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WATER AND SANITATION INDUSTRY MASTER PLAN

RESEARCH REPORT

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OVERVIEW

Water and sanitation are necessary conditions for human existence and economic development. There are, however, major challenges (domestically, regionally and globally) in relation to water and sanitation. There are also historical inequalities. Challenges include water security; water access; increased health and environmental regulation; aging infrastructure; and financial sustainability. Systemic responses include demand management; transitions toward more smart and sustainable technologies; sector restructuration; and tariff (as well as wider financing) reforms. Emerging solutions encompass infrastructural, technological and managerial responses.

The global water and sanitation market was estimated to be US$862 billion in 2016. This includes both capital and operational expenditure, the latter accounting for 64%. The market is expected to reach close to US$900 billion by 2022, growing by +3.7% a year over the 2015-2022 period. South Africa, ranked 16th, accounted for 1.3% of the global market. In South Africa, government has committed R115 billion until 2024 to water and sanitation infrastructure. Projects have been designed to “crowd in” private sector investment, and private sector initiatives are independently investing in transitioning risk management of their asset base toward smarter and more sustainable solutions. Yet these significant investments (and those projected to follow) fall short of the projected needs. Improving efficiencies is therefore a key focus of many efforts.

This Research Report provides the available evidence related to the development of the Water and Sanitation Industry Master Plan. It underpins the associated Policy Report (TIPS, 2022). It provides a detailed analysis of the water and sanitation industrial value chains to suggest that South Africa is well-positioned to leverage the expenditure to grow a domestic manufacturing base which will simultaneously address domestic priorities; sustain and grow existing businesses and jobs; develop export potential; and transform and transition local industries.

Economic data reported in this report reflect a bumpy, uneven but mostly upward trajectory in the production and sales of raw materials and equipment used in water and sanitation. Related Master Plans have initiated policy interventions to take these industries forward. It is proposed that the Water and Sanitation Industry Master Plan builds on these through a set of six key pillars:

- Developing and retaining skills;
- Improving industry competitiveness and capacity utilisation;
- Reducing cheap and sub-standard imports;
- Promoting export of local products;
- Strengthening research and development (R&D), standards and certification;
- Improving expenditure and procurement.

This report analyses key issues (based on these six pillars) and provides a line of sight towards addressing these more coherently by highlighting key policy implications. Together with the Policy Report, this Research Report summarises an 18-month process, including desktop research, interviews, a set of national stakeholder dialogues, and a series of sub-dialogues. A vision and associated interventions are developed in the Policy Report, forming the foundation of a Water and Sanitation Industry Master Plan for South Africa. The reports complement the 2018 Department of Water and Sanitation (DWS) National Water and Sanitation Master Plan (DWS, 2018), by focusing on the emergence and growth of locally designed, competitive manufactured products and services. They are also drafted to work jointly with other industrial development master plans, such as those for the plastics, steel and chemicals value chains.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AfCFTA	African Continental Free Trade Area
ARC	Agricultural Research Centre
ASTPM	Association of Steel Tube and Pipe Manufacturers
BERD	Business Expenditure on Research and Development
CHIETA	Chemical Industries Education & Training Authority
COSM	Committee of Secondary Manufacturers
CIDB	Construction Industry Development Board
CSIR	Council for Scientific and Industrial Research
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DHS	Department of Human Settlement
DMR	Department of Mineral Resources
DoH	Department of Health
DSI	Department of Science and Innovation
dtic (the)	Department of Trade, Industry and Competition
DWS	Department of Water and Sanitation
ECSA	Engineering Council of South Africa
EPCM	Engineering, Procurement, Construction and Management
EU	European Union
EWSETA	Energy and Water Sector Education and Training Authority
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GFGC	Gross Fixed Capital Formation
GWI	Global Water Intelligence.
HDPE	High Density Polyethelene
IDC	Industrial Development Corporation
IPAP	Industrial Policy Action Plan
ISO	International Organization for Standardization
ITAC	International Trade Administration Commission of South Africa
LGSETA	Local Government Education and Training Authority
merSETA	Metals, Engineering and Related Services Education and Training Authority
MRA	Mutual Recognition Agreements
NBI	National Business Institute
NBR	National Building Regulations
NDP	National Development Plan
NGS	Next Generation Sanitation
NPC	Natal Portland Cement
NRCS	National Regulator for Compulsory Standards
OFO	Organising Framework for Occupations
OPC	Original Portland Cement
PCC	Portland Cement Company
PIRB	Plumbing Industry Registration Board
PPP	Public Private Partnership
PTS	Proficiency Testing Scheme (PTS)
PVC	Polyvinyl Chloride

R&D	Research and Development
SABS	South African Bureau of Standards
SACU	Southern African Customs Union
SADC	Southern African Development Community
SAFCEC	South African Forum of Engineering Consultants
SALGA	South African Local Government Association
SANS	South African National Standards
SANAS	South African National Accreditation System
SAIF	South African Institute of Foundrymen
SAPSDA	Southern African Pump Systems Development Association
SASSDA	Southern Africa Stainless Steel Development Association
SAPPMA	South African Plastic Pipe Manufacturers Association
SARS	South African Revenue Service
SAVAMA	South African Valve and Actuator Manufacturers Association
SCM	Supply Chain Management
SDGs	Sustainable Development Goals
SEIFSA	Steel and Engineering Industries Federation of South Africa
SETA	Sector Education and Training Authority
SIC	Standard Industry Classification
SMEs	Small and Medium Enterprises
SMMEs	Small, Medium and Micro Enterprises
SOE	State Owned Enterprise
STEASA	Steel Tube Export Association of South Africa
STEM	Scientific, Technical, Engineering and Mathematics education
TIPS	Trade & Industrial Policy Strategies
TVET	Technical and Vocational Education and Training colleges
UAE	United Arab Emirates
UK	United Kingdom
UKZN	University of KwaZulu-Natal
US	United States
VAMCOSA	Valve and Actuator Manufacturers Cluster of South Africa
WSP	Water and Sanitation Program (World Bank)
WRC	Water Research Commission
WWMA	South African Water Meter Manufacturer’s Association

1. INTRODUCTION

Water, much like electricity, underpins economic development and social progress. In turn, the inability to ensure water security has dramatic consequences for businesses and households. In addition, the lack of access to modern water and sanitation services entrenches poverty and inequality.

Since 1994, South Africa has made significant progress in rectifying an unequal system inherited from the apartheid era, materially expanding water and sanitation services in the country. However, the country, like many others worldwide, still faces challenges in water security, access to water and sanitation services, water quality, infrastructure development, and financial sustainability.

Indeed, much more remains to be done to redress past inequalities (Mudombi, 2020). While access to water and sanitation services is relatively high in the country compared to other countries in the region, the challenge relates to the quality of access to adequate services (Mudombi, 2020; Stats SA 2017). Lack of access to adequate services has negative socio-economic consequences as it impacts on people's health and socio-economic well-being.

As a water-scarce country, South Africa still struggles to ensure water security. Climate change impacts, notably the increasing occurrence and strength of droughts, further complicates this. Already, 98% of South Africa's available water is allocated to users at a high assurance of supply, leaving little room to manoeuvre. Furthermore, water demand is forecast to keep growing, leading to severe gaps in core industrial areas (Gauteng, KwaZulu-Natal, Mpumalanga and Western Cape) and an overall 17% gap by 2030 (WRG, 2009). The expansion of services has also come at the expense of maintaining existing infrastructure.

In addition to challenges associated with poor water availability, the water quality is also increasingly problematic. The quality of South Africa's water resources is an area of great concern. Poor water quality is not only a socio-economic issue but also leads to a reduction in water availability. The more water is polluted, the more water is required to dilute those pollutants. Poor water quality therefore places additional stress on our water availability. In 2011, 65% of South Africa's 792 wetland ecosystems were considered threatened and 48% critically endangered; 60% of South Africa's 223 river ecosystems were considered threatened, with 25% classified as critically endangered (DWA, 2013).

A society-wide behaviour change towards proper valuing and use of water is needed. The country, from households to communities to businesses, needs a new water paradigm that embeds water sustainability and resilience in day-to-day practices (Taing et al, 2019). The average domestic water use (including industrial water use) in South Africa is around 237 litres per person per day, compared to a world average of 173 litres per person per day (DWS, 2018). This is a combination of crumbling infrastructure, leading to high losses, as well as huge inefficiencies in the system, with high levels of wastage.

Overall, this brings significant risks and exacerbates the vulnerability of the economy. About 9.5 million jobs are significantly dependent on water in South Africa, including the quasi-totality of agricultural jobs and a third of industrial employment. Urgent, radical interventions are required to ensure water security in South Africa as well as widening the access to services. The COVID-19 crisis has, once more, shed light on the country's lack of water and sanitation services.

The 2018 National Water and Sanitation Master Plan, led by the DWS, constitutes the overall framework for the sector, setting out short-, medium- and long-term plans until 2030 to ensure water security and equitable access to water and sanitation services for all in South Africa. As South Africa rolls out an economic recovery stimulus package, the crisis also offers an opportunity to address many of the country's water and sanitation problems (see Mudombi and Montmasson-Clair, 2020 for more details on this).

From a trade and industry perspective, the scale of the challenges and interventions required to address them brings substantial opportunities. Water and sanitation are intertwined with technology, and industrial and economic development. Water security and access to modern water and sanitation services relies on technology and industrial development, while industrial development, and more broadly, economic development, depends on water security and modern water and sanitation services.

The centrality of water and sanitation drives a spectrum of activities to provide safe, affordable and modern access to water and sanitation services to all. This includes the development, storage and transport of water resources, the collection, treatment and beneficiation of wastewater, and the management of water consumption.

The water and sanitation sector has been identified by the South Africa's Industrial Policy Action Plan (IPAP) as a potential driver of industrial development, notably through the emergence and growth of locally-designed and manufactured products and services (the dti, 2018). Subsequently, the development of a Water and Sanitation Industry Master Plan has been initiated under the leadership of the Department of Trade, Industry and Competition (the dtic)[1].

The core aim of the Master Plan is to ensure that local industries grow rapidly while upgrading their technological base and competitiveness. The plan should also support socio-economic aims, such as large-scale job creation; small business support; increased black ownership, including by workers and communities; more equitable remuneration and career mobility; and technology upgrading and spillovers. Importantly, this Master Plan focuses on the industrialisation aspects of the water and sanitation industry, and a distinction needs to be drawn between this work and the 2018 National Water and Sanitation Master Plan by the DWS, which is a comprehensive plan for the development of the water and sanitation sector. The Industrialisation Master Plan, led by the dtic, aims to complement and enhance (rather than duplicate or reinvent) the 2018 DWS plan.

This document is a research input into the development of the Water and Sanitation Industry Master Plan. Based on extensive desktop research and engagement with local stakeholders in the value chain, it provides important foundations for the design and implementation of the Master Plan. Section 2 reviews key relevant global dynamics. Section 3 details the value chain at the core of the Master Plan. Section 4 unpacks key thematic issues to be addressed by the Master Plan. Section 5 concludes.

[1] The Department of Trade, Industry and Competition was established in June 2019 with the merger of the Department of Economic Development and the Department of Trade and Industry.

