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The right to functioning urban infrastructure – A review

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Review article

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Abstract

A major objective of local government in South Africa, as defined in the Constitution, is to ensure the provision of services to communities in a sustainable manner. However, neglect of infrastructure continues to hamper access to service delivery, affecting all citizens and the economy. Informed by the author's own long career involvement and current research programme in infrastructure operation and maintenance, together with current extensive secondary research, he identified that lack of care for infrastructure leads directly to infrastructure failure. This, in turn, harms the economy and inconveniences citizens, and, in some instances, even deprives them of their rights. This article draws attention to some generic reasons for the failure of infrastructure and service delivery and explores ways for measuring infrastructure and service delivery deficits. It emphasises the consequences of service delivery failure and notes the experiences of four towns, all of which have service delivery deficits. The article then contrasts the public statements of authorities such as Ministers and the Auditor General with the dearth of effective action on the part of many municipalities, and asks why this should be.

Keywords: Infrastructure maintenance, infrastructure operation, municipalities, service delivery failures, economy, budgets, skills

DIE REG OP FUNKSIONERENDE STEDELIKE INFRASTRUKTUUR – 'N OORSIG

'n Belangrike doelwit van plaaslike regering in Suid-Afrika, soos omskryf in die Grondwet, is om die voorsiening van dienste aan gemeenskappe op 'n volhoubare wyse te verseker. Verwaarloos van infrastruktuur belemmer egter steeds toegang tot dienslewering, wat alle burgers en die ekonomie raak. Ingelig deur sy eie lang loopbaanbetrokkenheid en huidige navorsingsprogram in infrastruktuuroperasie en instandhouding, tesame met huidige uitgebreide sekondêre navorsing, identifiseer die skrywer dat 'n gebrek aan sorg vir infrastruktuur tot infrastruktuur mislukking lei. Dit benadeel op sy beurt die ekonomie en verontref burgers – in sommige gevalle selfs ontnem van hul regte. Hierdie artikel vestig die aandag op enkele generiese redes

vir die mislukking van infrastruktuur en dienslewering en ondersoek maniere om infrastruktuur- en diensleweringstekorte te meet. Dit beklemtoon die gevolge van diensleweringsmislukking en neem kennis van die ervarings van vier dorpe, wat almal diensleweringstekorte het. Die artikel kontrasteer dan die openbare verklarings van owerhede soos ministers en die ouditeur-generaal met die gebrek aan doeltreffende optrede van die kant van baie munisipaliteite en vra waarom dit so is.

Sleutelwoorde: Begrotings, diensleweringsmislukkings, ekonomie, infrastruktuurbedryf, instandhouding van infrastruktuur, munisipaliteite, vaardighede

TOKELO EA LISEBELISOA TSA LITŠEBELERSO TSE SEBETSANG NTLE LE TŠITISO LITOROPONG - TLAHLOBO

Sepheo sa manthla sa mmuso oa lehae Afrika Borwa, joalokaha ho hlalositsoe molaong oa motheo, ke ho netefatsa phano ea litšebeletso ho sechaba ka mokhoa o tsitsitseng. Leha ho le joalo, ho se tsoeloe ha litšebeletso tsa manthla ho ntse ho tsoela pele ho sitisa phihlelo ea phano ea litšebeletso, 'me sena se ama baahi bohle le moruo. Sengoli, se bonts'itse hore khaello ea tlhokomelo e lebisatse ka kotloloho ho hloleheng ha litšebeletso tsa manthla joaloka meaho. Sena o se fihletse ka boiphihlelo ba hae tšebetsoeng ea lilemo tse ngata 'moho le boithuto bona mabapi le ts'ebetso le tlhokomelo ea meaho, hammoho le lipatlisiso tsa morao-rao tse pharalletseng. Sena se senya moruo hape se sitisa baahi, 'me ka hangata se ba amoha litokelo tsa bona. Sengoliloeng sena se hlokomelisa a mang a mabaka hlalositso ho hloleha ha litšebeletso tsa manthla le phano ea tsona, 'me se hlahloba mekhoha ea ho metha tlhokahalo ea litšebeletso tsona le phano ea tsona. Sengoliloeng sena se boetse se lekola litlamorao tsa ho hloleha ha phano ea litšebeletso mme e ela hloko liphihlelo tsa litoropo tse nne, tseo kaofela ha tsona di nang le kgaello ea phano ea litšebeletso tsa manthla ka kakaretso. Sengoloa sena se phethela ka ho bapisa liphatlatso tsa sechaba tsa ba bohlong joalo ka Matona le Mohlahlobi e Moholo oa

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Libuka, 'moho le khaello ea ts'ebetso ea maphomella ka lehlakoreng la bomasepala ba bangata. E qetella ka ho botsa hore na ke hobane'ng ho na le khaello e joalo.

1. INTRODUCTION

A discussion of infrastructure deficit and access within the South African context would not be complete without an examination of how widespread failure to operate and maintain existing infrastructure is almost indiscriminately affecting all of the population, and the economy. Competently operated and well-maintained infrastructure such as reservoirs, pipes, treatment works, bridges, roads, rail, harbours, electricity distribution, schools, hospitals and clinics underpins quality of life and economic development. If badly operated and inadequately maintained, it will impede social and economic growth, and undermine the goals of sustainable, inclusive economic growth and spatial transformation. Briefly, water reservoirs and pipes for sustenance and physical health, waste-water reticulation and treatment plants to promote dignity, electricity generation and distribution for stoves and machines and for learners who study after dark, solid waste collection and disposal for hygiene, roads for access to learning, work opportunities, and markets – that is the purpose of infrastructure.

