

HARARE'S WATER WOES: USING ROOT CAUSE ANALYSIS TO PIERCE THE BLACK BOX

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Abstract

Faced with deteriorating service delivery, Harare City Council (HCC) introduced a plan it called City Stabilisation Plan (CSP) on 16 September 2020. A key feature of the plan which seemingly received widespread public acceptance was restoring water service delivery. In the same vein, HCC unveiled its annual budget for 2021 on 19 November 2020. Arguably the budget had a skew towards improved local socio-economic development. In essence, however, performance has largely remained inadequate, limited and staggered. Services that are seemingly stalling include road construction and maintenance, healthcare, water supply and solid waste management. This is prompting the question of what might have gone wrong. By focusing on failing water supply, the article attempts to acquire insight into the nature, constraints and dynamics characterising contemporary urban service delivery in the City of Harare. In the most part, the article achieves its objectives through application of root cause analysis technology.

Keywords: service delivery; Zimbabwe; City of Harare; water service delivery; root cause analysis; water infrastructure; water pricing policies.

1. INTRODUCTION

In Zimbabwe as is probably the norm around the world, primary responsibility for the provision of urban services usually rests with city government. This is usually the case even when city governments resort to alternative models of service delivery. The responsibilities of city governments may involve some or all of the following: waste collection and disposal, civic amenities provision, roads construction and maintenance, water supply public conveniences, infrastructure provision and maintenance; environmental management, local planning functions, street cleaning, development control and land-use management (Marumahoko et al, 2020).

City governments enjoy the advantage of proximity. They are also better placed to diagnose, comprehend and tailor-make solutions to service delivery challenges (Ahmad & Devarajan, 2005; Marumahoko & Nhede, 2021). Recently, however, it appears to be the case that both the quantity and quality of urban service delivery in Zimbabwe is backtracking (See Figure 1). Service delivery is seemingly constrained by challenges that include finance and capacity, coordination and governance the rapid pace and scale

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of urbanisation, unresponsiveness of city government; multiplicity and rigidity of laws and regulations; low levels of community participation, the lack of accountability of local decision makers (Marumahoko, 2020a). In the same vein are allegations of lack of policy coherence, oversight and monitoring, lack of information/data to enable justification of decisions in service delivery, inadequate sources of revenue and the lack of adequate knowledge of local government issues.

Using root cause analysis, the article attempts to identify the primary causes of inadequate water service delivery and the complex systems around the problems. In doing so, it is hoped that the article will facilitate greater debate and appreciation of the true root causes of declining service delivery in urban Zimbabwe in general and in the City of Harare in particular.

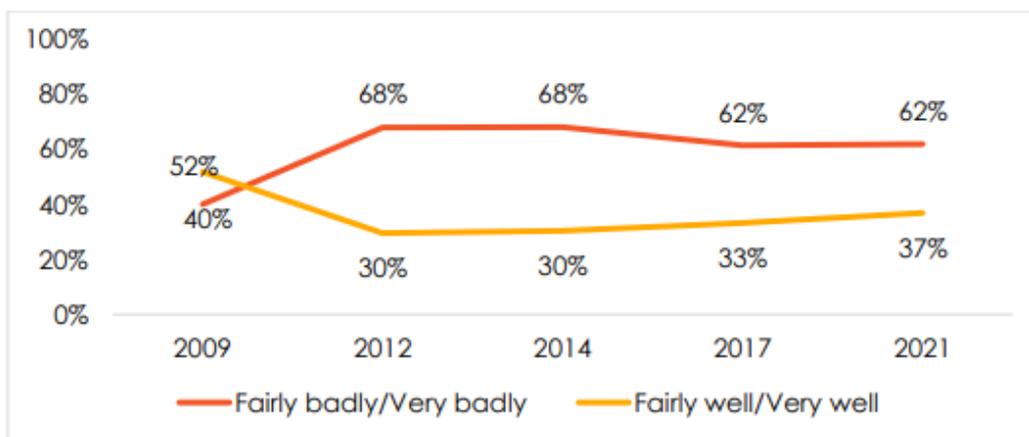


FIGURE 1 - RESPONSE TO THE QUESTION: HOW WELL OR BADLY WOULD YOU SAY THE CURRENT GOVERNMENT IS HANDLING THE FOLLOWING MATTERS, OR HAVEN'T YOU HEARD ENOUGH TO SAY: PROVIDING WATER AND SANITATION?

Source: Afrobarometer, 2021

The article is organized as follows: it begins by introducing root cause analysis, the objective being to facilitate shared understanding and appreciation of the technology and its application in problem solving. In this regard, three root cause analysis methods, 5 Whys, Change analysis/Event analysis and the Cause and effect Fishbone technique (also called the Ishikawa diagram) are discussed, briefly. Thereafter, a brief background of the City of Harare is given, the objective being to shed some light on the organisation, institutions, processes and mandate of the city government in service delivery. In the same vein, the article engages on the statement of the problem. In this regard the article briefly engages public characterisation and mischaracterisation of service delivery in the city with the aim of laying a basis for ascertaining whether public perceptions are aligned or misaligned to the root causes of diminished service delivery. Following this, the article outlines its research methodology. Thereafter, root cause analysis technique is applied to tap water supply in the City of Harare. Following rigorous analysis, the article briefly discusses the nature, characteristics, dynamics, limitations and challenges of four issues identified

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as being at the centre of the root causes of the capital's water woes. The article then presents its concluding remarks.

