The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

EMPIRICAL EVIDENCE ON THE CURRENT CONDITIONS OF WATER RESOURCE INFRASTRUCTURE WITHIN THE ETHEKWINI REGION

NOSIPHO BUHLE FAYA [1] and IRUKA CHIJINDU ANUGWO [2]

[1, 2] Department of Construction Management & Quantity Surveying, Durban University of Technology, South Africa. Email: [1]chwane@gmail.com, [2]IrukaA@dut.ac.za ORCID ID: [2]0000-0002-2905-1413

Abstract

Water is an essential and critical resource for human, animal, and plant survival and continued existence on planet Earth. Water is increasingly becoming a scarce resource; however, the issue of water scarcity has been exacerbated by the intensity of climate change conditions as well as aging water resource infrastructure in many countries, more especially in developing countries such as South Africa. Therefore, there is an urgent need to upgrade water resource infrastructure in South African cities in order to alleviate the stress on the current systems in place. This study aimed to evaluate the current conditions of water resource infrastructure and its management within the eThekwini region. In order to achieve that, this study's qualitative research method was adopted whilst using an in-depth interview approach, which is rooted in an ethnographic research approach to directly observe the current condition of eThekwini region water resource infrastructure assets. Thus, study observation and in-depth interaction were held with the operational personnel who are responsible for the operation and maintenance of the water infrastructure assets. The study findings reveal that the current condition and capacity of the water management system at eThekwini are not in a satisfactory state as some of the infrastructure is old and requires extensive maintenance. This study concluded and recommended that the eThekwini region needs to earnestly strive towards improving its current state of water resource infrastructure in order to meet its satisfactory capacity through routine maintenance.

Keywords: Current Condition, eThekwini Region, Maintenance, Water Infrastructure.

1. INTRODUCTION

Water resource management is a key factor for sustainable development, however, water scarcity has increasingly becoming a global concern due to climate change as many countries are either facing drought with extreme heat or heavy rains with floods (Eckstein, 2009). South Africa is a potentially drought-stricken country as such, water resource management and conservation has become a key government imperative (Loucks, 2000). However, in particular, the eThekwini region within KwaZulu Natal has been experiencing flooding which could be potentially related to the increase in the impact of climate change. For example, devastating flooding incidents were observed on the N2 freeway in Durban, in October 2017 and South of Durban in March 2019 respectively (Ritchie, 2017; de Greef, 2019). Thus, there is a need to strategically evaluate technical measures in place with regard to water resource management systems and infrastructure adaptability in the face of climate change (Gilrein et al. 2019. Thus, effective strategic and technical measures would enhance eThekwini region's capacity in conservation of the excessive water and curb the potential damage brought by floods. Therefore, water management systems have become a necessity, especially in drought-stricken areas where weather variations adversely affect communities (Kundzewicz et al.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

2001). Thus, an effective water resource management system and resilience infrastructure for water control remains a reliable remedy that would foster regions and communities to adapt to efficient water harvesting and recycling techniques. According to the Water Institute of Southern Africa (2023), without a strategic and resilient intervention in water resources management, the future of humanity is bleak. Water management systems have become a necessity, where weather variations adversely affect communities. To an extent, adequate infrastructure capacity remains a reliable remedy that would allow communities to adapt to sustainable means of water management (Padre, 2001). Water management is essential at both the community and government levels. At the local level, it is important to have the skills necessary to effectively manage water and advocate for improvements (Giacomello, Meigh, and Sullivan, 2003). These may be indicated and achieved by educating people about the implementation of government policies and their response to local needs in a constructive way. Thus, the purpose of this study is to assess the current conditions of water resource infrastructure within the eThekwini region

2. LITERATURE REVIEW

Overview of Integrated Water Resource Management

Water resource management in South African water institutions places great emphasis on benefitting the public in terms of water resource management through an integrated network approach (Claassen, 2013). This has led to an integrated approach to water resource infrastructure and its management. Therefore, integrated water resources management (IWRM) has often been interpreted and implemented in a way that is only really suited to countries with the most developed water infrastructures and management capacities (Butterworth, Warner, Moriarty, Smits and Batchelor, 2010). Integrated water resource management (IWRM) is a holistic approach that seeks to integrate the management of the physical environment within the broader socio-economic and political framework (UNESCO, 2009). The ideas of IWRM are a call to consider water resources and their management more holistically, i.e., to manage it across sectors, and to ensure wide participation in decision-making (Giordano and Shah, 2014). The integrated approach is geared toward promoting ways of enabling participation among a broad spectrum of stakeholders for sustainable environmental benefits. Thus, the need for sustainable development is the core driver of IWRM, which is to enhance the preservation of natural resources, such as water and ecosystems.