But 'service delivery' is not achieved by the mere installation of infrastructure – for example, laying a pipe in the ground. Nor is 'delivery' concluded by the ribbon-cutting ceremony to celebrate the inauguration of the service (Public Works and CIDB, 2015; Wall, 2019). Rather, 'delivery' is clean, fresh, and pure water coming from that pipe 24 hours of every day and of every year, at the correct pressure – for the next 50 years!

Clause 152(1) of the Constitution states:

"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;¹ (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" (South Africa, 1996).

The Clause also states: "(2) A municipality must strive, within its financial and administrative capacity, to achieve the objects set out in subsection (1)" (South Africa, 1996).

The scale and pace of infrastructure delivery in South Africa in the past 24 years has been phenomenal, especially in respect of how basic services infrastructure has been extended to many previously unserved areas (Presidency, 2019a: 164; Presidency, 2014: 24-30). However, infrastructure roll-out does not necessarily equate to service delivery – even in the short term, but even less likely in the longer term, as the infrastructure ages, especially if the operation and maintenance of that infrastructure is not up to specification. The Cabinet-approved National Infrastructure Maintenance Strategy states: "'Delivery' needs to be understood as embracing not just the construction of infrastructure but the operation and maintenance of that infrastructure throughout its intended life" (Public Works, CSIR and Construction Industry Development Board, 2007: 3).

The Local Government Turnaround Strategy identified the primary municipal services as water, sanitation, solid waste (refuse) removal, electricity, and roads (CGTA, 2009). This article focuses on these services and discusses the extent to which infrastructure deficits affect all.

2. METHODS AND REVIEW APPROACH

The review provides a South African background on the access to service delivery, infrastructure operation, and maintenance deficits. First, the review summarises how infrastructure deficits, directly or indirectly, affect quality of life and the economy from both an international

and a South African perspective. Secondly, the review explores ways for measuring infrastructure and service delivery deficits. Thirdly, some generic consequences of service delivery failure are identified and the experiences of four towns, all of which have service delivery deficits, are noted.

Qualitative research methods were employed for this study, primarily through the application of desktop research and secondary data analysis. Relevant materials used in this review consisted of articles, reports, the internet, and other documents obtained from the authors' personal database of relevant material. The main source of information is the authors' own experience over a long professional career as civil engineer in both the municipal and private sectors in South Africa.

In the discussion section, the reasons for service delivery failure are evaluated and the consequences of failure are investigated, taking into account the economic and social effects, for example, financial cost of power outages, the environmental cost of pollution from waste-water systems, and the cost in both job losses and productivity.

3. KEY ISSUES

3.1 Infrastructure deficits affect all

A substantial amount of literature documents how infrastructure, directly or indirectly, benefits quality of life and the economy – and its corollary, and how the absence of infrastructure (the infrastructure is not there at all, or it is there but is not working) is to the detriment of quality of life and the economy.

3.1.1 South African literature

Each of the three South African Institution of Civil Engineering (SAICE) national infrastructure condition report cards (2006, 2011 and 2017) makes the above point. For example:

"In the global economy, the state of the nation's physical infrastructure provides one of

¹ Emphasis added.

the best indicators of its likely prosperity. Profitable economic activity requires efficient and functioning systems of transport, energy, water and waste management and social infrastructural services. There is also a positive relationship between buildings, infrastructure and human well-being. Well-designed and maintained public buildings and infrastructure contribute very significantly to good social relationships, reduced crime and increased productivity. Decrepitude and shabbiness have the opposite effect. In the case of critical social infrastructure, such as public schools, hospitals and clinics, infrastructural quality has been shown to have a proven positive effect on the impact of the service upon its users. In short, good infrastructure improves the quality and length of human life" (SAICE, 2011: 10).

The SAICE report cards have all been underpinned by comprehensive reports on each sector, compiled by infrastructure experts in each (for example, sanitation, rail, electricity).² The report on public health sector infrastructure effectively made the point that "anything below a C³ impedes service delivery, increases service and rehabilitation costs and *increases the [health] risk to patients and staff to unacceptable levels*"⁴ (De Jager, Kbenle, Motsatsi, Van Reenen & Koen, 2017: 30).

The Development Bank of Southern Africa (DBSA) clearly stated its view of the consequences of infrastructure operation and maintenance deficits (and of the absence of infrastructure in the first place) for access to service delivery.

"Infrastructure is directly linked to the economic development and growth of a country. ... It also increases productivity and improves the quality of life for many communities. ... When these infrastructures are not operating properly, the chain of production is disrupted. This

disruption hinders development, which causes economic deficit and, in turn, brings low standards of living" (DBSA, 2021).

This DBSA study gave the example of "dilapidated classrooms, toilets and other damaged school infrastructure [that] not only affect academic performance, but also infringe on the rights to education, as well as the rights to safety and health of learners as well as of teachers" (DBSA, 2021: online).

The Presidency and DBSA (2012: 6) report "argues that infrastructure development is an enabler of socio-economic development". Thus "infrastructure lies at the heart of government's stimulatory fiscal package and is a pivotal component of the New Growth Path". In addition, "[i]nfrastructure contributes to raising the quality of life by creating amenities, providing consumption goods (transport and communication services), and contributing to macroeconomic stability".

Further studies have attempted to quantify the costs to the economy of infrastructure failure. Examples in electricity and roads follow.

Eskom, the state-owned enterprise responsible for generating over 90% of electricity in the country, has for several years been forced, by frequent breakdowns of generation plants, to implement rolling blackouts. Various estimates have been made of the cost of this load-shedding to the economy, quality of life, and infrastructure itself. For example, the CSIR estimated that the "impacts to the economy" in 2019 alone were between R60 billion and R120 billion (Wright & Calitz, 2020: 5).

