

Water Supply to Big Cities: Training and Development Initiatives Implemented by South Africa's Largest Water Board: A Focus on the City of Johannesburg (Gauteng province, South Africa)

By Wayida MOHAMED, Maußeen MILES, Asief ALLI, Poppie SERA and Hendrik EWERTS

Rand Water, Johannesburg (South Africa)

People living in big cities around the world are supplied with potable water through sporadic water supply networks. In South Africa, water is generally supplied uninterruptedly. However, the efficacy of water supply to big cities such as the city of Johannesburg (CoJ) may be destructively impacted due to various challenges the county is currently facing. A major challenge faced by the South African water sector is a shortage of critical water-related skills. South Africa's largest water board (SALWB) situated in the Gauteng province is implementing a number of training programmes to address the skills shortage challenges. Training and development (T&D) initiatives implemented by SALWB are aimed at capacitating the water sector to ensure sustainable water supply networks. Individuals obtaining qualifications through these T&D initiatives will focus on the full cycle of water supply (e.g. water conservation and water demand management, operation and maintenance of infrastructure as well as the quality of potable water). T&D initiatives discussed in this paper also focus on socio-economic benefits for the country and add meaningful value to the South African water sector.

Introduction

Millions of people living in big cities around the world are accessing potable water through sporadic water supply systems (ILAYA-AYZA and *al.*, 2017). On the contrary, in South Africa, water supply systems are supplying water continuously (24 hours daily). However, there are socio-economic, environmental and political factors posing risks to continuous water supply systems. In South Africa, factors of major concern include increasing water scarcity due to climate change, population growth and relocation to cities (especially relocation to Johannesburg) which may lead to more frequent use of sporadic water supply. Sporadic water supply systems should be the last consideration to take in terms of water scarcity (ILAYA-AYZA

and *al.*, 2017). Therefore, proactive strategic planning and relevant initiatives should be in place to avoid the implementation of sporadic water supply systems.

According to South African legislation (Water Services Act – Regulation & Notices 1997-2001; South African Constitution, Act 108 of 1996) access to water for all South Africans is a constitutional right. Therefore, the South African government and water sector are planning proactively to adhere to the South African constitution by managing resources, operations, services delivery and maintaining infrastructure.

Strategic planning to safeguard the efficacy of water supply to big cities such as Johannesburg (in South Africa) remains one of the primary objectives for the South Af-

rican government and water sector to support economic growth. People living in Johannesburg are supplied with potable water by various municipalities. Municipalities are continuously supplied daily with potable water by South Africa's largest water board (SALWB) that produces potable water using conventional water treatment processes. The economic well-being of Johannesburg (as South Africa's wealthiest city) is maintained by an uninterrupted water supply system. NASTAR (2014) provides evidence to support the wealth of Johannesburg as a big city, contributing 16 % to national gross domestic product (GDP) and 40% to GDP of Gauteng province (COJ, 2012a).

The reliability of continuous water supply to the city of Johannesburg (CoJ) and other parts of the county is a primary objective for SALWB. SALWB therefore considers all water production and distribution unit processes, from source water abstraction up to the point of consumption, as a fundamental part of water supply - where relevant knowledge and skills (expertise) are required. However, the necessary expertise may not always exist within the water sector to focus on the integrity of different stages interconnected with water supply. Therefore, SALWB uses a well-developed training approach to mitigate these challenges through training and development (T&D) initiatives in order to subsequently alleviate the shortage of critical expertise in the water sector. Given the risks and challenges that may adversely affect the supply of water to the City of Johannesburg, the research presented herein discusses the socio-economic and environmental implications of T&D initiatives on the sustainability of water supply to big cities such as the City of Johannesburg.

Training approach aligned to water supply services

The Figure 1 (see below) shows some of the important elements assimilated for various training programmes implemented by SALWB, while the Figure 2 demonstrates the typical pathways a trainee can follow to obtain certification towards professionalization.