2. ROOT CAUSE ANALYSIS (RCA)

RCA is methodology that combines elements from engineering, psychology, and other disciplines and has been formally endorsed by policy makers in the USA, UK, Australia, and Denmark and is in the process of being adopted by other countries (Nicolini et al, 2011). RCA can be applied to a range of situations from personal life to business firms and public sector organisations (Carroll, 1998). In the UK, the National Health Service (NHS) is an example of a public sector agency that uses RCA to investigate clinical incidents. At the NHS, the use of RCA is based on the assumption that "when incidents do happen, it is important that lessons are learned across the NHS to prevent the same incidents occurring elsewhere (National Patient Safety Agency (NPSA), 2004)".

According to the Institute of Internal Auditors, root cause analysis (RCA) identifies why a problem occurred (2013). Based on the assumption that every problem has a root cause, the theoretical framework systematically traces the reasons for the occurrence of a problem (Fourie & Poggenpoel, 2017). The reasons for problems could range from errors to non-compliance with procedures, systems and protocols. Given that problems are not easily attributable to one factor, root cause analysis, applying near scientific reasoning, narrows the process of identifying problems and their root causes (Doggett, 2005). In tracing events and activities back to their origin, RCA applies in-depth analysis and separates symptoms from the root causes of problems. Whereas symptoms are usually the initial warning signs that something has gone wrong, root causes are real causes of the problem that are only conclusively attributed to rigorous analysis of the entire situation (Carroll et al., 2002). As a technique, root cause analysis can be applied without much variation to private sector problems as well as to public sector problems (Fourie & Poggenpoel, 2017).

According to Amo, the RCA process is organised in sequential steps (1998). These include: (1) identifying the incident to be analysed; (2) organising a team to carry out the RCA; (3) studying the work processes; (4) collecting the facts; (5) searching for causes; (6) taking action; and (7) evaluating the actions taken (Amo, 1998). At the UK's National Patient Safety Agency (NPSA), for example, RCA investigations are undertaken by a small team assembled by the quality co-ordinator or patient safety officer and steered by a facilitator (Nicolini et al, 2011). It is the duty of the team members to agree on the terms of reference, methods of investigation, and engage in information gathering, process mapping, and the identification of contributory root causes. Thereafter the team compiles a report and makes suggestions for transformation (Nicolini et al, 2011).

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There are a number of methodologies, techniques and approaches for conducting root cause analysis. They include change analysis, barrier analysis, events and causal factor analysis, Kepner-Tregoe problem solving and decision making model comprised of situation analysis, problem analysis, solution analysis and potential problem analysis. In the ensuing paragraphs, the article discusses the 5 “whys” technique, change analysis/event analysis and cause and effect fishbone analysis.

2.1 The 5 “whys” technique

The 5 “whys” approach is a common technique used in performing a root cause analysis (Nicolini et al, 2011). It is often thought of as the annoying toddler approach. A characteristic of the technique is that every answer to a “why” question is followed up with an additional, deeper “Ok, but WHY?” question (Asian Development Bank, 2017). At the core of the questioning is the need to facilitate root cause analysis. The more the “whys”, the better are the chances to get a more informed picture of the reasons behind a certain problem and reduce the likelihood of the problem recurring. In this regard, the 5 “whys” not only serve to avoid assumptions, they also provide detailed responses to incremental questions, thus aiding answers to become clearer and more concise each time.

2.2 Change analysis/event analysis

Change analysis/event analysis is another useful method of exploring root cause analysis. It involves carefully analysing the changes leading up to an event (Wilson, 2014). It is often used when there are a large number of potential causes. It does not focus at the specific day or hour that something went wrong. Instead, it focuses at a longer period of time thus gaining a historical context. It could work like this: first, every potential cause leading up to an event are listed, including any time a change occurred for better or worse. Second, would be to class each change or event by how much influence is brought to bear on it. Third, is going event by event and making a decision on whether or not that event was an unrelated factor, a correlated factor, a contributing factor, or a likely root cause. It is at this stage that most of the analysis occurs and other strategies like the 5 “whys” are used, leading to a discovery of the root cause. Fourth, is deciding on a remedy for the root cause or replicating the root cause success (Wilson, 2014).

2.3 The Fishbone or Ishikawa diagram technique

The fishbone diagram is another common technique to visually map cause and effect (Lewis, 2021). It is known as the Ishikawa diagram. The fishbone diagram aids to identify possible causes for a problem. This is facilitated by inspiring us to pursue categorical branched paths to potential causes. Through narrowing the causes, we end up at the right one. As a rule, the technique commences with the problem

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in the middle of the diagram. This provides a basis for the spine of the fish skeleton. Following this is brainstorming. A characteristic of this stage is that an assortment of causes is placed in off-shooting branches from the rib bones of the fish skeleton. This facilitates for categorisation which may be broad after which the groupings are broken down into the smaller components. In addition, this aids digging deeper into potential causes and sub-causes and interrogating each classification or branch as well as doing away with unrelated categories and identifying associated factors and likely root causes (Lewis, 2021).

3. THE CITY OF HARARE

Harare, formerly Salisbury, is the capital of Zimbabwe. It lies in the northeastern part of the country. Named for Lord Salisbury, then British prime minister, Harare was created by the British South Africa Company (BSACo) which ran Zimbabwe's affairs between 1890 and 1923 (Marumahoko, 2010). At independence in 1980, its name changed from Salisbury to Harare. The city's population as of 2012 when the last national census was held is 1.5 million people. Harare City Council is the administrative body tasked with providing services for residents of Harare. It is responsible for providing local government services such as health services, solid waste management, housing and accommodation and clean drinking water, among other functions. The governance of HCC as is the case with all local governments in Zimbabwe is divided between the elected and the unelected. The elected authority comprises 46 councillors who represent the residents of the wards in which they are elected for five years. It is led by a non-executive mayor assisted by a deputy mayor elected in chambers. The unelected authority or administrative arm of HCC is led by a Town Clerk (TC) aided by directors of services and operations. HCC supplies water to the satellite towns of Norton, Ruwa, Epworth and Chitungwiza that constitute Harare Metropolitan city. This way, it is responsible for providing water services to 4.5 million people.