Eskom has repeatedly emphasised that a major reason for the load-shedding (not the only reason) has been the significant under-maintenance of generation and transmission infrastructure in the past. For example, in 2021, the CEO stated: "Eskom's fleet of coal-fired power stations, excluding Medupi and Kusile, are on average 41 years old. These power stations have been run far harder than international norms and have not

been maintained as they should have been" (Eberhard, 2021: online).

The cost of under-maintenance of public sector electricity and all other public sector infrastructure (for example, roads) is enormous.

Over 10 years ago, the CSIR, using data supplied by two of the largest truck operators in the country, compared the costs of operating on roads with bad surfaces with the costs of operating on the equivalent roads with good surfaces. "When moving from a good condition road to a bad condition road, increase in vehicle maintenance and repair costs of approximately 121%" were reported from a large sample of vehicles. The CSIR stated that this is "attributed to deteriorating road quality". It went on to say that these additional truck costs add 10% to company logistics costs – which are then passed on to the consumers of the goods transported by truck (CSIR, 2009: 29).

To my knowledge, the cost to quality of life has never been quantified, but circumstantial evidence abounds for one topical example. At the time of writing (October 2021), the frequent severe interruptions to electricity supply heavily disrupted learners' preparation for matriculation examinations in the week immediately prior to the start of examinations. Serumula (2021: online) described this somewhat poetically as: "We raise our animus young in caves, under candlelight".

The above paragraphs refer only to the costs of failure of electricity and road infrastructure. But the economy and the quality of citizens' lives are as much affected by failure of infrastructure in other sectors, not least water supply. The Department of Water and Sanitation (DWS) has long been concerned about the condition of water and sanitation infrastructure in the country. The first sentence of the 'Call to Action: Addressing the Crisis' of the National Water and Sanitation Master Plan reads: "South Africa is facing a water crisis driven by a massive backlog in water infrastructure maintenance and investment" (DWS, 2018: 1).

2 The great majority of these experts were at the time employed by the Council for Scientific and Industrial Research (CSIR). The report cards represent the contribution of at least 100 researchers and practitioners who have convincingly pointed to shortfalls in operation and maintenance as the primary cause of poor infrastructure condition.

3 SAICE-graded infrastructure from 'A' 'World-class' through to 'E' 'Unfit for purpose'.

4 Emphasis added.

On at least two occasions in 2021, the South African Human Rights Commission (SAHRC) condemned municipalities for under-maintenance (or no maintenance at all) of infrastructure, particularly waste-water treatment works, pump stations, and reticulation (SAHRC, 2021a [for Emfuleni] and 2021b [for Tshwane]).

SAHRC (2021a: 3) expressed its condemnation of Emfuleni in explicit terms: “The flow of raw sewerage on public streets, paths, and into homes poses a major health hazard to people and is an obvious violation of their rights to dignity as well. In addition to, and apart from the long-term effects of pollution of the water source on life, are the direct concerns relating to the negative impact the pollution has had on the economy. Evidence was provided and accepted regarding a decrease in tourist and recreational activities on the river, due to the severity of the pollution of the Vaal. The impact of the discharge, occurring over more than five years at the time of writing, violated a number of constitutional rights, including the rights to human dignity, freedom and security of the person, an environment that is not harmful to health or well-being, not to be deprived of property, healthcare, food, water and social security, just administrative action and the rights of children to be protected from maltreatment and degradation. ... In addition to not providing water supply services, the Municipality has, by *not maintaining the water sanitation infrastructure*,⁵ caused sewage pollution of the Vaal and in the streets and homes of persons living in the Emfuleni municipal area”.

Lemanski (2020: 589) succinctly summed up citizens’ perceptions of the low levels of infrastructure provision together with substandard operation and maintenance of that infrastructure as follows:⁶ “... despite 25 years of significant post-apartheid public investment in housing and services, frustration at poor service delivery and

beneficiary (mis)use of public infrastructure remains dominant”.

Over time, business has not simply become increasingly vocal on the harm that failure of municipal service delivery is doing to its activities – and to the jobs, never mind the services, which it provides. It has also, in a few instances, taken action (for example, Clover in Lichtenburg and Astral Foods in Lekwa – see section 4.3.4).

Finally, a few points made by the National Infrastructure Maintenance Strategy, which emphasised the cost to the economy and society of neglect of maintenance, also drew attention to the following:

- The cost to the infrastructure budget itself.
“If government spends its maintenance budget on fixing infrastructure only after it has already broken down, then it is effectively throwing away a large proportion of that budget ... funds that could rather have been used elsewhere to improve the quality of life of its citizens. This is because it is much cheaper to carry out periodic preventative maintenance than to do repairs when infrastructure breaks down. The saying ‘a stitch in time saves nine’ applies” (Public Works *et al.*, 2007: 4-6).
- The opportunities for job creation through infrastructure maintenance. Based on conservative estimates, “employment to approximately 240 000 people for a year” could be provided (Public Works *et al.*, 2007: 4-6).

3.1.2 International literature

The American Society of Civil Engineers (ASCE) is the doyen of national infrastructure report cards, having published the first roughly 25 years ago. The most recent of these states:

“When we fail to invest in our infrastructure, we pay the price. Poor roads and airports mean travel times increase. An aging electric grid and inadequate water distribution make utilities unreliable. Problems like these translate into higher costs for businesses to manufacture and distribute goods and provide services. These higher costs, in

turn, get passed along to workers and families. By 2039, America’s overdue infrastructure bill will cost the average American household \$3,300 a year, or \$63 a week” (ASCE, 2021: 5).

International references abound of the impact of infrastructure on society and economic development – and, conversely, of the impact of the lack of infrastructure. Out of action infrastructure, due to maintenance issues, is, as far as service delivery is concerned, and if that infrastructure remains out of action, equivalent to that infrastructure not having been built in the first place. It is, therefore, valid to incorporate in this literature review documents on the effect of the lack, for whatever reason, of infrastructure on economic development and quality of life.