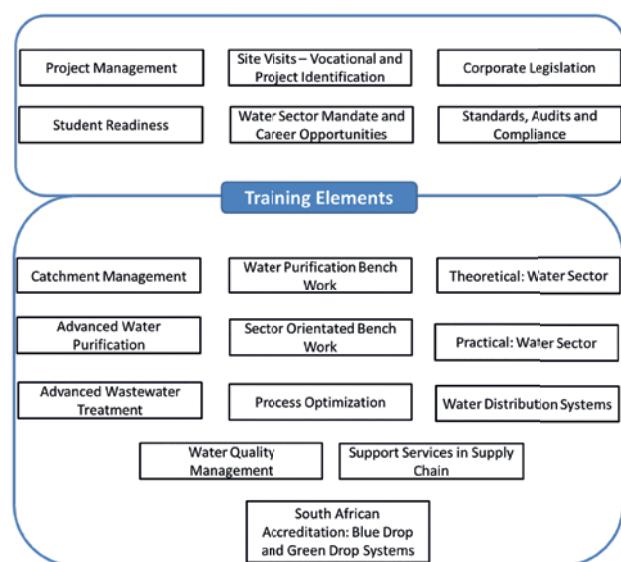


Figure 1: The important elements of training related to water purification, wastewater treatment and water supply to big cities in South Africa.

A typical training programme commences with induction which may cover the following training elements: basic project management, student readiness (which includes soft-skills), vocational work (project identification and site visits), water sector mandates, corporate legislation, compliance (related to standards and audits).

Technical training to support water supply may include the following critical elements: catchment management, basic and advanced water purification bench-work, theoretical and practical (water sector aspects), water sector orientated bench-work, advanced wastewater treatment (as part of the complete water supply chain), process optimization, water distribution systems, water quality management, support services in water supply chain and South African accreditation (Blue Drop and Green Drop certification requirements).

Custom-made training programmes implemented by SALWB in developing water sector related professions may differ depending on a) the requirements of training requestors (e.g. local municipalities or governmental departments), b) a training needs analysis or c) the skills shortages that occur in the South African water sector. All theoretical and practical training interventions implemented by SALWB or implemented in collaboration with training service providers are carefully monitored and evaluated to ensure compliance with the stringent accreditation requirements set by national training authorities such as SETA's (Sector Education and Training Authority).

The objectives of training programmes are driven by the potential impacts (as discussed in Table 1, see below) of skilled professions on aspects such as a) water supply, b) water production or c) water conservation, where disciplines such as artisans (e.g. electricians, welders and plumbers), water quality generalists and water agents play respective roles. Technical and vocational training for artisans plays an important role to develop skilled workers with reflexes that allows workers to interact with their job duties in the workplace (AB.HADI and *al.*, 2015). The skills education training authorities (as SETA) in South Africa play an important role in registering apprenticeship, learnership and internship trainees on National Qualifications Framework (NQF) requirements to ensure trainees obtain the relevant certifications (see Figure 2). An alternative pathway is through recognition of prior learning (RPL).

A pathway such as single apprenticeship contract is linked to a modular learning programme that ends in a trade test. This pathway has one entry and one exit point, while multi-learnership contracts are linked to a modular learning programme that ends in a trade test, after completion of a highest NQF level qualification with multi-entry and multi-exit points (DL, 2008).

Major technical and scientific disciplines

Sustainability of water resources is dependent on interactions between the environment, technology and social aspects related to a water supply system and the local population (ALI and *al.*, 2017). This paper highlights the ef-