2. GLOBAL DYNAMICS

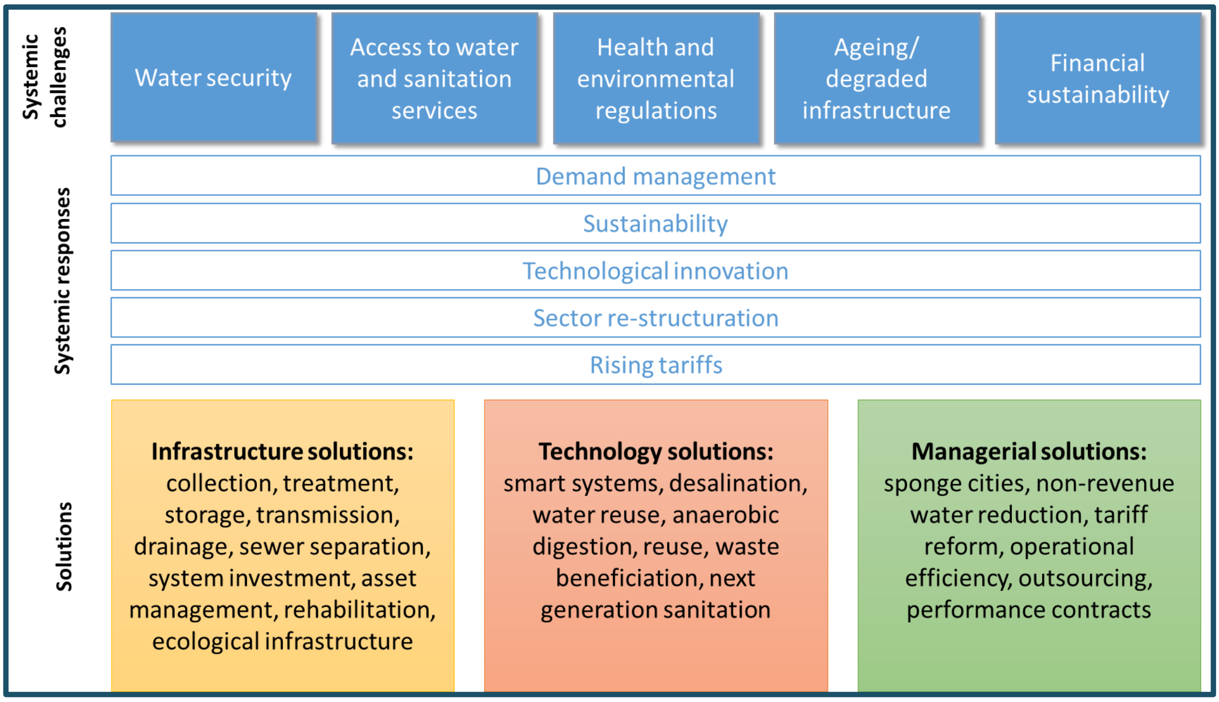
This section unpacks the key global dynamics that have shaped recent developments in the water and sanitation industry. Following a summary of systemic trends, it reviews the global market structure, demand patterns, geography, market segment, and supply dynamics.

2.1. Systemic trends and dynamics

For the purpose of the Master Plan, the main market drivers and constraints have been identified and illustrated in Figure 1. Water security and access to modern water and sanitation services are intertwined with technology and industrial development and, more broadly, economic development.

Key market drivers encompass heightened pressure on water security, notably due to climate change, the need to bridge the water and sanitation access gap, tighter environmental and health regulations, ageing and/or degrading infrastructure, and weakening financial sustainability. In light of these market forces, main systemic responses have been an increased focus on demand management; a stronger drive towards sustainability; higher interest in technological innovation; sector restructuring towards stronger utility autonomy and private sector participation; and rising water tariffs.

Figure 1: Main market drivers and constraints

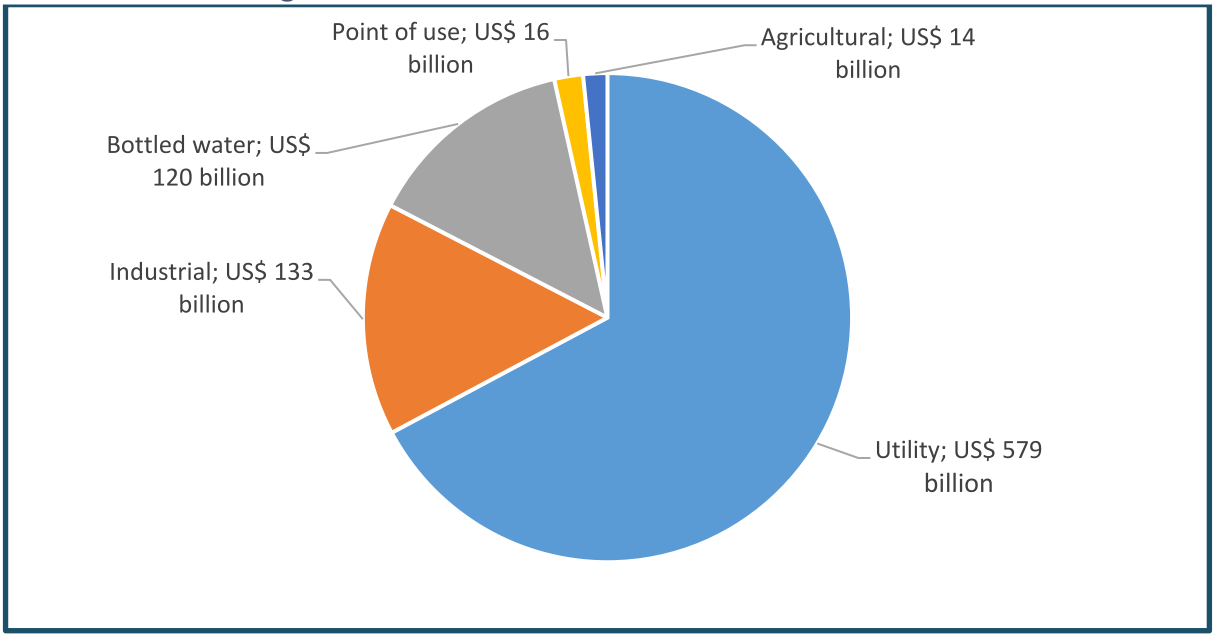


Source: Montmasson-Clair, 2018.

2.2. Market structure

The central role of water and sanitation and the dynamics highlighted in the previous section point to a significant and growing market. The global water and sanitation market, including both capital and operational expenditures, was estimated to be US$862 billion in 2016. The utility sector (67%) largely dominates the market, followed by the industrial (15%) sector and the bottled water segment (14%). Agriculture, while consuming more than two-thirds of water globally, only accounts for a marginal share of the market (Figure 2).

Figure 2: Global water and sanitation market in 2016

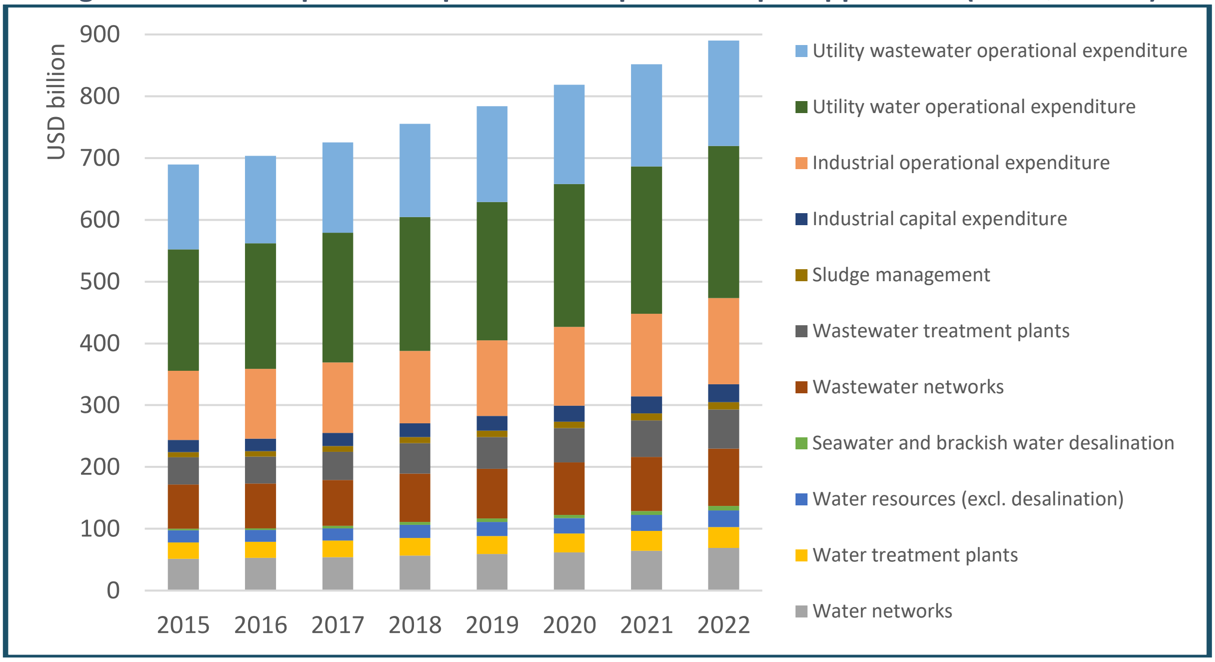


Source: Montmasson-Clair, 2018, based on data from Global Water Intelligence (GWI).

As illustrated in Figure 3, focusing on the two largest markets (the utility and industrial sectors), the market is expected to reach close to US$900 billion by 2022, growing by +3.7% a year over the 2015-2022 period.

Operational expenditures are larger than capital expenditures and account for about two-thirds (64%) of the market over the period 2015-2022. Water- and wastewater-related operational expenditure by utilities account for the lion's share of this market, representing respectively 28% and 20% of total expenditure.

Figure 3: Global capital and operational expenditure per application (in US$ billion)



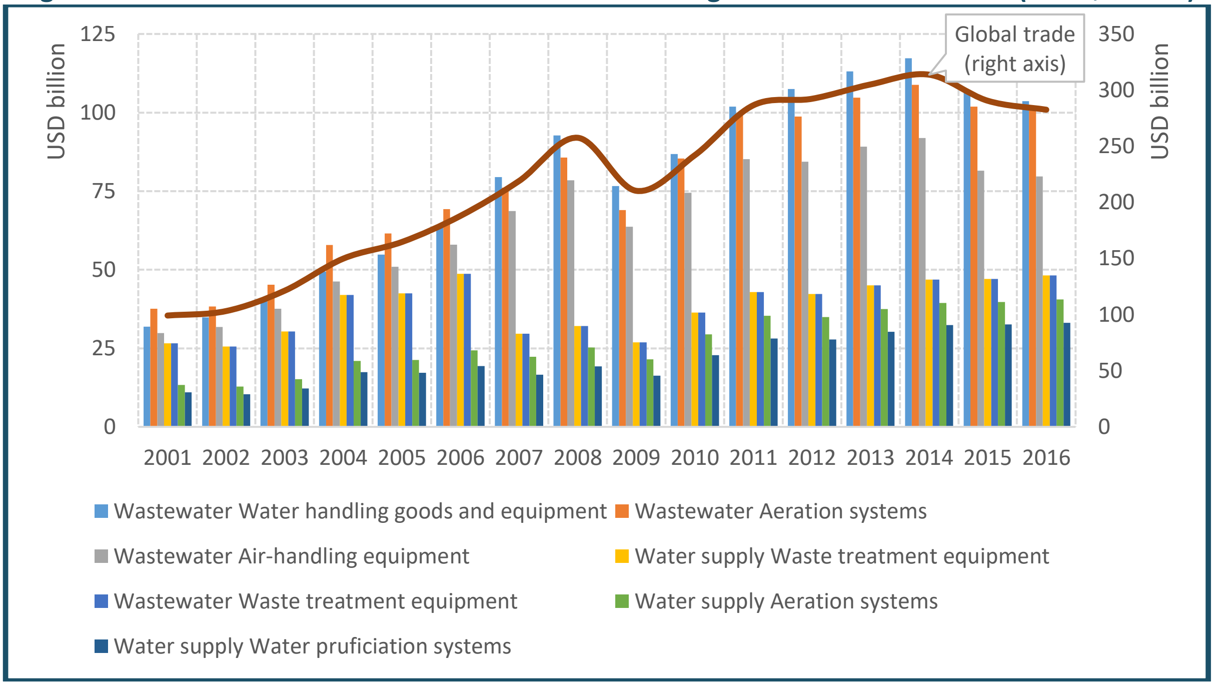
Source: Montmasson-Clair, 2018, based on data from GWI.