Ismail and Mahyideen (2015) outlined the impact of infrastructure on trade and economic growth in selected economies in Asia. Gaal and Afrah (2017) investigated the lack of infrastructure on economic development in a study region of Somalia. Calderón and Servén (2004) demonstrated how infrastructure improvements would raise the growth rate of the economies of selected Latin American countries by three percentage points.

Reinikka and Svenson (1999: 1), quoting evidence from a study in Uganda, found that

“poor public provision of infrastructure services – proxied by an unreliable and inadequate power supply, significantly reduces productive private investment ... Firms can substitute for inadequate provision of public capital by investing in themselves. This comes at a cost, however: the installation of less productive capital. ... Although macroeconomic reforms and stabilisation are necessary conditions for sustained growth in private investment, without an accompanying improvement in the public sector’s performance, the private supply response to macroeconomic policy reform is likely to remain limited.”

Calderón and Servén (2010: 38) reported on the extent to which “deficient infrastructure [is] a major

⁵ Emphasis added.

⁶ See also Presidency, 2011.

obstacle for growth and poverty reduction across” sub-Saharan Africa.

“Drawing from an updated dataset of infrastructure quantity and quality indicators covering more than 100 countries and spanning the years 1960-2005, the article estimates empirical growth and inequality equations including a standard set of control variables augmented by infrastructure quantity and quality measures and controlling for the potential endogeneity of the latter. The estimates illustrate the potential contribution of infrastructure development to growth and equity across Africa.”

Moreover, they found that, on average, growth increased by 1.6% between 2001 and 2005, due to infrastructure development. They stated that increasing the quantum of infrastructure assists in reducing inequality.

According to the World Bank (2017: online), “[c]losing the infrastructure quantity and quality gap [for sub-Saharan Africa] relative to the best performers in the world could increase growth of GDP per capita by 2.6% per year. If inefficiencies are addressed, public and private investment in infrastructure could be a strategic tool for poverty reduction and economic development.”

The lack of well-built infrastructure hampers any government’s response to an all-encompassing emergency such as COVID-19 “to a point of paralysis”. The African Development Bank (2018: 74) alluded to this: “The consequences of poor infrastructure are not just the opportunity costs of lost growth. They also include retarded human development. Higher child mortality is driven by low access to basic services, such as electricity and clean water.”

Dangra (2016: online) found that

“India’s ambition of sustaining its relatively high growth depends on one important factor: infrastructure. The country however is plagued with a weak infrastructure incapable of meeting the needs of the growing economy and growing population. We believe, for India, investments in infrastructure equal to 1% of GDP will result in GDP growth of at least 2%, as infrastructure has

a ‘multiplier effect’ on economic growth across sectors.”

The report illustrated this point about multiplier effect in a table of the ‘effects of an increase in spending of 1% of GDP’ of a few countries.

3.2 Measuring infrastructure and service delivery deficits

Tales of infrastructure breakdown leading to service delivery interruptions in South African urban areas, with resultant harm to quality of life and local economies, are becoming increasingly common. Many municipalities seem to be unwilling and/or unable to remedy the situation.

This section explores several ways in which infrastructure and its condition and operation can be benchmarked against definable standards, and the service delivery implications inferred therefrom. It also notes a few ways in which the responses of users to service delivery performance, as they perceive it, can be measured.

A technocratic view of infrastructure would begin with assessing, against definable standards, how well that infrastructure is delivering the intended service. For example, the DWS ‘Green Drop’ assessment criteria for wastewater treatment works include quantitative parameters such as measuring the effluent for chemical oxygen demand and turbidity, as well as qualitative parameters such as asset management, and a view of the credibility of sample analyses (DWS, 2009).

As might be expected, users of a service would more likely assess the value of infrastructure in terms of the reliability of the supply – to them. They would thus assess ‘service delivery’ of water as continuity of supply (as opposed to interruptions of supply), flow rates/ water pressure, and so on, including tangible signs of the apparent quality of water, such as colour and taste.

The presence of harmful bacteria is not likely to be immediately noticeable to users, unless those bacteria manifested their presence in the taste of the water, for example.

The ‘technocrats’ would detect these in their testing. By such means, aspects of service delivery failure would be discovered that would not necessarily be apparent, or immediately apparent, to users of the services, but that could, for example, cause them to fall ill, or lead to long-term consequences and/or consequences out of sight of the users (for example, effluent discharge contaminating downstream water supplies).

3.2.1 The technocrats’ view

A rigorous summary of the condition of engineering infrastructure in South Africa can be found in the 2017 SAICE infrastructure condition report card, which, like its 2006 and 2011 predecessors, “reflects the expert view of the Institution and its members on the current condition of a broad range of public infrastructure” (SAICE, 2017: 2). Greatly assisted, as noted earlier, by the CSIR, SAICE gathered and analysed every dataset on the condition of infrastructure owned by the public sector (*i.e.* the infrastructure owned by the three spheres of government and the state-owned enterprises) on which it could lay its hands. This work was, to a limited extent, supplemented by primary research such as inspections of infrastructure, conducted by experts. The resultant information was benchmarked against infrastructure performance norms (SAICE, 2006; 2011; 2017).

That this exercise concluded in 2017 with awarding South Africa’s public infrastructure an overall average (*i.e.* across all sectors) grade as low as only ‘D+’ indicates a worrying incidence of infrastructure failure, or propensity to fail, inevitably resulting in consequences for service delivery.

