bottlenecks, challenges and associated remedies. It is time for action.

7.6.5 The First and Second Economies

As long as capacity is inadequate and organisations are not geared up for service delivery it is those with little or nothing who suffer most. Hiding behind the skills gap as a reason for not appointing staff will mean that millions will remain trapped in poverty with no means of escape. Access, education and good health as a result of clean water, safe removal of sanitation, shelter and warmth are critical to the development of a productive workforce. Rural municipalities thus have a huge responsibility towards their inhabitants and should be structured around service delivery and employ experienced engineers to address urgent needs.

Whilst the current thrust of service delivery is aimed at those who have not had access to services in the past, Maslow's theory is hard at work. All are striving to improve

Capacity building for better cities

Professor Patrick Wakely argues that capacity building embodies much more than simply training and human resource development. If decision makers, managers, professionals and technicians are to operate at full capacity, they need more than just their own abilities. They need an institutional and organisational environment conducive to and supportive of their efforts, energies and capacities. Institutional and organisational restraints present as great an impediment to the effective management of cities and settlements as the inability of professionals, technicians and ordinary people. To be effective, capacity building must embrace all three aspects: human resource development, organisational development, and institutional development.

Human resource development (HRD) is the process of equipping people with the understanding and skills, and the access to information and knowledge to perform effectively.

Organisational development is the process by which things get done collectively in an organisation. It has to do with management practices and procedures, rules and regulations, hierarchies and job descriptions, and shared goals and values.

Institutional development encompasses legal and regulatory changes that must be made to enable organisations to enhance their capacities. It embraces such issues as regulations controlling financial management, borrowing and trading contracts, partnerships, salaries, by-laws, and development controls.

Globally the weakest link ... is at the level of local government. Municipal governments are the key actors in the management of towns and cities …. Yet ... in all but a handful of countries they have been starved of authority and resources … calling for an urgent and massive exercise in re-building the capacity. Re-tooling and in many countries … restructuring … includes the process of decentralization … developing enterprising and challenging work environment and career structure within local government that attract and motivate the best professionals, technicians and managers and rewards their creativity and innovation.

Source: Patrick Wakely, University College, London

their quality of life and many are now able to buy lifestyle, moving into the middle income bracket. This demands considerable extension to First World, or Western infrastructure.

Developing and operating this level of infrastructure requires First World technology, First World expertise, First World systems, and First World organisations. Expanding such capacity and development will contribute towards growth, which in turn will increase job opportunities and provide a slow but increasingly sure move for those in the Second Economy to the First Economy.

We cannot allow the huge investments being made in infrastructure development to be wasted because of inadequate capacity, systems and organisations.

Patrick Wakely's assessment of building better cities (see inset) captures the essence of the change in approach and environment required to attract and motivate the best professionals, technicians and managers. To ensure that we develop sustainable towns and cities as called for in the transformation of local government (see Figure 7.22), we must embark on building world-class organisations, no matter how big or small.

CONCLUSION

Engineering is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to plan on paper. Then it brings jobs and homes … it elevates the standard of living and adds to the comfort of life. That is the engineer's high privilege.

These were the words of Herbert Hoover, engineer, author, humanitarian and 31st US President.

It is time that we recognise the role of engineers and allow them to develop the infrastructure required to elevate the standard of living of all in South Africa.

RECOMMENDATIONS

The ENERGYS pilot project has proven its worth and the model must be adopted by all bodies supporting the public sector, on a large scale in all disciplines and in all departments.

- **Expand the ENERGYS model**
  Many more civil engineering staff with local government expertise are required. The challenge now is to harness existing expertise within and outside the sector to train a new cohort to take over in the years to come. Funding to radically expand civil engineering support in local government is urgently required.
- **Develop support initiatives in all professions**
  Develop similar models for electrical engineers, town and regional planners, building inspectors, laboratory technicians, valuers, operators and artisans.
- **Increase the number of young staff joining local government**
  A whole new generation of municipal engineering professionals must be developed. Students and graduates must be encouraged to join local government under mentorship and should be offered long-term career opportunities.
- **Curb the losses and utilise the entire skills base**
  The professional skills base is currently too small to afford the luxury of applying equity criteria in staff selection. The demographic profile of the profession should be used as the basis for setting targets and a major drive should be mounted to attract staff of both genders and all races.
- **Drive turnaround strategies**
  It is essential that expert teams are appointed to support the municipal manager in re-engineering the business of local government. Policy changes in respect of staff expenditure and several non-core functions should be considered prior to embarking on turnaround exercises.
- **Set conditions for support**
  To qualify for hands-on support and various grants, municipalities must commit to attending to revenue enhancement, chasing debts, raising tariffs, reviewing their organograms and appointing appropriate staff early on in the support cycle so that they can be adequately developed during the support period.