The spread between operational and capital expenditure is expected to further widen in the future as utilities in developed markets shift from large infrastructure projects to the rehabilitation of existing infrastructure and the implementing of smart, digital solutions. Developed water markets are increasingly driven by the need to improve performance and efficiencies, extend the life of existing systems, and maximise cost savings. Examples include cured-in-place piping solutions, efficient water treatment chemical dosing, advanced asset management systems, such as advanced metering infrastructure (AMI), leakage detection, advanced data analysis tools, control automation, and sewer optimisation (Deloitte, 2016; GWI, 2017; 2018; IWA, 2016).

In addition, decentralised solutions for both water supply and wastewater treatment are increasingly attractive and are rapidly spreading. Decentralised solutions can be mobile or permanent and are generally pre-fabricated, modular and containerised systems. Specific markets where decentralised solutions are deepening their footprint include water supply (through desalination and reuse) and wastewater treatment (through next generation sanitation technologies) in sparsely-populated and/or isolated areas, and industrial wastewater management. For instance, the industrial demand for mobile water treatment plants is expected to reach US$850 million by 2020, rising by more than 8% per annum from 2013.

Global trade in water- and wastewater-related products amounted to around US$282 billion in 2016 (see Figure 4), i.e. more than a third of the global market in that year. While this is consistent with the structure of the market, which favours local players (due to the strong weight of local, state-owned utilities and civil engineering on the market), it also denotes the key role of trade in equipment. In line with the global spending on equipment, trade is dominated by pumps, valves and compressors. As listed in Table 1, a limited set of 10 products accounts from about two-thirds of the trade.

Figure 4: Global trade in water- and wastewater-related goods from 2001 to 2016 (in US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI.
Note: The sum of individual categories is larger than global trade due to some products figuring in more than one category.

Table 1: List of main traded water- and wastewater-related products in 2016

ITEM	HS CODE	VALUE (US$ BILLION)	SHARE OF TOTAL TRADE
Valves, such as pressure or flow control, flush, ball, butterfly or diaphragm valves	848180	48.3	17. 1%
Electrical machines and apparatus	854370	32.8	11.6%
Air pumps, air/ gas compressors and ventilating or recycling hoods incorporating a fan	841480	18.8	6.6%
Parts of air/vacuum pumps, air/gas compressors, fans and ventilating or recycling hoods incorporating a fan	841490	15.3	5.4%
Compressors for refrigerating equipment	841430	13.0	4.6%
Centrifugal, power-driven pumps	841370	12.2	4.3%
Parts of machinery and apparatus for filtering or purifying liquids or gases	842199	12.1	4.3%
Refrigerating or freezing equipment	841869	8.5	3.0%
Instruments and apparatus for measuring or checking pressure of liquids or gases	902620	8.3	2.9%
Machinery and apparatus for filtering or purifying liquids	842129	7.7	2.7%
Other 60 products	n/a	105.5	37.3%

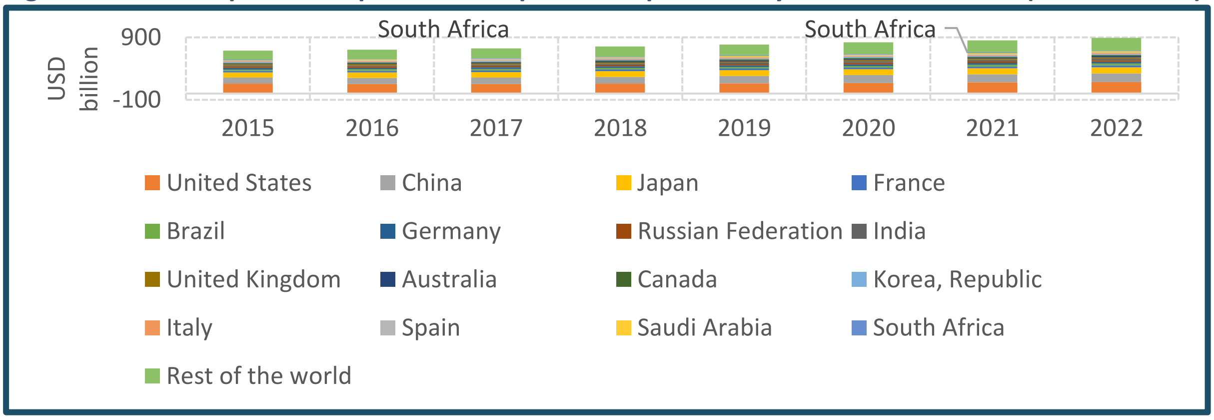
Source: Montmasson-Clair, 2018, based on data from Trade Map.

2.3. Geographically-concentrated markets

Geographically, the bulk of the global market is focused on a limited number of countries, with the top 15 countries accounting for 76% of demand. The United States (US) (21%), China (15%) and Japan (12%) lead the pack, concentrating about half the market (48%), as depicted in Figure 5. South Africa, ranked 16th, accounts for 1.3% of the global market. Africa as a whole remains relatively small, representing 3%-4% of global demand (between US$28 and US$33 billion in 2022).

Large mature markets, such as the US, Japan and Western Europe, are expected to grow at a pace below the world average of 3.7% a year over the 2015-2022 period. Australia and Canada are the notable exceptions in this respect, with forecasted growth rate above 5% a year. India (+9.8%) and Saudi Arabia (+9.2%) are forecasted to witness the fastest growth in top markets, while a number of smaller markets are seeing exceptional growth, such as Jordan (+24%) and Ethiopia (+16%).

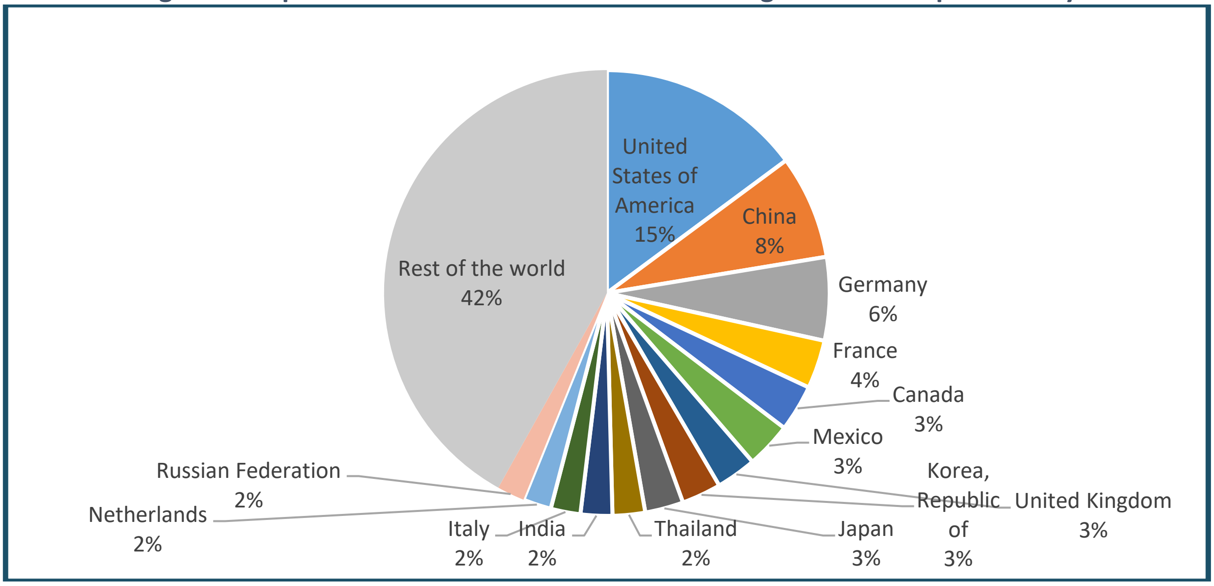
Figure 5: Global capital and operational expenditure per country from 2015 to 2022 (in US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI.

Correspondingly, imports of water- and wastewater-related products are dominated by few countries (see Figure 6). Half the demand originates from just 10 countries, with the US, China, Germany, France and Canada leading. All leading importers feature as top market (and vice-versa). Mexico, a top importer despite a relatively small market, is one notable exception, due to its role in bringing products into the North American Free Trade Area.

Figure 6: Import of water- and wastewater-related goods in 2016 per country

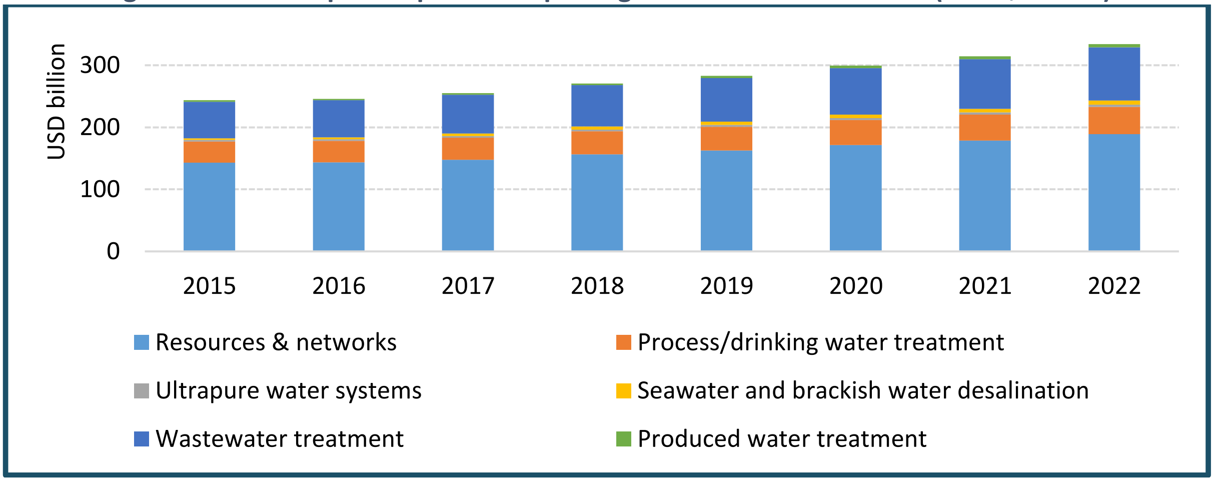


Source: Montmasson-Clair, 2018, based on Trade Map data.

2.4. Market segment/technology

Capital expenditure is expected to grow at 4.6% a year over the 2015-2022 period. From a market segment perspective (Figure 7), the development of water resources and networks, i.e. civil works and engineering, account for 58% of the capital expenditure market, followed by wastewater treatment (25%). All segments are expected to grow between 4%-15% a year over the 2015-2022 period. The desalination (1.7%) and produced water treatment (1.2%) segments are forecasted to witness the strongest growth, respectively at 15% and 12% a year.