While the SAICE infrastructure report cards constitute the only series of reports that survey all South Africa’s public sector infrastructure, several other reports take a similar technocratic view of individual infrastructure sectors, or of infrastructure in only specific geographical areas. A good example was the DWS trio of incentive-based certification programmes: Blue Drop (for water treatment and

reticulation systems), Green Drop (for waste-water systems) and No Drop (for water demand management of water systems). Unfortunately, since 2014, there has been a multi-year interruption to the inspection and analysis, and publication of this set of excellent reports. DWS has, however, commenced the inspections for a Green Drop report to be published during the second quarter of 2022, to be followed by a Blue Drop report a year later.

Some departments in some of the spheres of government periodically (not necessarily at regular intervals) undertake assessments of their service delivery capability and/or of the serviceability of their infrastructure, but most of them do not. Moreover, of those departments that undertake the assessments, many do not place the results in the public domain, and/or publish them in a format that makes it difficult to access or interpret even by parties with technical knowledge (De Jager & Wall, forthcoming).

In a few instances, however, departments have published short and very intelligible summaries of the masses of data in their possession. For example, DWS has, over the years, been candid about the gap between 'infrastructure delivery' and 'service delivery'. Using, *inter alia*, information from the annual Statistics South Africa General Household Survey, DWS stated the following in 2018:

"88.0% of households had been provided with a basic level of water supply infrastructure. However, not all of the infrastructure was able to meet the level of assurance (reliability) of supply requirements, defined for a basic water supply as interruptions of less than 48 hours at any one time and a cumulative interruption time of less than 15 days every three months. If this reliability requirement is taken into consideration, then the 88.0% value reduces to 74.36%" (DWS, 2019: 35).

Briefly, whereas some reports in the public domain have on various dates assessed the condition of infrastructure owned by the public sector, some, but not all, have also commented on the service delivery

implications of the condition and operation of this infrastructure. Other reports that appear from time to time provide selected statistics on infrastructure condition and/or service delivery, such as, for example, a report on the roads sector from a firm of consultants (Frost & Sullivan Africa, 2021).

The reports of the Auditor General sometimes make a direct comment on service delivery and infrastructure and its condition. For example, in the Municipal Financial Management Act (MFMA) 2018-2019 report, the summary comment on the neglect by many municipalities of infrastructure asset management planning in respect of 'Road Infrastructure', "27% did not develop or approve road maintenance plan and 16% did not determine backlog in renewal and routine maintenance" (Auditor General, 2020: 5).

3.2.2 The users' view

Voters can, and sometimes do, let their views on service delivery be known at national, provincial, and local government elections. However, apart from being an infrequent opportunity for users to express their opinions, these elections deliver messages from voters, in which service delivery issues would be only one of many on which voters are expressing opinions.

Formal service delivery complaints, received by call centres, might in the past have been an accepted way of measuring the users' view of service delivery, but no longer – not in a society of IT-based social media where service delivery protests have become such a visible manifestation of views.

A credible barometer of service delivery protests in South Africa has for some years been provided by Municipal IQ, which describes itself as 'a specialised local government data and intelligence organisation'. Its most recent annual summary, that of the year 2020, notes the 'downward dip' in that year compared to the several years preceding it, but adds that this dip is 'not necessarily an endorsement of municipalities'. Rather, it ascribes

the dip to COVID-19 lockdown measures which for most of the year placed restrictions on public gatherings (Municipal IQ, 2021: 1).

Nonetheless, 2020 witnessed 102 service delivery protests, during which "protesters raise issues that are the responsibility or perceived responsibility of local government (such as councillor accountability, the quality and pace of basic service delivery, and, in metro areas, housing)". One hundred and two protests is of an order of magnitude not seen since 2011, whereafter the numbers grew annually, reaching a peak of 237 in 2018 (Municipal IQ, 2021: 1).

3.3 Consequences of service delivery failure

Failure of the vast majority of types of engineering infrastructure affects all citizens – either because they themselves directly lose access to that service (for example, water), or because the infrastructure failure affects facilities or other services they use (for example, their place of work, shopping, or education). It might even affect their prospects of employment.

Moreover, failure of a specific type at a specific place can set off a chain of effects – maybe even a vicious spiral. For example, if a major pipe from a town's water-treatment works blocks or bursts, not only does the water to all households and businesses dwindle to a trickle within a few hours, but the cut-off of water can trigger failure of manufacturing systems that depend on a reliable water supply (reliable in volume, pressure, and quality – and no interruptions to supply). Food processing is an example in this instance.

Certain types of service delivery failure can also cause equipment failure, sometimes with widespread effects. For example, it is common for the start-up surge demand of an electric motor to be *several times the continuous energy rating*. In this context, 'electric motor' includes power tools, fans, air conditioners, and pumps. A municipal councillor responsible for infrastructure described how, because of this motor behaviour, load-shedding can

damage equipment to a municipal electricity distribution system:

“Eskom’s loadshedding has a significant impact on the City of Tshwane’s infrastructure as it often causes the tripping of electricity grids and power surges due to overloading when loadshedding ends. The reality is that municipal electrical distribution systems are not designed for continuous loadshedding conditions. During loadshedding the switching (turning on and off) of electricity to a grid happens up to three times per day, but the real challenge is that the load is synchronised and concentrated. All geysers, pumps, heaters, air conditioners etc start simultaneously. ... It is this concentrated load that sometimes is high enough to trip a circuit breaker, but the peak current is also high enough to cause a blowout on the joints of the 11 kV cables buried underground” (Nel, 2021: personal communication).

Failure of various types of bulk infrastructure, as distinct from local suburban infrastructure, can affect a wide area. For example, water-treatment works and waste-water treatment works, high-voltage electricity transmission lines, bulk electricity generation (Eskom loadshedding affects all users as well as street lighting and cell phone operations⁷), major roads (for example, road surface failure/pothole formation), traffic lights at major intersections, key civic buildings, area-wide telecommunications, and anything affecting districts of significant employment. The 2021 restoration to full operation of the treatment works at a town in North-West province was in the interests of all the townspeople.