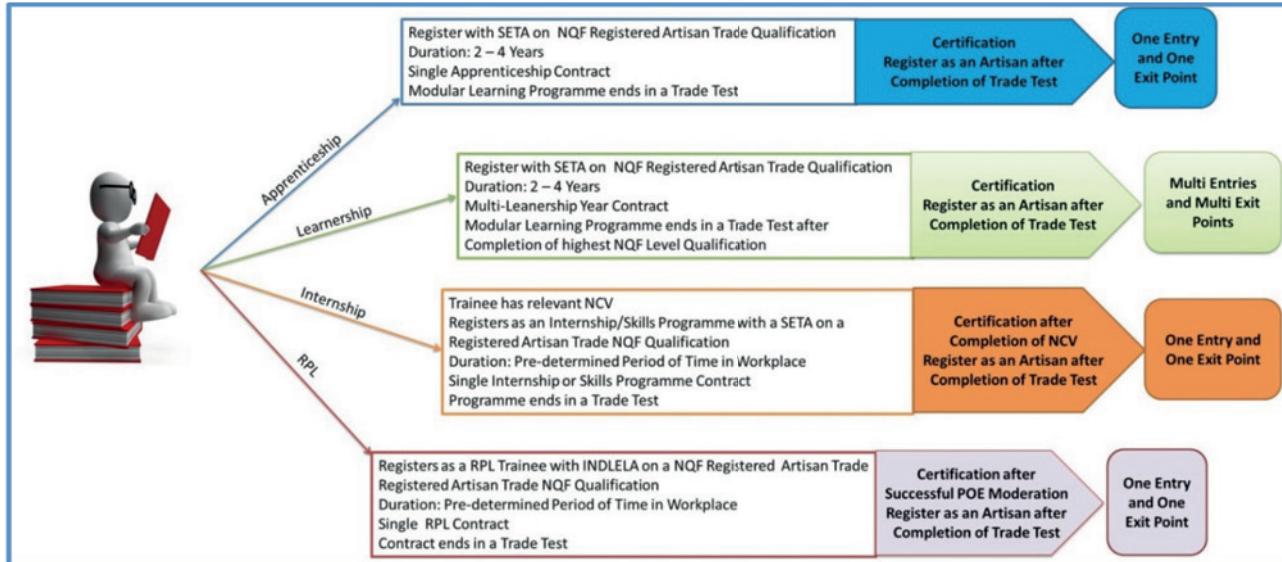


Figure 2: Various pathways a trainee can follow when registering for an apprenticeship programme, learnership programme, internship programme (skills programme) and recognition of prior learning (RPL) programmes to obtain certification and register as an artisan.

ficacy of water supply to the City of Johannesburg as one of the big cities in South Africa, with specific emphasis on technical disciplines (e.g. artisans, engineers, water quality and process controllers) and one social responsibility discipline; namely: water agents.

Other important disciplines not discussed in this paper (e.g. information and communication technology) support various facets of water supply and demand management (WWAP, 2016). Furthermore, information and communication technology (ICT) advances may have implications on water-related employment in terms of quantity (i.e. reduced number of staff) as well as quality (i.e. relevant knowledge, skills and capacity).

The previously mentioned interactions can cause supply-demand imbalances at diverse temporal scales and the response of consumers to water use regulations impacts future water availability (ALI and al., 2017). Therefore, the

focus on the T&D implemented by SALWB related to water supply services are likely to be directly focussed on people with science, technology, engineering and mathematics (WWAP, 2016). Table 1 (see above) gives a list of the important disciplines identified by the South African government that have a substantial impact on water supply services in terms of building and operations of infrastructure, maintenance of infrastructure, water conservation and demand management, as well as the production of quality potable water supplied in sufficient quantities.

Socio-Economic Benefits

The interaction between water supply and socio-economic factors are inseparable, even though water supply matters and economic growth are driven by separate policies (ZHANG and al., 2016). Water supply to big cities and small towns has improved over the last decades in South

Disciplines	Potential Impact
Artisans	Maintenance and repairing of water supply infrastructure.
Engineers	Building, maintaining and repairing of water supply infrastructure.
Water Agents	Water conservation and water demand management issues in local communities.
Water Quality Generalists	Quality of water: Water quality assurance, compliance (e.g. South African National Standards for Drinking Water – SANS 214)
Process Controllers	Quantity of Water: Production of water to ensure the demand for water in big cities is met.

Table 1: Major technical and scientific water-related skills and potential impacts on water supply.

Africa, particularly in the Gauteng province (where the City of Johannesburg is situated), to strengthen economic growth in the country. It is also part of SALWB's primary objectives to support training initiatives which are aimed at equipping underserviced cities and towns in South Africa. The major social and economic benefits are as follows: a) non-sporadic water supply with a positive impact on economic growth, b) development of skills for the water sector and subsequently reducing unemployment, and c) created sustainable water supply related jobs.