Figure 7: Global capital expenditure per segment from 2015 to 2022 (in US$ billion)



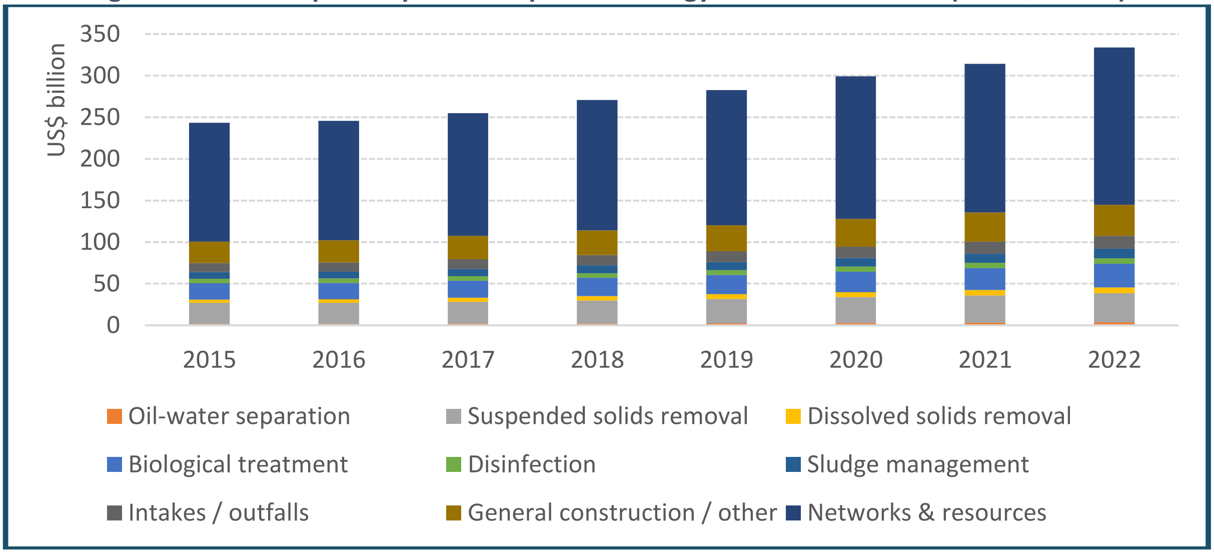
Source: Montmasson-Clair, 2018, based on data from GWI.

From a technology perspective (Figure 8), besides resources and networks (58%), this corresponds to general construction (11%), suspended solid removal (10%) and biological treatment (8%) being the main second-tier markets.

Despite accounting for only about 3% of the capital expenditure, sludge management is a strong growth area. Sludge management is a rising area of concern for increasingly populated and industrialised countries. Opportunities for sludge beneficiation, both through wastewater treatment plants and other technologies, such as anaerobic digestion, are also leading utilities and industries to upgrading sludge treatment capabilities. For example, biogas production through anaerobic digestion and enhanced dewaterability (i.e. the ease through which water can be removed from sludge), thermal/drying technologies, and nutrient and phosphorus recovery are driving the industry towards advanced sludge management systems.

Wastewater management is forecasted to grow strongly with capital expenditure by utilities for wastewater treatment plants and sludge management growing by 5.4% and 5.5% respectively over the 2015-2022 period, amounting to US$63.5 and US$11.9 billion in 2022.

Figure 8: Global capital expenditure per technology from 2015 to 2022 (in US$ billion)

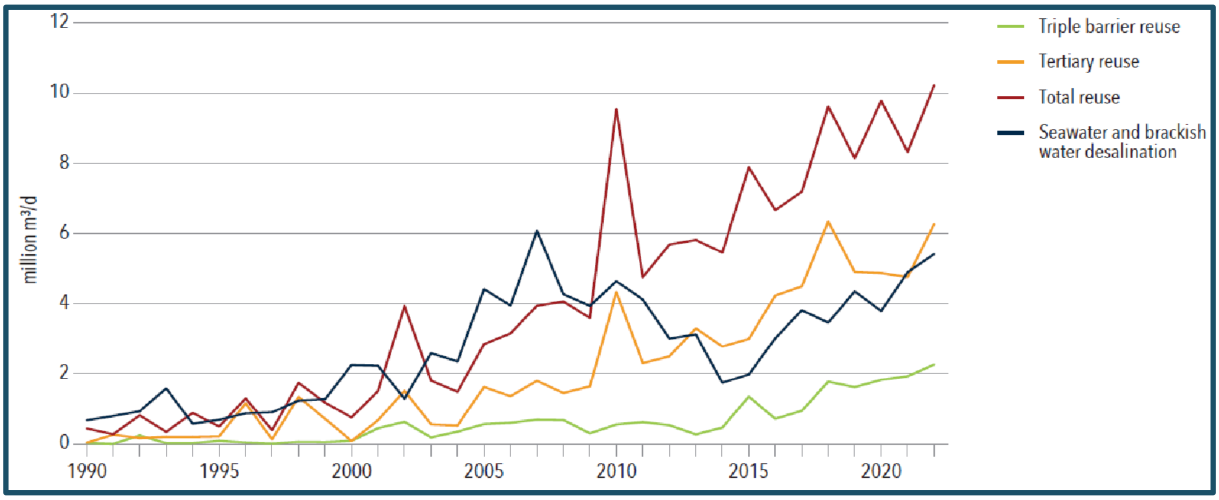


Source: Montmasson-Clair, 2018, based on data from GWI.

Unconventional resource development, i.e. desalination and water reuse, is also experiencing strong growth on the back of rising water security concerns (Figure 9).

The market for desalination is forecasted to reach US$4.8 billion in 2022, after rapidly increasing at a rate of 15.3% a year from 2015. Similarly, demand for membranes should witness some solid growth prospects. High pressure membranes (RO/NF), low pressure membranes (MF/UF), non-membrane filtration and disinfection and chemical feeds should respectively grow by 7.6%, 6.5%, 4.3% and 4.0% over the 2015-2022 period, reaching US$12.8 billion.

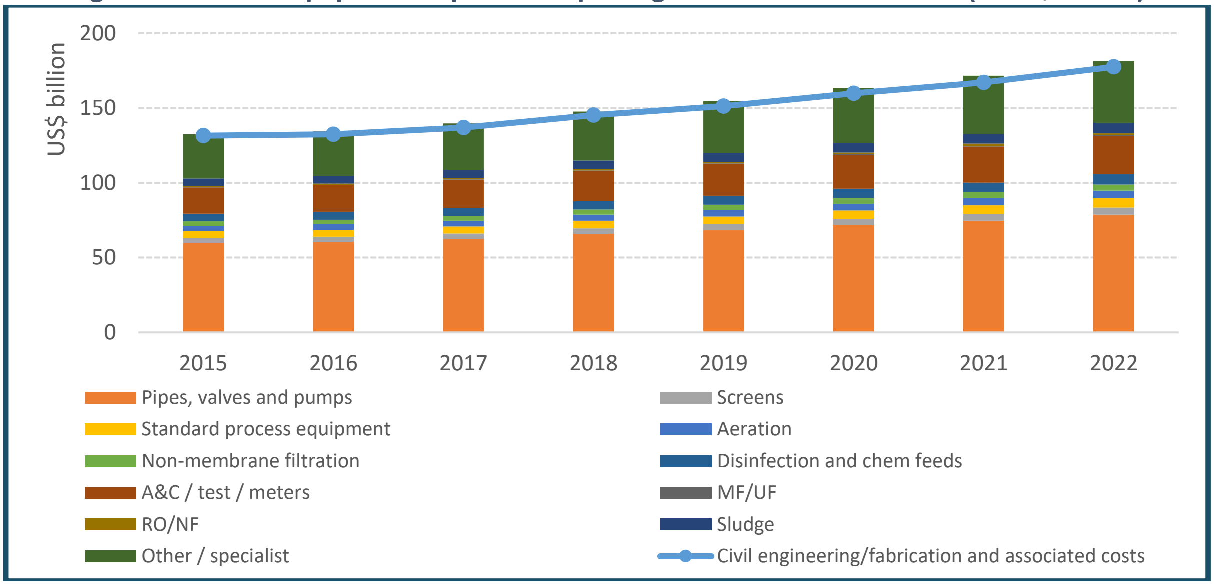
Figure 9: Incremental contracted desalination and reuse capacity from 1990-2022



Source: GWI, 2018.

Beyond water desalination and reuse, the global equipment market, which is essentially technology-based, is estimated to reach more than US$180 billion by 2022 (Figure 10), rising by 4.6% a year from 2015. It is equivalent in value to the civil engineering and fabrication market, which is almost exclusively driven by the utility sector (95%). The equipment market is heavily dominated by pipes, pumps and valves, which account for 44% of it (and growing at 4% a year). Automation and control equipment, including sensors and meters, constitutes the second largest segment (14%), increasing by 5.6% per annum over the 2015-2022 period.

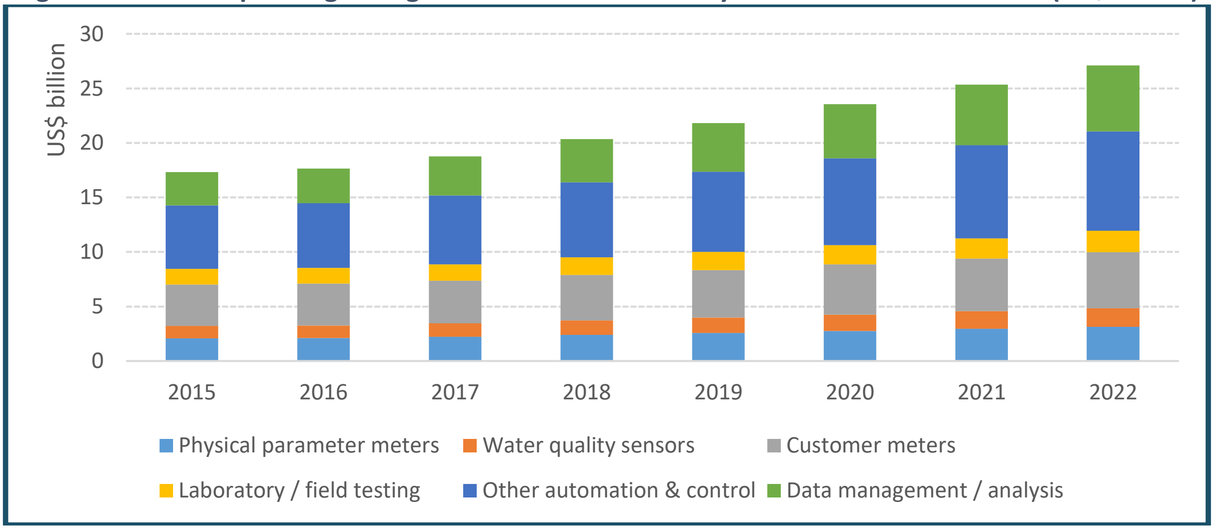
Figure 10: Global equipment expenditure per segment from 2015 to 2022 (in US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI,

The emphasis on digital solutions by utilities is supported by the imperatives of stretching capital budgets and optimising operations as well as transitioning towards smart city management. The market for digital transformation is expected to grow by 6.6% a year over the 2015-2022 period, primarily driven by data management and analysis (+10.3%).

Figure 11: Global spending on digital solutions in the utility sector from 2015 to 2022 (US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI.

At a sectoral level, the utility sector drives the bulk of demand for equipment (83%, spilt between 43% for wastewater and 40% for water). Food and beverages (4%) as well as upstream oil and gas (3%) are the largest industrial markets. Upstream oil and gas (+10.1%), pharmaceuticals (5.8%) and food and beverages (5.4%) are expected to be the fastest growing market segments over the 2015-2022 period.

2.5. Global supply dynamics: Disaggregated but geographically-concentrated

Given the structure of demand, dominated by civil works/engineering and localisation policies driven by state-owned entities, supply chains have a strong local flavour in most markets. As raised in the previous section, global trade in water- and wastewater-related goods, driven by equipment, is nevertheless sizeable. Systemic trends (see Section 2.1) driving the move from capital to operational expenditure, and the focus on technological solutions and cutting-edge expertise (for demand management for example), are furthermore increasingly globalising water and sanitation markets.