Prudent municipalities identify the the most strategic infrastructure in the sense that were it to fail, the consequences for the municipality would be the greatest. Their next step should then be to attempt to either mitigate the consequences of failure or reduce the risk of failure. For example, some years ago, one South African metropolitan municipality identified that, of all its tens of thousands of infrastructure assets, the most harm would be

caused by failure of the pumps in a particular waste-water pump station – by no means its largest or most expensive asset. Should even one of the large pumps fail, contaminants would flow downriver the short distance to the sea and thereafter deposit on the city’s beaches, causing incalculable damage to the city’s international reputation as a desired holiday destination, and hence to the region’s economy.

Once this was understood, the municipality hastened to take short-term mitigation measures, including the installation of back-up pumps, while considering the possibility of, in the long term, relocating the pump station.

The following is a final example of the way in which infrastructure failure can affect all citizens. Considerable research has been done on the consequences of bad road conditions. Generally, this research investigated one of the following: (i) the effect of the condition of roads on road accidents, and the financial and economic consequences (not ignoring the human-interest consequences) or (ii) the effect of the condition of roads on vehicles and on goods carried on those vehicles.

Focusing only on (ii) above, and accepting that there might be varying interpretations of what could be ‘good quality’ and ‘poor quality’ road surfaces, a broadly representative selection of conclusions from research supports the CSIR findings reported earlier (CSIR, 2009), adding that average fuel consumption was 15% higher on poor quality as opposed to good quality roads. Poor quality roads shortened expected tyre life by two-thirds (CSIR, 2009; Van der Merwe, 2011; Chatti & Zaabar, 2012; Ross & Townshend, 2018).

Not surprisingly, the manufacturers and distributors of the goods carried generally attempt to cover the costs of damage in the final selling price of the goods.

The effects of service delivery failure can sometimes be mitigated by coping mechanisms, but these are generally only available to those who can afford to pay or are subsidised. For example,

shopping centres and office blocks purchase generators. Customers or tenants are expected to afford the associated extra costs. Another example of coping mechanisms against water-supply problems is that households purchase JoJo or similar tanks for water storage, or have boreholes sunk on their properties.

Alternatively, the cost of coping infrastructure for those not able to purchase it can be subsidised. For example, the programme to install 87 000 solar water heaters on RDP houses (Davis, 2021).⁸

The above readily shows that service delivery failure has financial and human costs affecting all the population and the local economy.

3.4 Selected vignettes of service delivery failure

Official reports, supported by my personal observation and media reports, suggest that many municipalities, if not the majority of them, are struggling to provide even basic services. Infrastructure failures, directly causing service delivery interruptions, are harming economic activity and the citizens’ quality of life, directly and indirectly. Example of ‘directly’: the water supply becomes intermittent, or even undrinkable, causing hardship to residents, and possibly even making them ill. Example of ‘indirectly’: a factory, unable to keep operating because of problems with the public sector infrastructure, reduces staff or even closes down, causing loss of jobs.

Not only does the quality of life of citizens suffer as a result, but local economies, which should be underpinned by reliable engineering services such as water supply, sanitation, roads, electricity, and solid waste disposal, are being seriously harmed.

This is exemplified by the experiences of four towns. The first is a large industrial town. The other three are smaller towns, in each

⁷ Worsened by theft of batteries, needed to keep cell phone operations online during load shedding, at towers (Daniel, 2021).

⁸ While the principle of including solar water heating installations in RDP housing projects is applauded, provision must be made for maintenance and repair of these units, given that many householders will find the task beyond them. However, no evidence of this provision could be found.

case centres for the processing of agricultural produce – and clearly, the viability of agro-processing enterprises is heavily dependent upon the local engineering services being reliable (Presidency, 2019b). The chosen towns and their local municipalities (LM) are Emfuleni LM, in Gauteng; Koster, in Kgetlengrivier LM, North-West province; Lichtenburg, in Ditsobotla LM, North-West province, and Standerton, in Lekwa LM, Mpumalanga.

3.4.1 Emfuleni

Service delivery by Emfuleni Municipality has been in the news for the wrong reasons, for at least the past decade. Eventually, prompted by the consequent pollution of the Vaal River, the SAHRC investigated and reported that, “[i]n addition to not providing water supply services, the Municipality has, by not maintaining the water sanitation infrastructure, caused sewage pollution of the Vaal and in the streets and homes of persons living in the Emfuleni municipal area” (SAHRC, 2021a: 2-3).

No calculation could be found of the economic effect of the contamination disgorged from Emfuleni into the Vaal River, but it must be considerable, affecting at least three downstream groups: towns such as Bloemhof and farmers who draw water from the river; owners of the many holiday resorts along the banks, and potential users of the water from the Vaal Barrage, Rand Water’s reserve supply, should Vaal Dam ever become unusually depleted.

3.4.2 Koster

Koster is a small town at the centre of an agricultural community. The struggle of citizen groups with the Kgetlengrivier Municipality (KLM) over the poor service rendered by its water and waste-water treatment works came to a head in late 2020, when the High Court delivered the following judgment:

“The Municipal Manager of the KLM is ordered to imprisonment

for 90 days, suspended on the following terms:

a.

That the spillage of raw sewage into the Elandsrivier and the Koster River be cleared up within 10 week days from the date of the order and that the First Respondent,⁹ duly assisted by the Second to Fourth Respondents, is ordered to take all necessary steps to ensure that raw sewage is not discharged into the aforesaid rivers or onto land surrounding the respective sewerage works at Koster and Swartruggens” (Registrar of North West High Court, 2021: s.p.).

Within three months, the citizen group restored full service at the waste-water treatment works.¹⁰

3.4.3 Lichtenburg

Lichtenburg, in the heart of South Africa’s main maize-growing area, is the location for factories manufacturing, among other things, cement, liquid fertilizer, animal feed and agricultural implements, as well as what is said to be the country’s biggest cheese factory.