4. STATEMENT OF THE PROBLEM

Harare City Council (HCC) has been accused of gross incompetence allegedly due to its failure to address issues such as poor road network, potholes in the streets, inadequate solid waste management, potable water crisis and mismanagement of funds. In 2018, the city of Harare faced a potential class lawsuit by residents who feared their health had been undermined by supplying them with what was described as "visibly contaminated water" (Chipunza, 2018). In 2020, the Combined Harare Residents Association (CHRA) approached the High Court seeking an order to compel HCC to supply uninterrupted clean water to residents at the height of the efforts to combat the further spread of the Covid-19 pandemic

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(Tapfumaneyi, 2020). According to Human Rights Watch (2021) over half of the metropolitan city's 4.5 million people lack access to clean water. Residents allegedly endure long periods without access to safe and clean water supply, a phenomenon observed widely across urban Zimbabwe (see Figure 2). Deprivation is allegedly forcing citizens to resort to unprotected common water sources, despite the known risk of contaminated water (Cassim, 2021; Human Rights Watch, 2021).

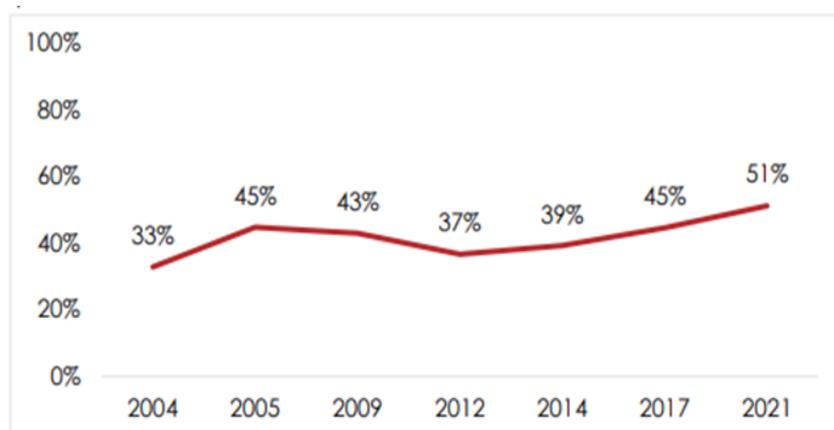


FIGURE 2 - RESPONSE TO THE QUESTION: OVER THE PAST YEARS, HOW OFTEN, IF EVER, HAVE YOU OR ANYONE IN YOUR FAMILY GONE WITHOUT ENOUGH CLEAN WATER FOR HOME USE (% WHO SAY "SEVERAL TIMES" OR "MANY TIMES" OR "ALWAYS")

Source: Afrobarometer, 2021

The capital's water woes are seemingly undermining people's rights to water and sanitation and the rights to life, food and health. Section 77 of Zimbabwe's 2013 Constitution protects the right to water. It states that every person has the right to safe, clean, and potable water (Kondo et al, 2021). It also obligates the state to take reasonable legislative and other measures, within the limits of available resources, to achieve the progressive realization of the right to water. In 2010, Zimbabwe along with over 100 other countries, voted in the UN General Assembly to recognize a freestanding right to water (Human Rights Watch, 2021). One year down the road, the UN Human Rights Council endorsed the right to safe drinking water and to sanitation as basic rights. In 2015, the General Assembly adopted a resolution that states that the right to water entitles everyone, without discrimination, to have access to sufficient, safe acceptable, and affordable water for personal and domestic use.

In its General Comment No. 15, the UN Committee on Economic, Social, and Cultural Rights has interpreted international law on the right to water, as well as state obligations (Kondo et al, 2021). The state's minimum core obligations are listed as including ensuring people's access to sufficient, safe water and physical access to water facilities or services that are not too far away. Zimbabwe has ratified international human rights treaties that explicitly or implicitly contain provisions on the right to water. They include the International Covenant on Economic, Social, and Cultural Rights, the

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Convention on the Elimination of All Forms of Discrimination against Women, the Convention on the Rights of the Child, the Convention on the Rights of Persons with Disabilities, and the International Covenant on Civil and Political Rights (Human Rights Watch, 2021).

In 2020, the HCC appeared to have taken note of public concerns surrounding inadequate tap water. On 16 September 2020, the city appeared to do something about the concerns. It unveiled a turnaround plan that it said promised, among other things to address the vexing challenge of failing water supply. The turnaround strategy is also known as the City Stabilisation Plan (CSP). It identifies pressing problems, recommends solutions and establishes key performance indicators. At the time of its launch the plan promised to turnaround the fortunes of the city within 100 days but more importantly, it was touted as a springboard for improving the performance of the HCC into the future. In that regard, the city adopted the CSP as “both a roadmap towards success and also a key accountability tool against which the residents of Harare can hold city fathers and mothers accountable” (City Stabilisation Plan, 2020).

The CSP was presented to Harare citizens not only as the basis of satisfactory service delivery but also as a standard for assessing performance for the period up to the end of the first quarter of 2023 when the next local government elections are held and voters are afforded yet another opportunity to either rebuke current serving councillors by voting them out or retaining them in their current positions. In presenting the CSP to city dwellers, the Mayor of Harare (Jacob Mafume) committed to more effective service delivery that is “affordable, accessible, and at acceptable levels of quality based on the participation of the residents and stakeholders of Harare” (City Stabilisation Plan, 2020). Important to this article, the plan committed to restoration of adequate water supply to city residents. It spelt out the guiding principles and philosophies underpinning successful service delivery as being based on the following:

- Appreciation of the challenges that citizens are facing in terms of service delivery
- The need to increase the interaction between citizens and the City fathers and mothers
- Appreciation of the level of suffering of the residents due to the economy-wide crises engulfing the country and how this impacts on their ability to meet Council obligations
- The need to focus on public services, including those that affect our overall well being, dignity and worthiness
- Appreciating the changing nature of the sources of livelihoods of the residents
- Low salaries for Council workers and limited opportunities for continuous professional development

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- The need for collective effort where the residents work together with city fathers and mothers to resolve the teething problems
- The need to improve communication between, residents, city fathers and council employees
- The use of Public Private Partnerships in particular BOT and BOOT arrangements to venture into projects that address the needs of the city and accelerate the improvement of service delivery (City Stabilisation Plan, 2020).