Table 2: Leading global water-related companies in 2017

FIRM	ORIGIN	DESCRIPTION	REVENUE (US$ BILLION)	SECTORS OF OPERATION
Veolia	France	Water operator and systems integrator	12.5	Eq Sy En Op C
Suez	France	Water operator and systems integrator	11	Eq Sy En Op Ow C
Ecolab	US	Water treatment chemicals and related services	7.1	Sy C
Pentair	US	Pumps, valves, UF membranes, and pool equipment	5	Eq Sy
Xylem	US	Pumps, analytics, and wastewater technology supplier	3.7	Eq Sy
Grundfos	Denmark	Pump supplier with strength in residential services	3.2	Eq
American Water	US	Regulated utility and non-regulated services	3	Op Ow
Sabesp	Brazil	Water concessionaire	3	Op Ow
Thames Water	UK	Regulated utility	2.9	Op Ow
Severn Trent	UK	Regulated utility and contract operations	2.6	Op Ow

Source: Montmasson-Clair, 2018, based on data from GWI. Note: Eq = Equipment; Sy = Systems; En = Engineering; C = Chemicals; Op = Operations; Ow = Ownership/.

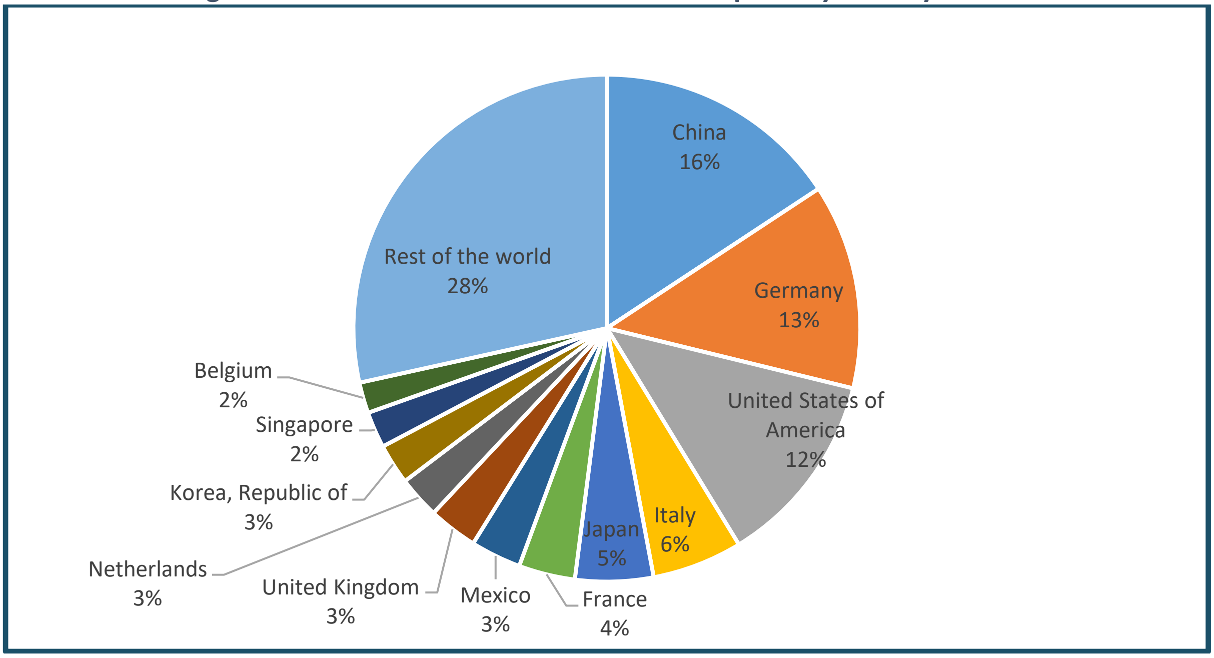
As it stands though, water businesses are not large businesses by global industrial standards. Indeed, the market is fairly disaggregated, with local firms playing a strong role (see Table 2). In addition, aside from utilities, there are few water pure players. Most private companies are subsidiaries of larger groups, like Veolia Environnement (US$27 billion in yearly revenue in 2017). Veolia and Suez, the two market leaders, both total annual revenues in excess of US$10 billion for their water operations, but only 50 companies harness revenues of US$1 billion or more.[2] In addition, there are about 1 300 privately-owned businesses active in the industry with revenues in excess of US50 million.

Despite this high degree of disaggregation, expertise is fairly concentrated geographically. As listed in Table 2, developed countries are over-represented in the leading firms, with French, US, Danish, British, German, Japanese and Finnish firms featuring strongly. Importantly though, a number of Chinese firms have progressively made their way to the top 50 of the industry (Sound, Origin, Beijing Capital and Beijing Enterprises Water Group Limited).

As with the firm level, the provision of tradable water- and wastewater-related products (see Figure 12) is concentrated geographically with China, Germany and the US servicing 41% of the market and the top 10 exporters accounting for more than two-thirds of the market.

[2] For comparison, the revenues of top 500 companies worldwide range from US$22 to US$486 billion.

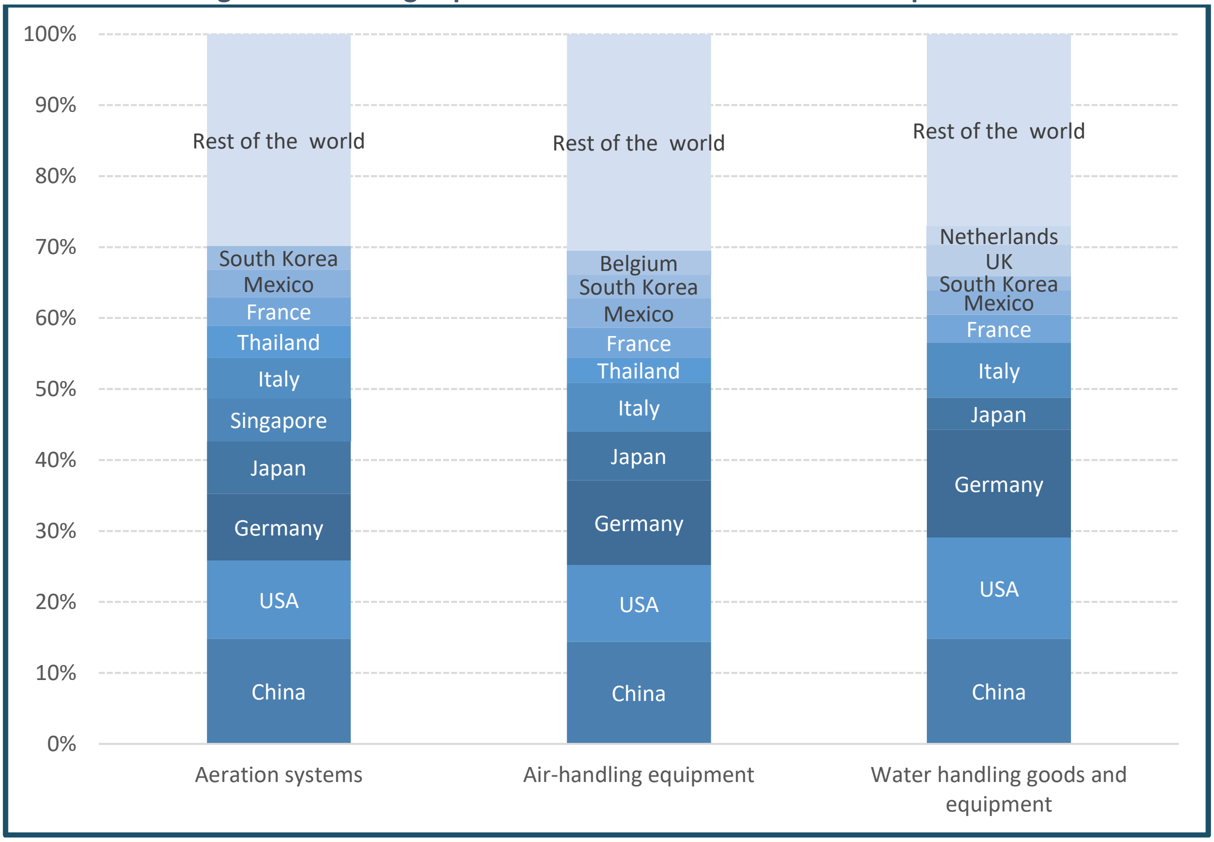
Figure 12: Water- and wastewater-related exports by country in 2016



Source: Montmasson-Clair, 2018, based on Trade Map data.

Leading exporters remain relatively unchanged across top segments (Figure 13), with China, the US, Germany and Japan leading the pack. This picture (of manufacturers) is slightly different from the origin of top firms, which tend to provide services and expertise rather than manufactured products. Most notably, China and Germany, while not among the leading providers of water and sanitation expertise, are the two leading exporters of water- and wastewater-related products.

Figure 13: Leading exporters of main water-related traded products



Source: Author, based on Trade Map data

3. SOUTH AFRICAN VALUE CHAIN ANALYSIS

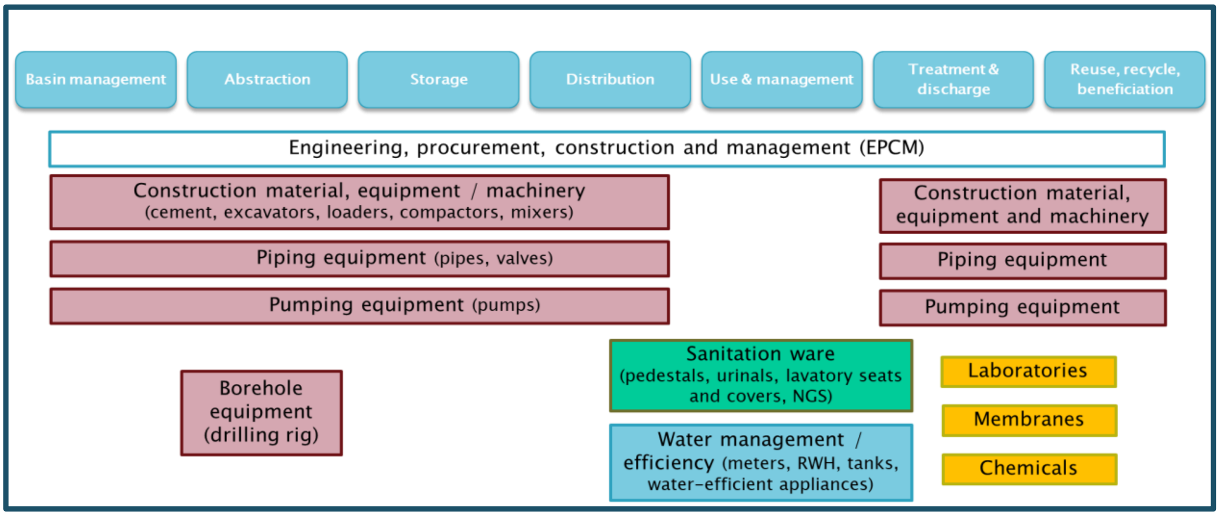
The following section provides an overview of the value chain which forms the backbone of the water and sanitation industry in South Africa. It focuses on the manufacturing and other industrial activities which make the various key components of the value chain.

3.1. Overview

The water and sanitation industry value chain is made up of various key stages. These are different from the traditional stages of the water and sanitation value chain (such as water abstraction, water use and wastewater treatment) and effectively cut across them. The industrial value chain (Figure 14) comprises the key manufacturing inputs that feed into the water and sanitation sector, namely:

- Engineering, procurement, construction and management (EPCM) runs across all the stages of the water and sanitation value chain, particularly through project development, operations and management;
- Key civil engineering inputs, i.e. construction materials, equipment and machinery, piping equipment, valves, pumping equipment and borehole equipment, constitute the primary industrial suppliers into the sector;
- Sanitation ware and systems, ranging from pedestals and urinals to next-generation sanitation systems, feed mostly at the level of water use and management but are increasingly relevant for water treatment and discharge as well as reuse, recycling and beneficiation;
- Water management and water-efficiency devices and appliances have an impact on the bulk of consumption at the residential, commercial and industrial levels;
- Laboratories, membranes and chemicals all enable the treatment, discharge as well as reuse, recycling and beneficiation of water and wastewater.