The United Nations (UN) (1972) Conference on the Human Environment presented objectives to inspire and guide people (public and private entities) in the preservation and enhancement of the human environment. The conference put forward 26 principles to address that need, which include the safeguarding of natural resources for the benefit of present and future generations through careful planning or management; and a call on states for an integrated and co-ordinated approach to development planning. IWRM is a useful and necessary model for emphasizing the systematic interconnectedness of human activities and the environment (Tejada-Guibert, 2015). However, this approach has been less effective as a result of climate change, scarcity of water resources, regional political challenges, and aging infrastructure.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

At the International Conference on Water and the Environment, January 1992, in Dublin, key principles were identified in integrated water resource management, such as:

- Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment.
- Water development and management should be based on a participatory approach involving users, planners, and policy makers at all levels.
- Women play a central part in the provision, management, and safeguarding of water.
- Water has an economic value in all its competing uses and should be recognized as an economic good.

The approach to the implementation of the IWRM principles in the South African context would need to be revisited in order to address the changing environment as a result of climate change. According to spring (2011), there is a lack of awareness among citizens of the needed paradigm shift from the government to an integrated management of water systems. The integrated management of water resources includes rainwater harvesting; maintenance and replacement of infrastructure; restoration of ecosystems; and urban planning (spring, 2011).

Challenges in Managing Water Resources and its Infrastructure

Kabat and van Schaik (2003) note that the rapidly growing catalog of storms, floods, and droughts from across the globe has made climate variability a challenging issue, as extreme weather is disrupting lives and national economies. Thus, behind the disaster statistics are climatic trends that pose serious challenges to the management of the world's water resources (Kabat and van Schaik, 2003). Water is essential for human existence and survival, as well as for the economic development of any nation (Tallis, Kareiva, Marvier, and Chang, 2008). However, there are some major challenges facing water resource management and supply. In South Africa, the provision and management of water will be a continuing challenge due to the need to keep pace with the rapidly growing population, climate change, increased industrial demand, and infrastructure development (Gumbi and Rangongo, 2018). There is a growing need to allocate water resources between different sectors in a way that optimizes economic growth and sustainability (Gumbi and Rangongo, 2018). However, the issues of climate change have the potential to exacerbate the risks associated with water scarcity and quality. Some of the challenges are poor maintenance of infrastructure, drought and floods, and vandalism of infrastructure.

3. RESEARCH METHOD

This study adopted a qualitative research method based on a case study of the eThekwini region's water resources-related entities in Durban, South Africa. This study was based on an ethnographic research approach to directly observe and gain insight into the current condition of eThekwini region's water resource and infrastructure assets maintenance and as such an

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

interactive session (semi-structure interviews) was held 8 operational personnel who are responsible for operation and maintenance of the water infrastructure assets and the interaction (semi-structure interviews) with the 8 personnel at the selected water infrastructure facilities within the eThekwini region.

Table 1: Rank/ Position/ Job Title of sampled participants

S/N	Rank/ Position/ Job Title	Number of Sampled Participants
1	Wastewater Treatment Superintendents	6
2	Technician	1
3	Process Controller	1
	Total Sample/ Selected	8

Source: Researcher's construct (2023)

Data analysis involves "breaking up" the data into manageable themes, patterns, trends, and relationships (Mercy, 2014). NVivo software was used for the content analysis of the collected data, through which themes and conceptual ideas were generated and analysed accordingly.

4. FINDINGS AND DISCUSSION

The deductive method was applied to the analysis of the gathered data. This method involved analyzing the data after it had been sorted and coded to see if the interviewees' evidence, experiences, opinions, and perceptions of the eThekwini region's water resource management systems showed any patterns. Therefore, the study sought to ascertain the current state of the Water Resource Management Systems in the eThekwini region. The respondents were also asked whether, in the past 10-to-15 years, the water management systems have been functioning at their full capacity; and whether the budget allocated is enough to sustain the municipality's water resource management and infrastructure development.

> *Themes (current state of water resource management Systems): "Current condition not satisfactory"; "need for upgrade water infrastructure"; "Infrastructure not resilient enough"*

The findings from the respondents indicated that the current condition and capacity of the water management system are not in a satisfactory state. They (respondents) also said that the municipality has been grappling with maintaining the old infrastructure, which has required a lot of money. Thus, the collective and emerged findings of the study from respondents revealed that the demands of the city have increased, but the municipality has not increased its resources to meet the demand by upgrading the water infrastructure.

One of the respondents explained that the existing infrastructure is outdated (close to 40 years old) and it is deteriorating and unable to contend with the ever-changing climate, demands, and technology. Furthermore, other respondents added that: "*These conditions have led to major malfunctions in the system, which points to the lack of budget allocated to maintain and sustain the development that is happening in the city".*

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

5. CONCLUSION AND RECOMMENDATIONS

The study conclusion and recommendation were based on collected and analyzed data of the research study. The study concluded based on key findings that the municipality has been challenged by the condition and capacity of the water management system, and also by the need to maintain the old infrastructure. It seems there is not enough in the budget to meet the demands of upgrading and upscaling to more modern technology in order to mitigate the deterioration of the old infrastructure. These findings corroborate with the conclusions of studies by Ziervogel et al. (2014) and Donnenfeld et al. (2018). The study further concluded that the aging infrastructure within the eThekwini region requires urgent attention, considering that there has also been a rapid change in the effluent that needs to be treated in the wastewater treatment plants. Based on the findings, all the infrastructure changes require a financial injection in order to realize the changes needed. These findings validate the studies of Chelleri, Schuetze, and Salvati (2015), and Crabb and Robin (2006). Thus, the study recommends that the eThekwini region should strive earnestly to ensure that its current state of water resource infrastructure is at full functional and satisfactory capacity by routinely updating and upgrading its structural integrity in order to ensure it is resilient against collapse.