Revitalising service delivery also featured as a strong component of HCC annual budget for 2021. On 19 November 2020, Councillor Tichaona Mhetu of Warren Park who is also the Chairperson of the Finance and Development Committee presented a budget proposal for approval to the Full Council that suggested that policymakers at HCC are seemingly appraised of the challenges hampering improved provision of tap water in the capital (HCC 2021 Annual Budget Statement). The budget statement was presented under the theme “Restoring service delivery: Towards a smart city”. Its budget lines were aligned to the City Stabilisation Plan (CSP), unveiled two months before it. Not only did it tap into the CSP, it amplified it, aligning the policy documents. In essence, HCC annual budget echoed concerns of failing service delivery highlighted in the CSP. Among other things, the 2021 Revenue and Capital Estimates sought to fulfil HCC’s 2021 strategic goals and attaining customer satisfaction (HCC 2021 Annual Budget Statement as read with CSP, 2020). Furthermore, it had a strong skew towards restoring service delivery in the “water sector, to manage solid waste effectively and to ensure that our roads are more trafficable” (HCC 2021 Annual Budget Statement).

The 2021 annual budget was presented as a recitable phenomenon with its pillars said to be comprised of five components (CSP, 2020). These are (1) closing all revenue leakages, eradicating corruption, ending nepotism and managing cost; (2) efficient tariff modelling and billing, exploitation of all new revenue streams and enhanced debt collection; (3) facilitating operational and technical efficiency through restoring infrastructure, allocative efficiencies, and efficient service delivery; (4) prompting employee motivation and productivity through optimising manpower utilisation, enhancing Integrated Result Based Management system (IRBM) and introducing a fair and competitive remuneration and (5) facilitating good governance through restoring public confidence in the HCC, building on performance culture, adherence to standard operating procedures and mainstreaming a culture of transparency and accountability (HCC 2021 Annual Budget Statement). In the 2021 capital budget, water supply in Harare was a component of the Water, Sanitation and Hygiene programme (WASH) and was allocated ZWL\$4 766 208 500.00, allegedly in line with the aspirations of the stakeholders of the City (see Table 1 below). The capital funding structure was as follows:

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TABLE 1 - WATER, SANITATION AND HYGIENE FUNDING

Capital funding structure	Amount in ZWL\$
Water services	2 384 020 300
Waste water	1 533 548 200
Solid waste	848 640 000
Total WASH	4 766 208 500

Source: Harare City Council's annual budget statement (2021)

Despite meticulous policy and financial planning, water supply for the City remains largely subdued. Recourse to CSP and the 2021 annual budget as springboards for realising improved service delivery appears to have fallen short of set goals. The narratives on urban water supply slippages in the city of Harare are contested. Although there are other causes for failing water supply as we shall see discussed elsewhere in the paper, it is not unusual, on impulse, for the politics of service delivery to loom large over other explanations.

Seemingly, on the one hand it is not unusual for a section of the society to attribute Harare's water woes to poor governance, including, incompetence, corruption and failure to govern properly by the party that controls (HCC) Harare City Council (Chidakwa, 2019). In the opposite direction, another section of the society accuses national government of undermining urban service delivery in Harare through alleged encroachment on the turf of HCC (City of Harare, 2021). In 2001, for example, it is often pointed out that national government capriciously took over water and sanitation functions from HCC and other city governments and gave them to Zimbabwe National Water Authority (ZINWA), a parastatal that national government controls, worsening urban water supply (Marumahoko et al, 2020). Yet others blame both national government and HCC (along with other city governments) for allegedly failing to work together to reverse the downward spiral in urban service delivery (Netsianda, 2019).

Among other factors, one author blames depletion of water resources, reduced water treatment, population growth, lack of construction of new dams, lack of rehabilitation of existing reservoirs, siltation and leakages (Cassim, 2021). Another author discounts the role of climate change for the shortages and blames pre-colonial and post-colonial governments for doing little to boost water supplies to keep pace with a "swiftly growing urban population and a geographically expanding city" (Musemwa, 2021). Others blame poor planning, inefficient internal systems, low revenue collection efficiencies and systems that are not responsive to programme-based budgeting (Chidakwa & Vambayi, 2021).

From the foregoing, it is clear that there are many narratives and explanations on the supposed causes of erratic water supply in Harare. Some of the explanations appear to focus on the symptoms of failing service delivery. Others are seemingly the result of speculation and guesswork. It is against this backdrop that root cause analysis technique was deployed to dig deeper into the causes of declining water supply.

5. METHODOLOGY AND APPROACH OF THE STUDY

Unearthing the dynamics of backtracking service delivery requires systematic investigation. Using root cause analysis technology presented diagrammatically in Figure 3, the article interrogates every potential cause of declining tap water supply and asks questions in pursuit of clarity and certainty. Questions such as “why”, “how” and “so what does that mean” facilitate certainty about root causes, distinguish symptoms from root causes and are a basis for fixing root causes to prevent issues from happening again as well as carve a path towards greater and more informed understanding of root causes and their characteristics.