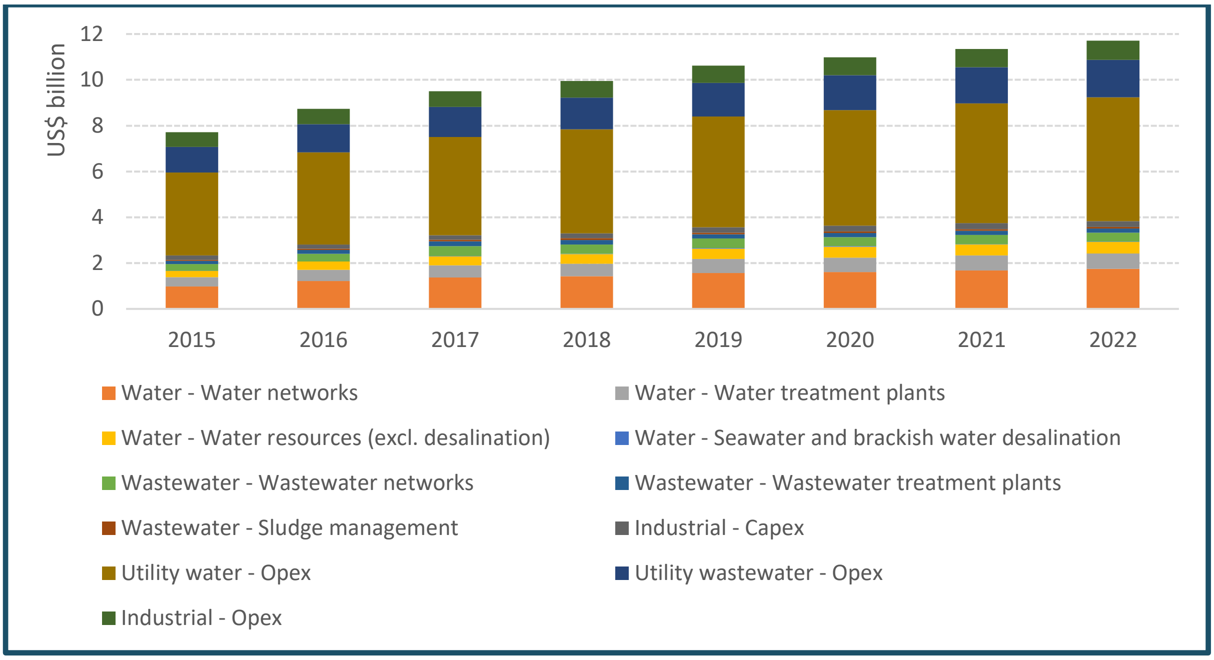
Figure 14: Overview of the water and sanitation industry value chain



Source: Authors.

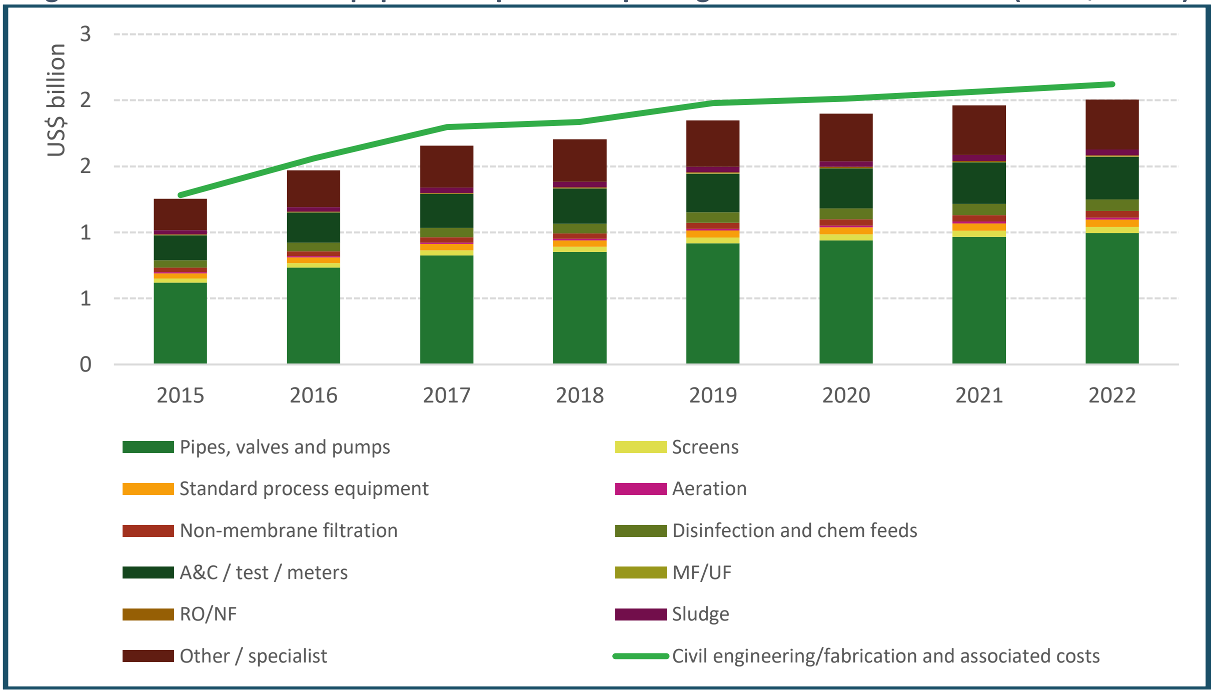
Overall, South Africa's water market, while small on a global scale (slightly more than 1%), is significant at the local level. Rising at 6.2% a year from 2015 to 2022, it is expected to reach US$11.7 billion at the end of forecast period (Figure 15). The civil engineering and equipment and components (Figure 16), which account respectively for 18% and 17% of the South African market, are furthermore projected to grow strongly, at 7.5% and 6.9% a year over the 2015-2022 period.

Figure 15: South Africa's capital and operational expenditure (in US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI.

Figure 16: South Africa's equipment expenditure per segment from 2015 to 2022 (in US$ billion)



Source: Montmasson-Clair, 2018, based on data from GWI.

3.2. Engineering, procurement, construction and management

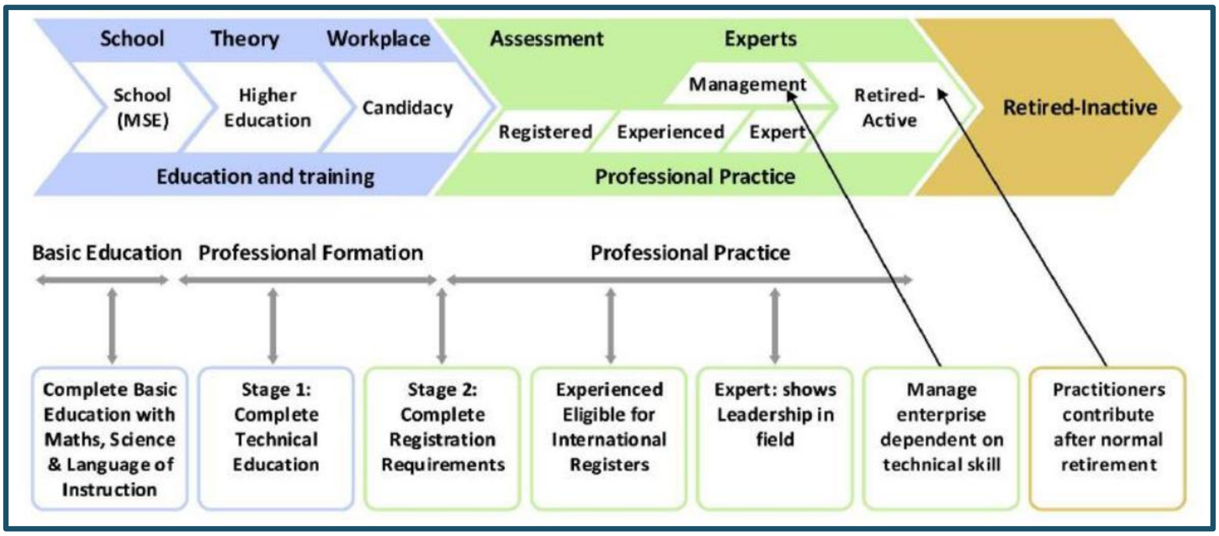
EPCM is characterised as professional contracting services that are offered to a client, through advice and management of the engineering design, procurement, and construction.

EPCM contractors do not have a direct industry association since there are different types of engineers, however, they fall into different associations including the Engineering Council of South Africa (ECSA), the Consulting Engineers South Africa, the International Federation of Consulting

Engineers, the Construction Industry Development Board (CIDB) and the South African Forum of Civil Engineering Contractors (SAFCEC).

Technical expertise is required for long-term planning, overseeing service providers and managing operations and maintenance. Figure 17 illustrates the basic engineering skills pipeline, for all types of engineers. To be able to provide EPCM services, contractors are expected to have gone through adequate engineering education, training and experience. For instance, the Construction Education and Training Authority (CETA) oversees training in the construction industry. There are a number of training initiatives carried out by the various professions which carry out building installations.

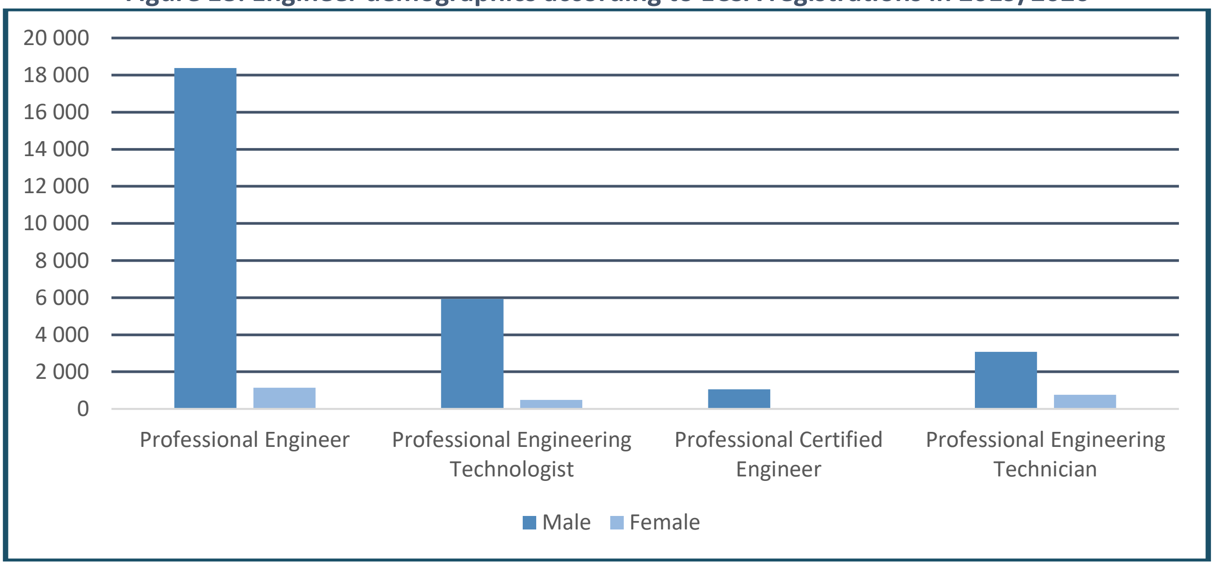
Figure 17: The engineering skills pipeline



Source: SADC, 2018.