However, in June 2021, citing ‘ongoing poor service delivery’ by the municipality, Clover announced that it will be closing down the cheese factory that employs over 300 local people (Fin 24, 2021: online). The prospect of loss of this major contributor to the local economy, and the fact that it could trigger the closing down of other businesses, not surprisingly prompted an immediate reaction from the provincial government (Bhengu, 2021: online; South African Government, 2021: online).

3.4.4 Standerton

Standerton is a large commercial and agricultural town on the banks of the Vaal River. The adjacent districts specialise in cattle, dairy, maize, and poultry farming. Astral Foods has been a major employer in the town for many years.¹¹

9 The citizen group that had brought the action.

10 <https://www.facebook.com/watch/?v=189099962989097>; and subsequent coverage by this same TV programme (‘Carte Blanche’).

11 <https://www.astralfoods.com/>.

The Standerton poultry-processing facility, said by Astral to be the largest such facility in Southern Africa, requires 5.5 Ml/day of water to process two million broilers a week. However, according to the company, within the past few years, the undersupply of water escalated to the point where the municipality was unable to supply the minimum contracted 4 Ml/day of water. This, Astral stated, is due to deteriorating infrastructure (Liedtke, 2019: online).

“The company’s Goldi processing facility was, subsequently, forced to reduce production to 50% of the scheduled capacity, with a concurrent negative impact on workers employed at the plant, suppliers and the greater Lekwa community. The municipality has now ‘undertaken’ to deliver a minimum of 2 Ml/d of water to the Goldi processing plant through its municipal infrastructure. The municipality has also appointed Astral as an emergency services provider and agreed to cede 3.5 Ml/d of their raw water allocation from the Vaal river system to Astral for a period of two years. Following this development, Astral installed infrastructure on one of its poultry farms alongside the Vaal river in the vicinity of Standerton, enabling it to extract raw water” (Liedtke, 2019: online).

However, the municipality could not perform even its much-reduced duties. Hence,

“[i]n April, the South African High Court ordered the national government to intervene in the affairs of a municipality for the first time. The intervention was a result of an ongoing financial and service delivery crisis in the Lekwa local municipality in Mpumalanga. The issue was brought by poultry producer Astral Foods, which said that the municipality had not been able to provide clean water or electricity. The group claimed that 40% of its production was under threat due to the crisis” (Staff Writer, 2021: online).

3.4.5 Commentary

The travails of these four towns are still currently developing stories. Moreover, while they might be those towns with the highest service delivery problem media profile at the time of writing, they are by no means the only towns with service delivery problems, which also extend to

metropolitan municipalities.¹² As the Deputy Minister of Finance stated:

“Lekwa is not the only municipality to have failed in terms of the constitutional and developmental mandate assigned to local government. Regrettably, 25 years into a new local government dispensation, after the introduction of progressive and enabling municipal legislation, extensive capacity-building efforts and increased grant allocations, there are 39 other municipalities in a situation as critical as Lekwa” (Staff Writer, 2021: online).

Finally: it must be noted that, while in all four cases the necessary infrastructure has, by and large, been ‘delivered’ at some point in time, the required services are not being ‘delivered’. Service delivery would not have been in such great trouble in the four towns if the existing infrastructure had been correctly operated and maintained over the years.¹³

4. DISCUSSION

Based on the review, neglect of operation and maintenance of infrastructure affect, to a very large extent, all in the areas concerned, undermining the economy and the quality of life of citizens. However, in those instances where service delivery is failing, why is it failing? For example: How does it come about that much infrastructure is not in a fit-for-purpose condition? This could be due to a combination of injudicious operation and too little

maintenance. Or it could be that the infrastructure is simply old and needs to be refurbished or replaced.

But why is this the case? What is the underlying problem? It is not difficult to suggest possible contributory reasons. For example, the municipal staff are insufficiently skilled and/or badly managed (they are given the wrong priorities) and/or not motivated (there is hardly any accountability). For another example, operation and maintenance are under-budgeted, or this budget is underspent, or part of this budget is diverted to other purposes during the year (an all-too-common occurrence).

Another possibility is that the infrastructure itself is or has become unsuitable for the purpose. That is, it is under-capacity for current needs (and thus overloaded), or it is of the wrong design (too complex, not robust, wrong process in relation to soil conditions, water types, and so on), or it has become too expensive to operate.

While underbudgeting for maintenance and repair¹⁴ is not justifiable and makes no sense in the long run,¹⁵ it is nonetheless understandable that it happens “in a political landscape dealing with a tight budget and a scarcity of skills”, as the CEO of the South African National Roads Agency put it. He went on to say that “[t]he critical question was how much does engineering [read ‘infrastructure’, or ‘service delivery’] inform needs and priorities in that landscape” (quoted in Frankson, 2018: 25).

What, then, is required to ensure that the infrastructure remains in good condition and able to deliver the service reliably and safely?

The following is a list of essential elements. (Note that these elements need time to be built (or rebuilt). None is amenable to a ‘quick fix’):

- Staff are sufficient in number, competent (training and

experience) and committed (*i.e.* share suitable value systems).

- The infrastructure is appropriate for its purpose, and staff have the necessary knowledge of that infrastructure.
- There is sufficient budget for repairs, planned maintenance, spares, infrastructure refurbishment and renovation, etc.