The design of the root cause analysis followed these steps: the process of unearthing root causes of declining water supply in Harare began with the researcher forming a six-member team to assist the researcher conduct the root cause analysis. In this regard, team members were selected from Harare Water, a division of HCC responsible for managing production, distribution of potable water and providing sewerage services, councillors, water experts and policy analysts. All the team members had varying experience in water supply, development of policies, standards, monitoring and evaluation of urban water supply projects in Zimbabwe and beyond.

The analysis lasted about three months and commenced with emphasis being placed on defining and understanding the problem, brainstorming its possible causes, and analysing root causes and effects. The team met twice weekly, and each meeting was scheduled to last not more than three hours. Once the problems were diagnosed, the next step was subjecting them to rigorous analysis with the intention of separating symptoms from true root causes of inadequate water supply in the city of Harare.

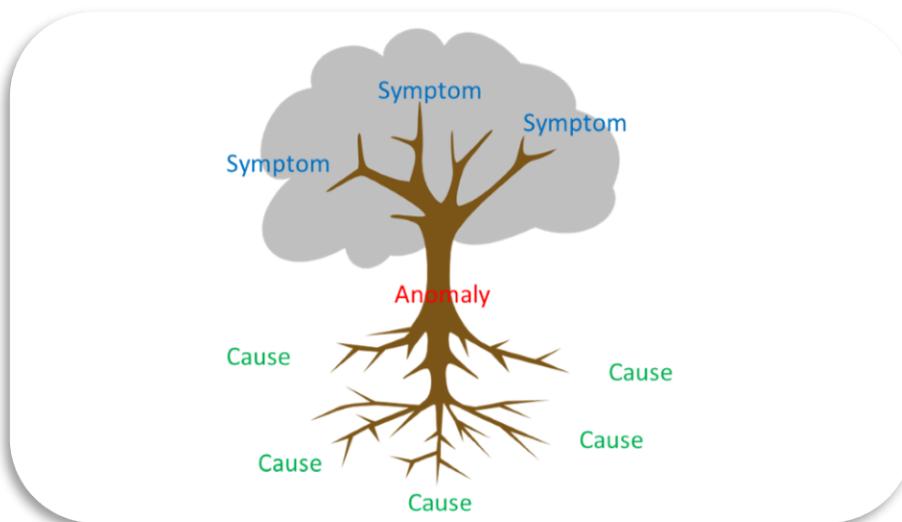


FIGURE 3 - STANDARD DEPICTION OF ROOT CAUSE ANALYSIS
Source: Patnaik (2020)

6. THE CAUSES OF ERRATIC WATER SUPPLY

Aged infrastructure, poor revenue inflows, weak customer service orientation, increasing arrears, water leakages, weak financial and operational management systems, reduced investment in infrastructure, and lackadaisical approach to policy implementation were found to be causes of declining service in the City of Harare. In the same vein, low annual rainfall, droughts, climate change, inability to manage water resources, economic downturn, inadequate water planning and maintenance and the recall, suspension and dismissal of elected councillors and mayors were identified as the other high profile causes crippling water supply. Although all of these issues negatively affected water services, water leakages, scarcity of water treatment chemicals, poor investment in public infrastructure and inefficient water tariff modelling stood out as the challenges substantially undermining efforts by HCC to address the water woes besetting the capital. In the ensuing paragraph, the article briefly engages the nature, characteristics, features and dynamics of the issues seemingly exerting more harm than others.

6.1 *Water loss through leakage*

Water leakage was identified as one of the key challenges undermining adequate water provision. It is characterised by water already treated to drinking water standards being lost in the distribution systems (Ndunguru & Hoko 2016). The water is lost through water bursts, ageing infrastructure, intermittent supplies, dysfunctional meters, and unauthorised connections. In 2016 the percentage of water wastage allegedly ranged from 29% to 43%. By the end of 2021, water wastage had reportedly increased to 62% (Ndunguru & Hoko, 2016; Doma, 2021; Byo.com, 2021). Concerning is that for every 100 megalitres city governments are treating, they are said to be losing 68 megalitres (Herald Reporter, 2020). Treated water loss in Harare allegedly exceed the recommendation of the World Bank which is 20% for good performing water utilities in urban Southern Africa (Gumbo, 2004; Ndunguru & Hoko, 2016).

In Harare, water loss through leakage, especially water bursts often go unnoticed for a long time given that the city's water distribution system is largely buried and forgotten and attention is only given after water erupts to the surface (Chidakwa, 2021). Even then, it may be months before the leak is plugged with HCC frequently citing incapacity as the reason for inaction (Zhakata, 2021). Water that is not billed is also regarded as a component of water loss through leakage. It includes water for public fountains, street cleaning, watering municipal gardens, flushing mains and sewers, and firefighting among other things. It is unclear what percentage of treated water is lost that way.

Water theft, a component of unauthorised connections, is robbing the city of revenue required to keep the water distribution system efficient (Zwnews.com, 2021). Related to this is meter bypass, illegal connections and misuse of fire hydrants. It is not clear the volume of treated water that is lost that way

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and the subsequent impact on revenue collection and sustainability of service delivery. Worsening the situation is that although water audits are instrumental in furnishing the reasons for water losses and ensuring that all treated water is accounted, they are seemingly not considered a common feature of management of water distribution and management systems in HCC. Last year (2021) was an exception as the city managed to undertake water audit. The audit itself was not the initiative of HCC but followed a directive from national government (Chadenga, 2021).