Statistics on EPCM industry employment, revenue and major players are limited. However, based on ECSA registration statistics, as reported in their 2019/2020 Annual Report, Figure 18 provides a picture of the demographics.

Figure 18: Engineer demographics according to ECSA registrations in 2019/2020



Source: ECSA, 2020.

According to the SAFCEC (2021), the EPCM sector is facing the following bottlenecks:

- Poor access to infrastructural procurement;
- Corruption in terms of the awarding of public contracts;

- Shortage of technical skills in local government and industry as a whole because of limited graduate training and development towards becoming independent and competent professionals;
- Inadequate budgeting and expenditure on maintenance;
- Non-responsive and cumbersome water use licensing and permitting system; and
- Costly supply chain regulations and instructions that inadvertently increase the cost of projects, rather than produce an optimum result in terms of state spending.

3.3. Construction material, equipment and machinery

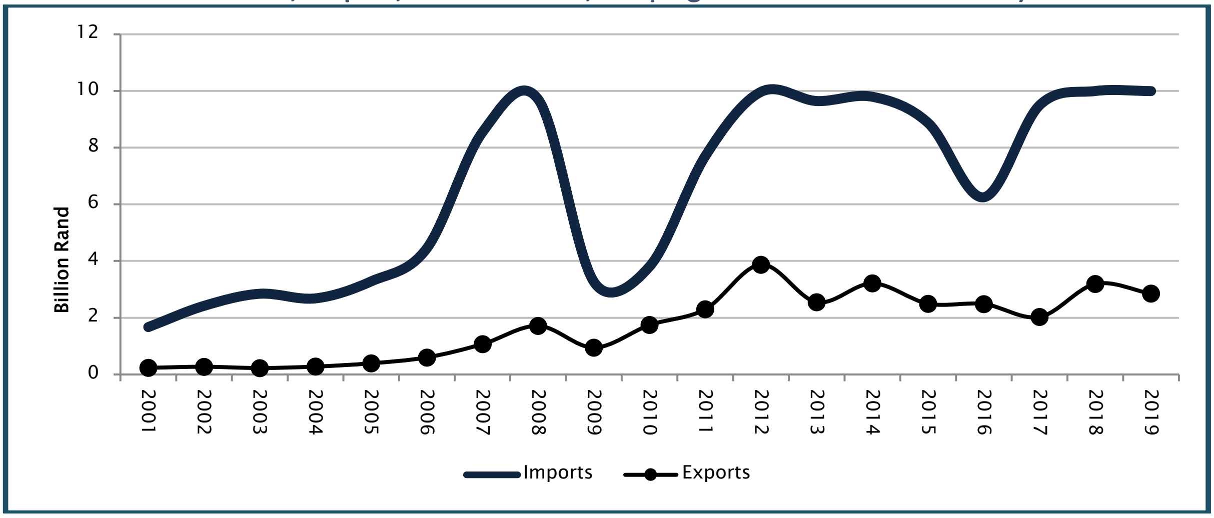
3.3.1. Equipment

Construction equipment and machinery (so-called yellow machinery) in the water and sanitation sector consists essentially of self-propelled bulldozers, angle dozers, graders, levellers, scrapers, mechanical shovels and excavators.[3]

The industry is capable, among others, of planning, designing, constructing, operating, managing, maintaining, rehabilitating and decommissioning dams, according to the South African National Committee on Large Dams.

South Africa displays a negative trade balance for such machinery and equipment (Figure 19). While exports have risen slowly over the past two decades, off a very low base, imports have increased sharply, although erratically. Imports rose after the 2008-2009 global financial crisis, declined between 2011 and 2016, and have since risen again. The volatility in imports depends on capital projects conducted locally in many demand industries, including dam building, mining and construction. In 2019, imports stood at R10 billion (compared to less than R3 billion for exports, essentially to the Southern African Development Community [SADC] region). Self-propelled mechanical shovels, excavators and shovel loaders were, in the main, imported items, primarily from China, the US, Japan and India.

Figure 19: South Africa's imports and exports of machinery HS 8429 (bulldozers, anglers, graders, levellers, scapers, shovel loaders, tamping machines and roadrollers)



Source: Authors, based on data from Trade Map, 2021.

[3] The market for this equipment spans across the water industry, mining, construction and agriculture.

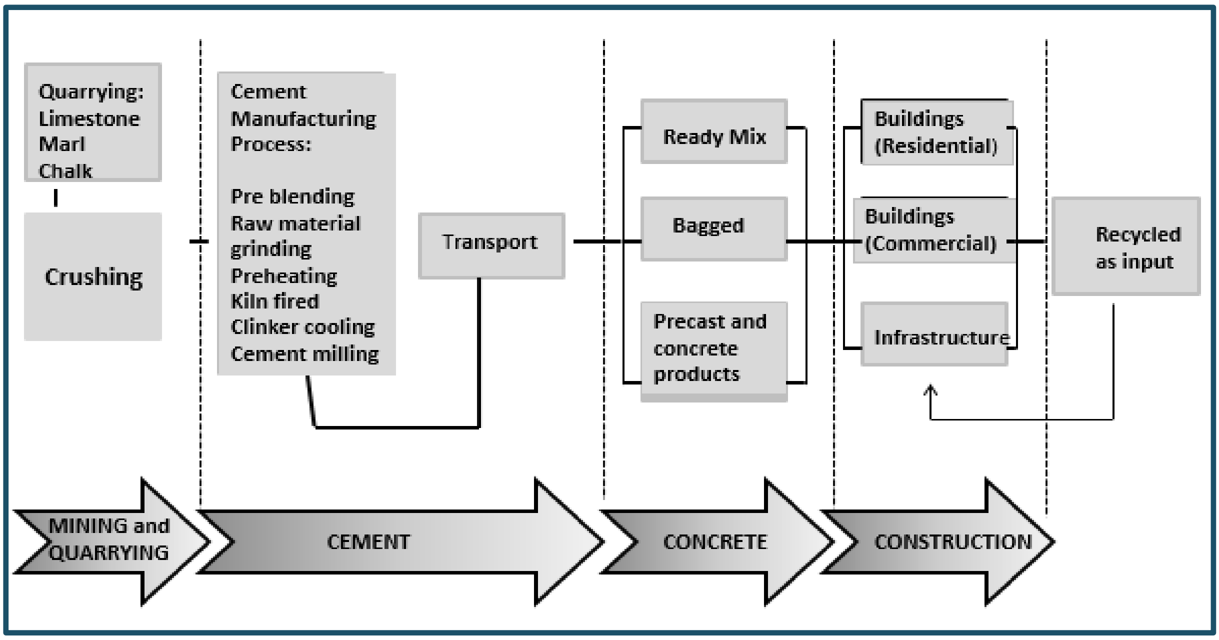
3.3.2. Cement[4]

The cement value chain traverses multiple sectors, beginning with the mining and quarrying of raw materials. The main ingredient of Original Portland Cement (OPC) is limestone, which is quarried to provide the key ingredient of clinker, calcium carbonate ($CaCO_3$). Cement production facilities are usually located close to quarries to reduce the expensive transportation of high volumes of rock. Very small amounts of iron ore, bauxite, shale, clay and sands may be needed to provide the extra mineral ingredients that make up the raw mix which enters the cement kiln. These additional mined and quarried inputs provide necessary iron oxides, alumina and silica in accordance with the specification of particular types of cement. Quarried raw material undergoes an initial and secondary crushing process on-site to produce 10cm pieces.

On entering the cement manufacturing plant, crushed limestone and other necessary mineral inputs are mixed and milled together to produce a raw meal. This raw meal is then preheated and precalcined before entering the cement kiln where clinker is produced. From the kiln, hot clinker is rapidly cooled. Gypsum is then added to the cooled clinker and the mixture is ground into a fine powder. Additional blending may then take place.

The final product is homogenised and stored in cement silos and then packed into bags ready for shipping or transported in bulk by road or rail.

Figure 20: Cement value chain



Source: Lowitt, 2020a.

Cement is the crucial ingredient (10%-12%) of concrete and binds sand and aggregate (65%-85%) and water (14%-21%) together. Concrete users access cement through three channels. The most common channel (in South Africa) is purchasing cement in bags from resellers in the retail and wholesale market. Contractors then mix their purchased cement with aggregate and sand and form concrete for use on-site. An alternative to bagged cement is the use of ready mix cement. In this channel, contractors specify a concrete mix design to a ready mix company, which mixes cement, aggregate, water, sand and other design ingredients off-site and delivers a ready to use liquid concrete to the client's site in concrete mixing trucks. Due to the setting time of ready mixed concrete, this channel only works if the distance between the construction site and the ready mix plant is relatively short.

[4] This section is extracted from Lowitt, 2020a.

Finally, cement can be delivered in dry bulk to producers of final concrete products, such as roof tiles, cement building blocks, fibre cement roof sheets, precast slabs and walls, pipes and roof beams. This cement is then mixed on-site by the fabricator to a specification suited for the final use of the product. The concrete is then placed into moulds and dried and cured ready for distribution into the market.

Cement and concrete are used in the construction industry to erect buildings and infrastructure. The design phase of the construction process (which engages the client with architects, structural engineers and contractors) determines the specification, characteristic and amount of cement and concrete that will be utilised in a particular construction project. Most residential buildings are designed to last 70 years, office buildings 100 years, and commercial buildings 50 years. Although commercial buildings are designed to last 50 years on average, they are replaced every 25 years due to thorough renovations to meet new functional requirements (Lenne and Preston 2018, Celadyn 2014). Big infrastructure projects, such as dams and roads, are designed to last more than 100 years with on-going maintenance factored into the original design and life cycle specifications. At the end of the life cycle of a building, concrete can be recycled as aggregate for use in the production of new concrete as a substitute for virgin gravel and stone. Concrete cannot be recycled as an input into cement manufacture. Concrete which is not recycled usually finds its way into landfill sites.

The first OPC was produced in South Africa in 1892 by the Pretoria Portland Cement Company (PPC). The company operated as a monopoly until 1934 when Afrisam, Lafarge and Natal Portland Cement (NPC) entered the market. These four companies were the only suppliers of cement in South Africa until 2006 when Sephaku (backed by Dangote from Nigeria) entered the market. This was followed by Chinese cement manufacturer Mamba Cement in 2016.

The big four of PPC, NPC, Lafarge and AfriSam created a legal cartel in 1940 for what were deemed public interest considerations by the government of the day. This cartel and its highly collusive behaviour endured until 1996. Under the democratically elected government of 1994, the cement cartel was dismantled in 1996 with authorities believing that companies would set their own prices and begin competing for market share. Instead, the four companies colluded to maintain the market shares they had under the cartel; establish pricing parameters to support the maintenance of market shares; and agree on marketing and distribution and geographic parameters. Each company agreed to make sales by region, packaging type, transportation, customer type, pricing, quantities and market share data available to an association of auditors which would aggregate the information and then disseminate it to the four companies. This information allowed the four to maintain market shares and devise joint strategies to maximise profits.

This illegal cartel operated from 1996 to 2006 when the Competition Commission began investigating the industry. After research confirmed non-competitive behaviour in 2009, PPC applied to for leniency and immunity, which was granted on condition the company stopped releasing data to the industry association of auditors, thereby halting the exchange of information between cement firms. The Competition Commission assumed that without this information cartel members would not be able to monitor compliance among other firms, resulting in increased competition in the market. In 2011, Afrisam settled with the Competition Commission followed swiftly by Lafarge in 2012.