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Engineering is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to plan on paper

Herbert Hoover
US president 1929–1933

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Source for figures

Figures 7.17 and 7.18: Adapted from Argyris, C 1990. *Overcoming organizational defenses: facilitating organizational learning action science.* Boston: Allyn & Bacon.

CHAPTER 8

The way forward

The difficulty lies not so much in developing new ideas as in escaping from the old ones.[1]

The KPAs outlined by the **dplg** that require support are the following:

- Institutional capacity and municipal transformation
- Basic service delivery and infrastructure
- Local economic development
- Financial viability and management
- Good governance

It cannot be business as usual. Whilst many of the conclusions outlined in the preceding chapters appear to be common sense, it is hoped that by considering the suggestions made in terms of structures, appointments, processes, spending models and training regimes, municipalities will realise that they have the ability within themselves to achieve these KPAs, build viable businesses and offer acceptable levels of service to all consumers.

The maladies discussed throughout are not unique to South Africa. The American experience may be summarised as follows:

- *In making it difficult to steal government's money we made it impossible to manage the public's money*
- *In adopting written tests scored to the third decimal point to hire our clerks, police officers and fire fighters, we built mediocrity into our workforce*
- *In making it impossible to fire people who did not perform, we turned mediocrity into deadwood*
- *In attempting to control virtually everything, we became so obsessed with dictating how things should be done, regulating the process, controlling the inputs – that we ignored the outcomes – the RESULTS!*

Our population is expecting delivery, in other words, **results.** The delivery of housing, national, provincial and local government infrastructure, education, health services, sporting facilities, improved information and communications technology (ICT) and safe access to enjoy the beauty of our country is 'Business South Africa'.

The vision and mission of all in Business South Africa must be breathed and owned by all in the business. Whilst senior cabinet members understand the imperatives, the business approach is at times not played out at the lower levels in sector departments, provincial and local government. All levels of Business South Africa must produce results that earn the country well-being and wealth.

- The business of housing must produce houses
- The business of education must produce graduates
- The business of health must produce healthy people
- The business of national and provincial infrastructure departments must produce and maintain infrastructure that supports growth
- The business of local government must produce and maintain infrastructure that allows all to live in dignity

- The business of crime prevention must ensure that all can live in safety
- The business of sport must produce great sportsmen and women
- The business of tourism must attract record levels of tourists

All these business units should be working together. Effectively, government departments at all levels are the middle management and the delivery arms and legs of Business South Africa run by the CEO, President Mbeki and his deputy and directors at cabinet level.

- If structures are empty and functions are not being performed, policies must be changed to allow for employment of all available skills
- If processes impede service delivery they must be changed
- If staff in branch offices and departments are not performing they must be rooted out
- If funds are disappearing the perpetrators must be punished

At the close of 2006, President Mbeki made strong statements that personal agendas cannot be accommodated.[2]

At much the same time, MEC M Fransman[3] called for an immediate moratorium on affirmative action in all priority skills areas:

> *We need to go beyond the blunt instrument of affirmative action if we want to more effectively address the vicious cycle of poverty that characterises the second economy.*

Whilst the suggestions above sound idealistic and perhaps impossible to achieve, author Malcolm Gladwell suggests in his book, *The tipping point*,[4] that only three catalysts are required to bring about change. These change agents are:

- A small group of passionate but influential people
- An important message or goal that sticks in people's minds
- An environment that is ready for change

The success of the broken window campaign in New York is one such example. The authorities decided to attend to minor, unchecked signs of deterioration and offences, which sent the message that not even the smallest misdemeanour or problem would be overlooked. The zero tolerance approach rapidly turned slums and crime-torn areas back into habitable suburbs.

Many countries, through strategic thinking, determination and strict discipline, have turned their economies and thus their fortunes around in a relatively short period.

The economy of Chile[5] turned around when civil engineer Eduardo Frei Ruiz-Tagle became president and placed education, infrastructure and developing export markets at the top of his economic agenda.