6.2 Scarcity of water treatment chemicals

The shortage of water treatment chemicals was diagnosed as the other reason behind Harare's perennial water woes. Water chemicals, a key component of the water supply system, are in short supply. The quality of the raw water sources from which Harare draws its supplies has declined over the years. Harare's main water reservoirs Lake Chivero and Manyame dam are heavily polluted (Mukeredzi, 2019). The pollution is mostly from sewage works as well as industrial waste from Harare, Ruwa, Norton and Chitungwiza. The waste flows into Lake Chivero and Manyame dam, Harare's main water sources.

The chemicals used to purify raw water and to bring it up to water drinking standards increased from two, decades ago (ZIMFACT, 2021). Currently, the city uses more than 10 chemicals to convert raw water to safe drinking water (Human Rights Watch, 2021, p.1). The chemicals are sourced mostly outside Zimbabwe and they are expensive (Magaisa, 2020; Matenga, 2021). They include: powdered activated carbon, liquid aluminium sulphate, gas chlorine, hydrated lime, granular aluminium sulphate, calcium hypochlorite, sulphuric acid, ammonium and sodium silicate (Mhetu, 2019; Saki, 2021).

The economic challenges facing the country characterised by major foreign currency shortages have negatively impacted procurement of water treatment chemicals outside Zimbabwe (Madzimure & Chidakwa, 2019). Without enough foreign currency, HCC is hampered to supply water to the greater Harare metropolitan region, which includes Harare the capital city and its satellite towns of Chitungwiza, Ruwa, Epworth and Norton. It also does not help much that procurement of water chemicals is now centralised, with national government ordering HCC to source its water chemicals from outside Zimbabwe through Chemplex Corporation Limited, a company where national government is a major shareholder (263 Chat, 2020; Karengazeka, 2019). With this arrangement, the benefits associated with competitive bidding are seemingly lost (263 Chat, 2020).

6.3 Development of water infrastructure

Limited capital investment in water infrastructure development was identified as another formidable setback to optimal water provision. Increased urbanization and rapid population growth is not matched by

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investment in public infrastructure that is lagging behind. The city's sources of water, Lake Chivero, Manyame, Harava and Seke dams are no longer meeting the demand for increased water supply in Harare (Magaisa, 2020). Much of the city's outdated infrastructure for piped water in Harare was developed in the 1950s (Human Rights Watch, 2021). Since then, the authorities have seemingly ignored development of water infrastructure.

Inadequate attention has been seemingly given to the refurbishment, operation and maintenance of dilapidated water supply infrastructure. The lion's share of the revenue collected by city authorities is not ploughed back into water distribution system rehabilitation. A small portion finds its way back into maintaining and upgrading water distribution systems. The remainder supports other cost centres. Seemingly, there is also too much reliance on water revenue to sustain other services. A study done a decade ago found that Harare budgeted to raise 33.6% of its 2010 revenues from water sales (Coutinho, 2010; Marumahoko & Fessha, 2011).

There is also uncertainty over the issue of who is responsible for bulk water supply and construction of new dams (Marumahoko, 2020b). It is not unusual for national government to conveniently blame HCC for not investing in bulk water supply. However, according to the Water Act and the Zimbabwe National Water Authority (ZINWA) Act, national government is assigned the responsibility for planning, development and management of water resources (Manzungu et al, 2016; Magaisa, 2020). Harare's role is confined mainly to distribution and billing (Magaisa, 2020). Over the past four decades (including in 2021), efforts by national government to build Kunzvi dam which is often touted as the panacea to Harare's water woes have been characterized by many false starts, amid allegations of underhand dealings and a lack of accountability (Gonditii, 2021; Cassim, 2021; Murwira, 2021).

6.4 Pricing policies for water supply

Absence of efficient tariff modelling was found to be another issue stalling water provision. Water tariffs in the city of Harare have the potential to constitute over 40% of HCC's revenue but they are unviable and inefficient. They are skewed towards protecting societal groups such as poor households and the destitute and not financial sustainability (Coutinho, 2010). Social protection is about ensuring the equitable and efficient allocation of available water to all users based on the understanding that the poor and destitute may be excluded from equal access to essential services, or be more vulnerable to poor service quality.

Supply costs in Harare, are either marginally incorporated into the tariff structure or ignored altogether. In essence, supply costs consist of capital costs. These cover both capital for renewal investment of existing infrastructure and new capital investment costs. In the same vein, supply costs also include operation and maintenance costs. These are costs associated with daily running of the water supply system

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(Marumahoko, 2020b). The low prices for treated tap water reduce the revenues of HCC undermining the capacity of the city to maintain spending on existing infrastructure.

Given that demand is exceeding supply capacity, it may be a good thing to close this gap. One way this is potentially achieved is by increasing investment in new infrastructure for water storage and transmission. Another way is by improving conservation of existing water resources. Finally, it may be good policy if HCC reviews issues pertinent to sustainable water management. Among other things, this may entail review of the definition of affordability, benefits and costs of metering, elasticity of domestic water use to prices and fiscal transfers to water services.

7. CONCLUDING REMARKS

The article applied root cause analysis (RCA) methodology to investigate the nature, dynamics and limitations of Harare's water supply system. At its center was deciphering the root causes of Harare's water woes. In the most part, the study focused on water supply in the period following unveiling of Harare's City Stabilisation Plan (CSP) and adoption of its 2021 annual budget. Water supply is a crucial component of the services Harare City Council (HCC) is required to deliver for the convenience of the citizens living under its jurisdiction. Although the RCA technology unearthed many causes for backtracking water supply; water leakage, a shortage of water treatment chemicals, limited infrastructure development and misaligned tariff structures and systems were identified as the major contributory factors to Harare's water woes. Many perceived causes seemingly turned out to be symptoms. It is recommended that at least US\$ 1 billion dollars a year for the next five years be invested in addressing Harare's water supply crisis to mitigate health risks.