Picking just one from the list – the topic of skills. There is no lack of high-level documentation on the shortage in municipalities of the skills essential for service delivery. For example, with respect to engineering skills,¹⁶ the surveys by Lawless (2007; 2016), 10 years apart, indicate that the serious shortage identified in 2005 has since worsened.¹⁷

It is not the purpose of this article to discuss why a municipality lacks skills or why appropriate budgets are not allocated to infrastructure operation and maintenance. Moreover, any such discussion would sooner or later lead to topics such as the extent to which the dysfunctionality of many municipalities is traceable to the way in which they were originally set up or politics and patronage, or if there are alternatives to municipalities to deliver at least some of the infrastructure services. These topics deserve research articles of their own.¹⁸

The duty of municipalities is, as noted earlier, to “ensure the provision of services to communities in a sustainable manner” (South Africa, 1996: Clause 152). The track record of South African municipalities in fulfilling that duty is, however, erratic.

¹² A number of other companies, as well as a national business organisation have recently drawn attention to the difficulties caused to them (or, in the case of the organisation, to its members) by the unreliability of infrastructure service delivery (Staff Writer, 2021; Mashego, 2021; Barron, 2021).

¹³ It was not many years ago that failure of engineering infrastructure was not recognised as a significant potential risk to economic growth in South African towns. For example, a typical text of the period makes no reference to this possibility, other than “Many towns have fairly good inherited infrastructure (water, sanitation, and electricity), although deteriorating maintenance is causing some of it to crumble” (Atkinson, 2008: 19). In other words, reliable engineering infrastructure was taken for granted. That is, although failures were less common at the time, the CSIR and others had by 2008 for years already been warning about the neglect of infrastructure maintenance, and the likely consequences thereof.

¹⁴ For more on under-budgeting, see Wall, 2021a.

¹⁵ Because neglect of maintenance of infrastructure is, in the long run, invariably ‘paid for’ in terms of reduced life of the infrastructure and/or greater unreliability of service delivery.

¹⁶ On the lack of financial skills at municipalities, see for example: https://www.engineeringnews.co.za/article/saica-points-to-cfos-lack-of-competencies-for-municipalities-financial-woes-2019-06-06/rep_id:4136

¹⁷ Comparing the 2015 findings with those of 2005, Lawless stated: “Although there has been an increase in the number of civil engineering staff, there has also been a massive increase in the number of households to be serviced. ... [thus] the ratio of civil engineering staff per 100 000 households has dropped from 15.9 to 14.8. [Moreover] the number of municipalities with no civil engineers on their staff has increased from 126 to 202” (Lawless, 2016: 56).

¹⁸ Such as Wall 2021b.

Why is this the case? Are municipal leaderships not aware of the consequences for economic development and their citizens' quality of life?

The relationship between maintenance (or lack thereof) and the life of infrastructure for various types of infrastructure under different conditions has been demonstrated, and documented, many times.¹⁹ Moreover, as this article has described at some length, poor operational practices and/or lack of maintenance are likely to lead directly to breakdown of that infrastructure, and consequent withholding of service delivery. The economic and social effects for those who were receiving the services would include the financial cost of power outages, the environmental cost of pollution from waste-water systems, and the cost in both job losses and productivity. Not to mention the social and health costs incurred by communities whose water supply is interrupted, and the costs to companies that have to install, for example, water tanks and generators to safeguard against interruptions in supply of reticulated water and electricity. President Ramaphosa has, on many occasions, made attracting investment the cornerstone of his goal to revitalise the economy. However, this will be a tough sell to investors if the local authorities of urban areas where investment is planned cannot guarantee water or electricity supplies.

The warning bells, at the cost of neglect of competent operation and maintenance of existing infrastructure is no longer affordable, have been ringing for a long time. For example, over a dozen years ago, the National Infrastructure Maintenance Strategy bluntly stated: "It is self-evident that failure of infrastructure services has consequences for human development, poverty alleviation and economic growth. ... this cannot continue, as it is a cost that strikes at the heart of government's growth objectives" (Public Works *et al.*, 2007: 5).

More recently, in the words of the Minister of Finance (2021: 12), "communities and businesses are becoming increasingly intolerant of municipalities that can neither deliver basic services nor conduct their administration effectively".

5. CONCLUSIONS

Over the years, government has emphasised the need for public institutions to be 'capable', putting forward capacity-building and other supportive measures as the answer, or at least a major contribution to the answer, for improvement of service delivery. For example, each of the three most recent State of the Nation addresses by the President have emphasised the importance of a capable public service. Whereas the addresses of 2019 and 2020 both in the broadest of terms summarised how this is planned,²⁰ the 2021 address reassuringly stated: "We remain on course to build a capable and professional civil service that delivers on its mandate and is accountable to the South African people" (Presidency, 2021).

However, given continuing municipal service delivery failures, some doubt must be cast on the extent to which efforts on the part of national government have truly improved the capability of many municipalities.

Indeed, the Minister of Finance (2021: 11) no less queried the efficacy of government programmes to build capacity in municipalities: "National and provincial government have to date spent billions of [R]ands in local government capacity building programmes. The poor performance of many municipalities shows that there was almost a zero return on that investment".

Political will and skilled leadership of municipalities are further essentials for service delivery improvement. Perseverance and strong political backing are

needed to address the 'patronage and politics' referred to earlier.

Finally, it is not the purpose of this article to suggest that any form of institutional change might be a key factor in the improvement of local service delivery. But it is clear enough that there needs to be some reform – not across the board, because some municipalities are successfully delivering services, their key mandate. However, many are not. Again, quoting the Minister of Finance (2021: 11-12): "We can't speak of economic recovery and prosperity when municipalities, as agents responsible for helping government achieve these objectives, find themselves in a perpetual crisis ... decisive action is needed to restore the integrity of the municipal sector".

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19 For example, Institution of Municipal Engineering of Southern Africa, 2011.

20 "We will strengthen the technical capacity in government to ensure that projects move faster, building a pool of engineers, project managers, spatial planners and quantity surveyors – an action team that can make things happen faster on the ground" (Presidency, 2019b: online).

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