The fortunes of Curitiba changed dramatically when enlightened administrator and architect by profession, Mayor Jaime Lerner, developed the Curitiba Master Plan and initiated many progressive projects in transport, food, health and pollution. Today Curitiba is the cleanest city in Brazil, job creation, food security and transport problems have been addressed and many cities have modelled their transport systems on the Lerner model.[6, 7]

From humble beginnings as a newly independent island in 1965, Singapore has developed a highly successful and transparent market economy. Singapore has consistently been rated as the least corrupt country in Asia and amongst the top ten cleanest from corruption in the world by Transparency International.[8, 9]

Municipalities have only three assets – infrastructure, the debtor's book and human capital. In business these would be closely guarded and efficiently managed. In municipalities, they get the least attention! We must get the fundamentals right first, before

moving on to the 'nice to haves' that have been added to the long list of local government responsibilities. We need sustainable infrastructure!

To deliver the infrastructure required means that South Africa must be visionary, strategic, determined and must harness **all** the capacity needed to initiate, design, deliver, operate and maintain infrastructure.

Willem H J de Liefde[10] captures a wonderful way forward for us when he describes his career:

> *I began my career as a sailor. The experience I gained at sea laid the foundation for my later work as a manager. At sea I experienced the importance of team spirit, mutual trust, respect and natural authority. I know the conditions under which energy is released and decisions are taken quickly. Once ashore I was amazed to discover that something that was self-evident on board ship was more the exception than the rule in the corporate world. I discovered that I achieved the best results when my actions were based on experience and intuition.*

Let us recognise the need for experience, team spirit and trust, and put rules and unnecessary controls behind us. It is time for:

- **South Africa** to mount a nationwide campaign to harness all professions to develop a new breed of local government officials. The process must be spelled out, understood and subscribed to by all municipalities, who should not see such an initiative as a threat but rather as the solution to their skills gaps
- **South Africa** to provide the full range of services, including economic and basic infrastructure and ongoing operations and maintenance
- **South Africa** to unpack the legislation and processes that are causing service delivery delays and define simplified yet effective new approaches
- **South Africa** to redefine council and senior administrative roles, authorities and appointments to ensure hands-on direction of service delivery, including:
  - Directing council powers to policy and oversight
  - Appointing seasoned managers as municipal managers
  - Elevating the technical services director to the post of chief engineer
  - Returning authority from support functions to line functions
- **South African** municipalities to be managed on a commercial basis, including:
  - Selecting top-class leadership
  - Instilling discipline
  - Tackling outstanding debtors and losses of whatever form head on
  - Aggressively accessing grants and alternative income
  - Increasing income through expanded services
  - Generally, increasing income and reducing costs
  - Focusing on core business

The time for 'tipping' is here.

South Africa has a choice – to continue with business as usual or to take the high road to develop a **uniquely South African** local government sector.

Taking the high road is within reach provided that decisive actions are taken immediately. Relaxing policy, inspiring, embracing, re-skilling – the time has come to involve all South Africans, regardless of political persuasion, age, gender or race, in the development

challenge. The only way to change the past and build a great future for all is to heed the words of President Thabo Mbeki, who in his book *Africa: The time has come*[11] said

> *… the African renaissance can only succeed if … its programmes are designed by ourselves and if we take responsibility for the success or failure of our policies …*

It is time to make a difference. Let all involved

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South Africa is faced with the challenge of significantly accelerating development of its social and economic infrastructure. Local government, in particular, has a constitutional duty to provide basic services. In this context civil engineering professionals play a crucial role. However, skills shortages and skills gaps are hindering delivery.

This SAICE report on *Numbers and needs in local government* examines the challenges facing the civil engineering profession in local government, pinpoints gaps and makes practical recommendations for short-, medium- and long-term strategies. These include mechanisms and interventions for educating, training, coaching, mentoring and utilising the knowledge and experience of all civil engineering professionals.

This cogent and meticulously researched report is an invaluable reference for policy and decision makers, civil engineering professionals and anyone involved with local government.

Implementing its recommendations will:

- Accelerate infrastructure delivery
- Enhance operations and maintenance
- Improve structures and streamline systems and procedures
- Enhance training opportunities and procedures
- Improve attraction and retention of staff, hence enhance capacity
- Establish a diverse, well-trained and multicultural workforce

enabling local government to contribute towards the promises of the new South Africa.

Allyson Lawless holds a master's degree in structural engineering from Imperial College, London. In 2000 she became the first woman president of the South African Institution of Civil Engineering. Since April 2003 she has been involved in capacity research to address the dilemmas of unemployment versus scarcity of skills in the civil engineering industry. In 2005 she published *Numbers and needs*, which has become the standard reference book for developing civil engineering professionals.

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