Specific Advancement and Sustainability

The unemployment rate amongst the youth in South Africa averages around 25.3 % (Department of Water and Sanitation, 2016). SALWB is planning to train approximately 16 000 unemployed youth to support water supply to big cities and reduce leakages around the county. This will have both a growth and sustainable development impact in South Africa by 2020. SALWB's training academy developed a Sustainability Model reinforced by research initiatives to ensure a maximum number of qualified trainees are being employed in various sectors (with emphasis on the water supply) in South Africa.

Added Value

Training is the process of developing knowledge, skills and abilities (ILO, 2009). The Training & Development Initiatives discussed in this paper add significant value to livelihood of young South Africans. South African youth are equipped with various technical and entrepreneurial skills that contribute to the improved social and economic conditions in South Africa. Developing knowledge, skills and abilities for the specific need of the water sector adds value to sustainable development goals. Furthermore, these initiatives also contribute towards alleviating the impacts of unemployment and poverty across communities in South Africa.

Conclusions

It is evident from literature that millions of people globally are accessing potable water through erratic water supply systems, with an opposite approach in South Africa where water supplies to big cities are known to be continuous. However, the South African water supply sector is currently facing a number of challenges which include amongst others: scarcity of freshwater, droughts in certain parts of the country as well as a shortage of critical skills in the water sector. These challenges may have an adverse impact on socio-economic development, especially in big cities where the economic nuclei of the country is situated. SALWB initiated various training programmes for unemployed youth in collaboration with government departments and other skills educational authorities (e.g. Department of Water and Sanitation and National Treasury) being primarily the funding agents of programmes and qualification registration bodies respectively. Critical training elements (or modules) are selected to ensure that training

programmes are relevant to specific professional occupations (professional disciplines and artisan trades). Trainee career pathways may have either a) one entry and one exit point, or b) multi entries and multi exit points to support skills development through apprenticeships, learnerships, internships and recognition of prior learning (RPL). Furthermore, T&D implemented by SALWB contributes to social and economic benefits as well as to add meaningful value to the South African water sector, with emphasis on water supply to big cities.

Acknowledgements

The authors gratefully acknowledge SALWB (Rand Water), the National Treasury and Department of Water and Sanitation for effectively implementing training programmes to capacitate the water sector and other sectors where skills shortage is posing risks for water supply.

References

- AB.HADI (Mohd Yusop), HASSAN (Razali), ABDUL RAZZAQ (Abdul Rashid) & MUSTAFA (Mohamad Zaid), "Application of thinking skills in career: A Survey on Technical and Vocational Education Training (TVET) qualification semi-professional job duties", *Procedia - Social and Behavioral Sciences* vol. 211, 2015, pp. 1163-1170.
- ALI (Alireza Mashhadi), SHAFIEE (M.Ehsan) & BERGLUND (Emily Zechman), "Agent-based modelling to simulate the dynamics of urban water supply: Climate, population growth, and water shortages", *Sustainable Cities and Society*, vol. 28, 2017, pp. 420-434.
- COJ (City of Johannesburg), "City of Johannesburg 2011/2012 annual report", City of Johannesburg, 2012a.
- DL (Department of Labour), "Scare and critical skills research project", Pretoria, South Africa, 2008.
- ILAYA-AYZA (Amilkar E), BENÍTEZ (Julio), IZQUIERDO (Joaquín) & PÉREZ-GARCÍA (Rafael), "Multi-criteria optimization of supply schedules in intermittent water supply systems", *Journal of Computational and Applied Mathematics*, vol. 309, 2017, pp. 695-703.
- ILO (International Labour Organization), *Protecting People, Promoting Jobs*, (2009), available at: <http://www.unesco.org/education/EFAWG2009/G20ReportILO.pdf>
- NASTAR (Maryam), "The quest to become a world city: Implications for access to water", *Cities*, vol. 41, 2014, pp. 1-9.
- WWAP (United Nations World Water Assessment Programme), "The United Nations World Water Development Report 2016", *Water and Jobs*, Paris, UNESCO, 2016.
- ZHANG (Xiaohong), QI (Yan), WANG (Yanqing), WU (Jun), LIN (Lili), PENG (Hong), QI (Hui), YU (Xiaoyu) & ZHANG (Yanzong), "Effect of the tap water supply system on China's economy and energy consumption and its emissions' impact", *Renewable and Sustainable Energy Reviews*, vol. 64, 2016, pp. 660-671.