REFERENCES

- 263 Chat. (2020). *Residents chide Harare City Council over dry weekend*. Retrieved from <https://www.263chat.com/residents-chide-harare-city-council-over-dry-weekend/>
- Afrobarometer. (2021). Zimbabweans grapple with water shortage amidst COVID-19 pandemic. *Dispatch No. 475*, 1-9.
- Ahmad, J. & Devarajan, S. (2005). Decentralisation and Service Delivery. *World Bank Policy Research Working Paper 3603*. Retrieved from <https://gsdrc.org/document-library/decentralization-and-service-delivery/>
- Amo, M.F. (1998). Root cause analysis. A tool for understanding why accidents occur. *Balance (Alexandria, Va.)*, 2 (5), 12-15.
- Asian Development Bank. (2017). *The 5 Whys technique*. Retrieved from https://www.researchgate.net/publication/318013490_The_Five_Whys_Technique.

HARARE'S WATER WOES: USING ROOT CAUSE ANALYSIS TO PIERCE THE BLACK BOX

- Byo.com. (2021). *62% of treated water wasted*. Retrieved from Bulawayo24.com, <https://bulawayo24.com/index-id-news-sc-national-byo-211519.html>
- Carroll, J. S. (1998). Organizational learning activities in high-hazard industries: The logics underlying self-analysis. *Journal of Management Studies*, 35, 699-717.
- Carroll, J. S. et al. (2002). Lessons learned from non-medical industries: Root cause analysis as culture change at a chemical plant. *Quality Safety Health Care*, 11 (3), 266-269.
- Cassim, J. (2021). *Major cities in Zimbabwe face water woes despite good rainfall*. Retrieved from <https://www.aa.com.tr/en/africa/major-cities-in-zimbabwe-face-water-woes-despite-good-rainfall/2393964>
- Chadenga, S. (2021). *Urban councils to carry out water audits*. Retrieved from <https://www.newsday.co.zw/2021/01/urban-councils-to-carry-out-water-audits/>
- Chidakwa, B. (2019). *Councils shoulder blame for poor service delivery*. Retrieved from <https://www.herald.co.zw/councils-shoulder-blame-for-poor-service-delivery/>
- Chidakwa, B. (2021). *Treated water goes to waste as Sunningdale runs dry*. Retrieved from <https://www.herald.co.zw/treated-water-goes-to-waste-as-sunningdale-runs-dry/>
- Chidakwa, B & Vambayi, C. (2021). *Harare presents a 41,8 billion budget*. Retrieved from <https://www.herald.co.zw/harare-presents-a-418-billion-budget/>
- Chipunza, P. (2018). *Harare faces lawsuit over poor water quality*. Retrieved from <https://www.herald.co.zw/harare-faces-lawsuit-over-poor-water-quality/>
- City Stabilisation Plan for Harare City Council (2020). Retrieved from <https://www.hararecity.co.zw/resources/of/strategic-documents>
- City of Harare (2021). *Uncertainty and leadership gaps hamper service delivery: Acting Mayor Cllr Mutizwa*. Retrieved from <https://www.hararecity.co.zw/news/read/uncertainty-and-leadership-gaps-hamper-servi>
- Coutinho, B. (2010). Sources of Local government financing. In J. De Visser, Steytler, N & Machingauta, N (eds.). *Local government reform in Zimbabwe*. (pp.71-86). Bellville, SA: Community Law Centre.
- Doggett, A. M. (2005). Root cause analysis: A framework for tool selection. *Quality Management Journal*, 12 (4): 34-45.
- Doma, M. (2020). *Harare city seeks to restore service delivery*. Retrieved from <https://www.theanchor.co.zw/harare-city-seeks-to-restore-service-delivery/>
- Fourie, D. & Poggenpoel, W. (2017). Public sector inefficiencies. Are we addressing the root causes? *South African Journal of Accounting Research*, 31 (3): 169-180.
- Gonditii, C. (2021). *Chinese company that won US\$109m Kunzvi Dam tender tainted by scandal*. Retrieved from <https://thenewshawks.com/chinese-company-that-won-us109m-kunzvi-dam-tender-tainted-by-scandal/>
- Gumbo, B. (2004). The status of water demand management in selected cities of Southern Africa. *Physics and Chemistry of the Earth*, 29, 1225-1231.
- Harare Residents Trust. (2020). *Recall of elected councillors exposes shortcomings in selection of councillors*. Retrieved from <https://kubatana.net/2020/09/14/recall-of-elected-councillors-exposes-shortcomings-in-selection-of-councillors/>