References

1) Butterworth, J., Warner, J.F., Moriarty, P., Smits, S. and Batchelor, C. (2010). Finding practical approaches to integrated water resources management. *Water alternatives*, *3*(1), pp.68-81.

2) Chelleri, L., Schuetze, T., and Salvati, L. (2015). Integrating resilience with urban sustainability in neglected neighborhoods: Challenges and opportunities of transitioning to decentralized water management in Mexico City. *Habitat International* 48 (2015) 122e130.

3) Claassen, M.(2013). Integrated water resource management in South Africa. International Journal of Water Governance, 1(3-4), pp.323-338.

4) Crabb, E, P and Robin, M. (2006) Institutional Adaptation of Water Resource Infrastructures to Climate Change in Eastern Ontario. *Climatic Change* (2006) 78:103-133. DOI: 10.1007/s10584-006-9087-5

5) De Greef K. (2019). South Africa Floods Leave at Least 60 Dead. Online-https://www.nytimes.com/2019/04/24/world/africa/durban-floods.html

6) De Greef K., 2019. South Africa Floods Leave at Least 60 Dead. The New York Times https://www.nytimes.com/2019/04/24/world/africa/durban-floods.html (Accessed 10 February 2020)

7) Donnenfeld, Z., Crookes, C. and Hedden, S. (2018). A delicate balance: Water scarcity in South Africa. *ISS Southern Africa Report*, *2018*(13), pp.1-24.

8) Eckstein, G.E. (2009). Water scarcity, conflict, and security in a climate change world: challenges and opportunities for international law and policy. Wis. Int'l LJ, 27, p.409.

9) Ritchie, G. (2017). Durban storm death toll has risen to at least six. Mail & Guardian https://mg.co.za/article/2017-10-10-police-officer-dies-in-durban-storms/ (Accessed 10 February 2020).

10) Gilrein, E.J., Carvalhaes, T.M., Markolf, S.A., Chester, M.V., Allenby, B.R. and Garcia, M., 2019. Concepts and practices for transforming infrastructure from rigid to adaptable. Sustainable and Resilient Infrastructure, pp.1-22.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.10318616

11) Gilrein, E.J., Carvalhaes, T.M., Markolf, S.A., Chester, M.V., Allenby, B.R. and Garcia, M. (2019). Concepts and practices for transforming infrastructure from rigid to adaptable. *Sustainable and Resilient Infrastructure*, pp.1-22.

12) Giordano, M. and Shah, T. (2014). From IWRM back to integrated water resources management. International Journal of Water Resources Development, 30(3), pp.364-376.

13) Gumbi, N. and Rangongo, M.F. (2018). Factors that Hinder Effective Management and the Supply of Clean Potable Water at eThekwini Municipality in KwaZulu-Natal. International Conference on Public Administration and Development Alternatives, 04-06 July 2018, Stellenbosch University, Saldahna Bay, South Africa.

14) Kabat, P and van Schaik, H. (2003). The Dialogue on Water and Climate. Published in The Netherlands by the Dialogue on Water and Climate.

15) Kundzewicz, Z.W., Budhakooncharoen, S., Bronstert, A., Hoff, H., Lettenmaier, D., Menzel, L. and Schulze, R., 2001, December. Floods and droughts: Coping with variability and climate change. In Thematic Background Paper presented at the International Conference on Freshwater, Bonn (pp. 4-8).

16) Loucks, D.P. (2000). Sustainable water resources management. *Water international*, *25*(1), pp.3-10.

17) Ritchie. G. (2017). Durban storm death toll has risen to at least six. Mail & Guardian (https://mg.co.za/article/2017-10-10-police-officer-dies-in-durban-storms/).

18) Spring, Ú.O., 2011. Aquatic systems and water security in the Metropolitan Valley of Mexico City. Current Opinion in Environmental Sustainability, 3(6), pp.497-505.

19) Tallis, H., Kareiva, P., Marvier, M. and Chang, A. (2008). An ecosystem services framework to support both practical conservation and economic development. *Proceedings of the National Academy of Sciences*, *105*(28), pp.9457-9464.

20) Tejada-Guibert, J.A., 2015. Integrated Water Resources Management (IWRM) in a Changing World. In Sustainability of Integrated Water Resources Management (pp. 65-85). Springer, Cham.

21) United Nation. (2018). UN Sustainable Development Goals,

22) Water Institute of Southern Africa. (2023). Water and Sanitation Africa: Complete water resource and wastewater management. *The official magazine of the Water Institute of Southern Africa*. Vol.18 (2).

23) Ziervogel, G., New, M., Archer van Garderen, E., Midgley, G., Taylor, A., Hamann, R., Stuart-Hill, S., Myers, J. and Warburton, M. (2014). Climate change impacts and adaptation in South Africa. *Wiley Interdisciplinary Reviews: Climate Change*, *5*(5), pp.605-620.