HARARE'S WATER WOES: USING ROOT CAUSE ANALYSIS TO PIERCE THE BLACK BOX

- HCC (Harare City Council) 2021 *Annual budget statement*. Retrieved from <https://www.hararecity.co.zw/resources/of/council-budgets>
- Herald Reporter. (2020). *National water audit looms*. Retrieved from <https://www.herald.co.zw/national-water-audit-looms/>
- Human Rights Watch. (2021). *Zimbabwe: Dire lack of clean water in capital*. Retrieved from <https://www.hrw.org/news/2021/09/22/zimbabwe-dire-lack-clean-water-capital>
- Institute of Internal Auditors. (2013) *Practice advisory 2320-2: root cause analysis*. Retrieved from https://na.theiia.org/standards-guidance/Member%20Documents/PA_2320-2.pdf
- Karenggezeka, Y. (2019). *Just in: Chemplex to supply water chemicals*. Retrieved from <https://www.herald.co.zw/just-in-chemplex-to-supply-water-chemicals/>
- Kondo, T., Masike, S., Chihera, B & Mbonderi, B. (2021). One step forward, two steps back: A review of *Mushoriwa v City of Harare* in view of Zimbabwe's constitutional socio-economic rights. *African Human Rights Law Journal*, 21, 610-637.
- Lewis, S. (2021). Fishbone diagram (Ishikawa cause and effect). Retrieved from <https://whatis.techtarget.com/definition/fishbone-diagram>
- Madzimore, J & Chidhakwa, B. (2019). *Harare water treatment chemicals arrive*. Retrieved from <https://www.herald.co.zw/harare-water-treatment-chemicals-arrive/>
- Magaisa, A. (2020). BSR: Urban councils – A case of responsibility without power. Retrieved from <https://bigsr.africa/bsr-urban-councils-a-case-of-responsibility-without-power/>
- Marumahoko, S. (2010) *Testing the boundaries of Zimbabwe's fiscal decentralization for urban councils* (Masters thesis). Retrieved from http://etd.uwc.ac.za/xmlui/bitstream/handle/11394/2569/Marumahoko_MPHIL_2010.pdf?sequence=1&isAllowed=y
- Marumahoko, S. (2020a). A conceptual framework for improved municipal service delivery in urban Zimbabwe. *Applied Research in Administrative Sciences*, 1(1), 24-36.
- Marumahoko, S. (2020b). Urban service delivery in post-Mugabe Zimbabwe. In A. Farazmand (ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance*. (pp. 1-9). Springer, DE: Cham
- Marumahoko, S. & Fessha, Y.T. (2011). Fiscal autonomy of urban councils in Zimbabwe: A critical analysis. *Law Democracy & Development*, 15, 1-22.
- Marumahoko, S. et al. (2020). Governance and urban service delivery in Zimbabwe. *Strategic Review for Southern Africa*, 42 (1 May/June 2020), 41-68.
- Marumahoko, S. & Nhede. T.N (2021). Service delivery and accountable governance in urban Zimbabwe: The issue of policy implementation. *Romanian Journal of Public Affairs*, Issue 3/2021, 65-84.
- Manzungu, E. et al. (2016). Bulk water suppliers in the City of Harare – An endogenous form of privatisation of urban domestic water services in Zimbabwe? *Water Alternatives*, 9 (1), 56-80.
- Matenga, M. (2021). *Harare water crisis far from over*. Retrieved from <https://www.newsday.co.zw/2021/06/harare-water-crisis-far-from-over/>
- Mhetu, I. (2019). *Harare ordered to dump middlemen in buying water treatment chemicals*. Retrieved from <https://www.newzimbabwe.com/harare-ordered-to-dump-middlemen-in-water-treatment-chemicals/>

HARARE'S WATER WOES: USING ROOT CAUSE ANALYSIS TO PIERCE THE BLACK BOX

- Mukeredzi, T. (2019). *Chinese enterprises to help end Zimbabwe's chronic water problems*. Retrieved from <https://www.chinadaily.com.cn/a/201910/15/WS5da52c23a310cf3e3557086a.html>
- Murwira, M. (2021). *Kunzvi dam: contractor pledges to meet targets*. Retrieved from <https://www.herald.co.zw/kunzvi-dam-contractor-pledges-to-meet-target/>
- Musemwa, M. (2021). Urban struggles over water scarcity in Harare. *Dædalus, the Journal of the American Academy of Arts & Sciences*, 150 (4) Fall 2021, 27-47.
- National Patient Safety Agency (NPSA) (2004). *Root cause analysis toolkit*. Retrieved from <http://www.nrls.npsa.nhs.uk/>
- Ndunguru, M.G, & Hoko, Z. (2016). Assessment of water loss in Harare, Zimbabwe. *Journal of Water, Sanitation and Hygiene for Development*, 6 (4), 519–533.
- Netsianda, M. (2019). *ED warns corrupt councils*. Retrieved from <https://www.herald.co.zw/ed-warns-corrupt-councils/>
- Nicolini, D. & Waring, J. (2011). *Policy and practice in the use of root cause analysis to investigate clinical adverse events: Mind the gap*. Retrieved from https://wrap.warwick.ac.uk/38585/1/WRAP_Nicolini_SSM_4_final_uploaded.pdf
- Patnaik, U. (2020). *The power of root cause analysis*. Retrieved from <https://upmusings.com/2020/05/19/the-power-of-root-cause-analysis-2/>
- Saki, C. (2021). *Proposal confirms city of Harare water as toxic*. Retrieved from <https://kubatana.net/2021/03/25/proposal-confirms-city-of-harare-water-as-toxic/>
- Tapfumanei, R. (2020). *COVID-19: Harare residents sue city, government over clean water supply*. Retrieved from <https://www.newzimbabwe.com/covid-19-harare-residents-sue-city-government-over-clean-water-supply/>
- UN (1966). *International Covenant on Economic, Social and Cultural Rights*.
- UN (1973). *International Convention on Civil and Political Rights*.
- UN (1979). *The Convention on the Elimination of All Forms of Discrimination against Women*.
- UN (1989). *The Convention on the Rights of the Child*.
- UN (2007). *The Convention on the Rights of Persons with Disabilities*.
- UN (2010). *The Right to Safe Drinking Water and to Sanitation*.
- Wilson, B. (2014). *Change analysis*. Retrieved from <https://www.bill-wilson.net/root-cause-analysis/rca-tools/change-analysis>
- ZIMFACT (2021). *FACTSHEET: How many chemicals are used to treat Harare's water?* Retrieved from <https://zimfact.org/factsheet-how-many-chemicals-are-used-to-treat-harares-water/>
- Zhakata, I. (2021). *Greendale residents raise money to fix burst water pipe*. Retrieved from <https://www.suburban.co.zw/greendale-residents-raise-money-to-fix-burst-water-pipe/>
- Zwnews.com. (2021). *Harare continues to lose treated water through pipe bursts, leaks*. Retrieved from <https://zwnews.com/harare-continues-to-lose-treated-water-through-pipe-bursts-leaks/>