In principle, there is no longer collusive behaviour in the local cement industry but CCRED (2015), Vosloo and Mathews (2017) and Theron and Van Niekerk (2018) all suggest that collusive behaviour is a recurrent behaviour in the cement industry worldwide and, given the history of the industry in South Africa, cartel-like behaviour is likely to reappear. Several people interviewed in the research process believe that high levels of tacit collusion continue to characterise the industry in South Africa today.

Due to the agreement by the cement companies to halt releasing data, there is no cement industry data publically available save quarterly sales data and data collected by the South African Revenue

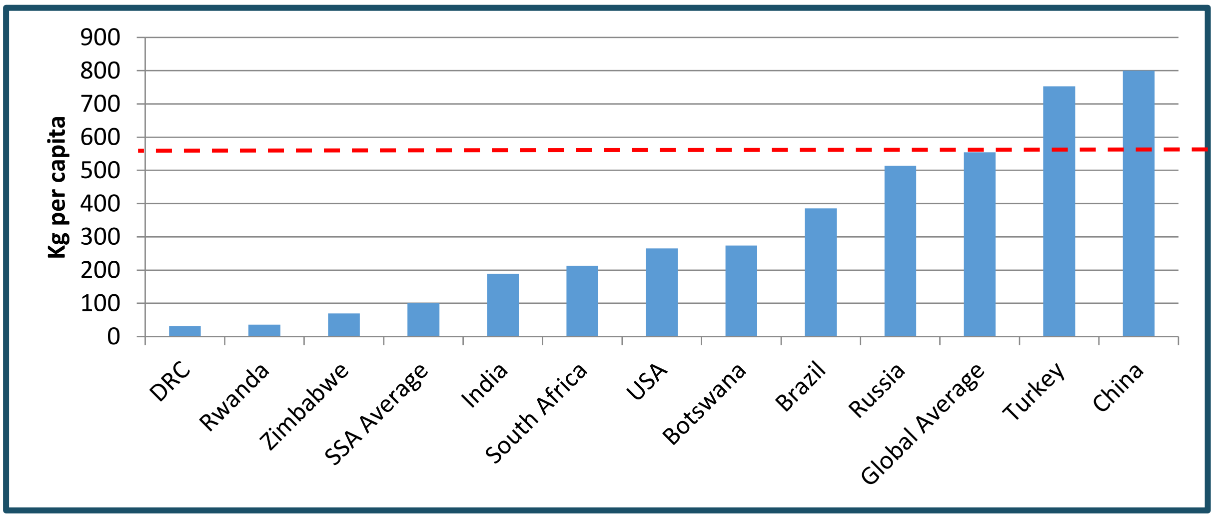
Service (SARS) on imports and exports. As such, no-one outside the industry has a dynamic view of the sector today, either at a descriptive level or of trends over time. This hampers policy and decision-making for supporting the industry in issues such as the International Trade Administration Commission of South Africa (ITAC) raising tariffs to protect the local market against cheap and inferior quality imports or impacts of the carbon tax.

As of 2016, there were six cement producers in the South African market, which were estimated to be worth R48 billion in 2014 and employed about 7 000 workers (Arp, Bole-Rentel and Jakuja 2018). PPC enjoys the largest market share at 22%, with NPC at 15%, Sephaku at 12%, Afrisam and Lafarge at 9% each and Mamba at 5%. The remaining 29% of the market is serviced by imports (about 5%) and third-party blenders[5] (Perrie 2014; Arp, Bole-Rentel and Jakuja 2018; PPC 2018). Ninety-one percent of the local market is OPC. In 2006, the retail market accounted for 52% of domestic sales. Ready Mix accounted for 15% of the market and 16% of cement production was channelled to concrete product manufacturers. Direct civil engineering company purchases accounted for 9% of sales, third-party blenders 6%, and 2% for others[6] (Perrie 2014).

More recent estimates suggest that the share of the retail market has increased to 70% (Brown and Hasson 2016). South Africa's market share of bagged cement differs from that found in Europe and most parts of Asia where the ready mix segment dominates the market. In the US, Australia and South Africa, the ready mix market is smaller and the bagged market dominates due to the extensive distances, which make ready mix site delivery unfeasible.

Developed countries accounted for less than 25% of the global demand for cement in 2005 and demand growth is relatively consistent at 1% to 2% per annum (WWF, 2007). The majority of demand growth is driven by developing countries, a trend which is forecasted to continue until at least 2050. Estimates for the growth of demand in cement to 2050 range from the International Energy Agency's 12% to 23% to the WWF's 25% to 50%. Figure 21 shows that per capita cement consumption in low- and middle-income countries falls well below the global average. This is due to limited levels of investment in the built environment and infrastructure in developing countries compared to developed nations.

Figure 21: Cement consumption per capita



Source: Lowitt, 2020a

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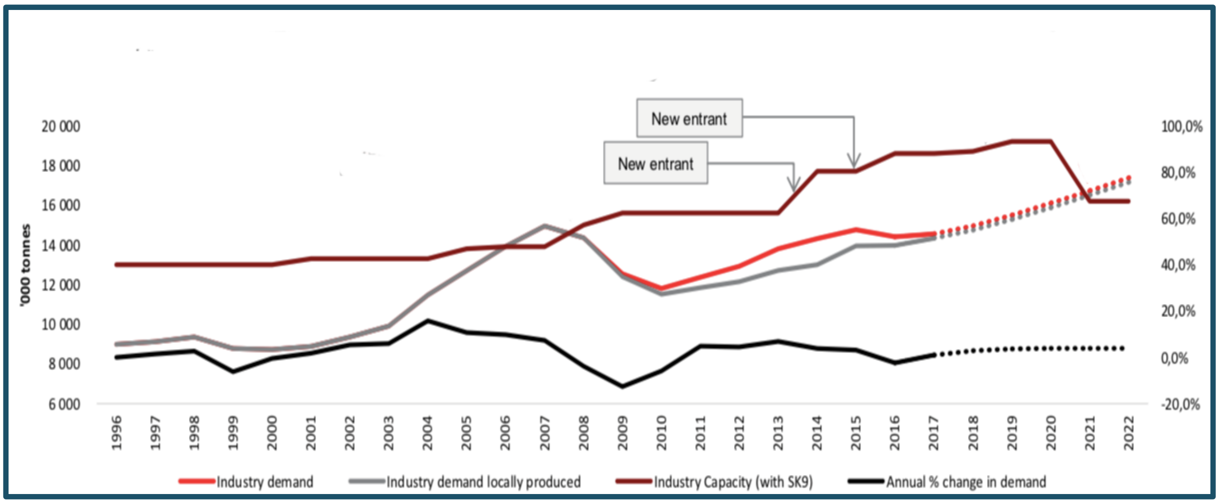
[5] Third-party blenders are small unbranded companies which buy clinker from large firms, blend the clinker with supplementary cementing materials and sell directly into the market or through some retailers. Their product is essentially "unbranded" cement.

[6] South African cement exports are minor due to the expense of transportation and the fact that most South African cement firms also operate plants in the rest of Sub-Saharan Africa, decreasing the demand for inter-regional exports.

Population increases, growing urbanisation and burgeoning middle classes in low- and middle-income countries should continue to drive demand for housing and associated infrastructure, thereby supporting an upward trend in the demand for cement and concrete. In South Africa, demand remained relatively stable post the 1994 election, peaking in 2006 and 2007 driven by infrastructure preparations for the World Cup, substantial investment in low-cost residential housing, and the building of the Gautrain.[7] The global financial crisis of 2008 strongly impacted the construction industry negatively and this, coupled with decreasing rates of private and public sector investment over the next decade, has resulted in depressed demand for cement even as new entrants Sephaku and Mamba entered the market.

Figure 22: Industry demand for cement 1996-2022



Source: Lowitt, 2020a, based on PPC, 2018

As a result of low levels of demand and increased productive investment, the capacity utilisation of the country's cement industry stands at a low 70% (PPC, 2018; ACMP, 2018), while industry stakeholders claim an 85% to 95% utilisation ratio is required to ensure profitability. Local cement producers claim they are facing "a perfect storm" of unfavourable conditions. Demand conditions are weak due to low levels of economic growth, as seen by a decrease in the number of building plans passed and lack of implementation of government infrastructure build programmes.[8]

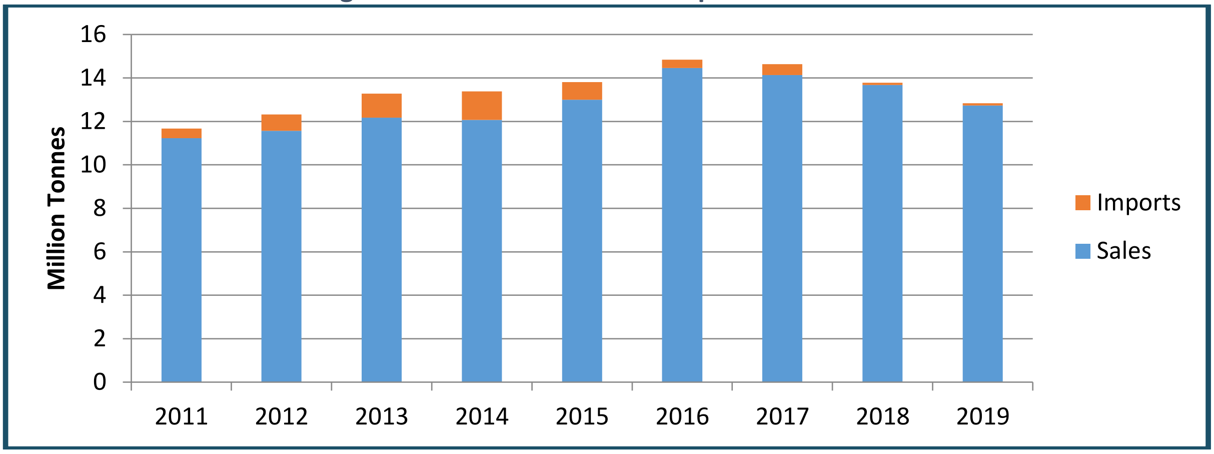
The entrance of Sephaku and Mamba have increased industry supply capacity at a time of low demand. Cheap imports since 2013 from Vietnam, Pakistan, India and China have been entering the local market and are up to 45% cheaper[9] than domestic products (PPC, 2019). In these conditions, the bargaining power of retailers (which account for 70% of sales) has increased, leading to falling prices and historically low industry profitability. Added to this, increases in the cost of electricity, labour and the newly introduced carbon tax all make current market conditions very difficult according to industry insiders.

[7] With residential housing accounting for 50% of demand for cement, interest rates are important in influencing demand.

[8] On average, between 2008 and 2020, 55% of demand has been residential buildings, 32% non-residential buildings and 13% infrastructure works (SARB n.d.2020)

[9] High price differentials are due to dumping and cheap transport options using empty ships returning from South African coal exports (especially to India).

Figure 23: Cement sales and imports 2011-2019



Source: Lowitt, 2020a, based on the Concrete Institute, 2020.

With sales averaging 13 million tonnes a year over the past nine years, and an industry installed capacity of 22 million tonnes, capacity utilisation has on average been 60%.[10] Sales and import data show that although imports began to increase in 2011 at a high percentage rate, this was off a low base and, in tonnage market penetration, was in fact modest. In 2015, ITAC provided tariff protection and imports have declined accordingly. Sales volumes increased modestly from 2011 to 2017 with annual growth rates declining by 2.2% from 2016 to 2017, 3.3% from 2017 to 2018, and a strong 7% contraction from 2018 to 2019.

Industry experts, however, believe that the announcement in the President's 2019 State of the Nation Address of R500 billion of new public sector investment and R43 billion of new private sector investment, if implemented, will go some way to increasing domestic demand. In addition, ITAC has agreed to impose tariffs on cheap cement imports to decrease market penetration. Rising freight costs and falling imports, due to a lack of shipping availability on the back of decreased coal exports to India, should also decrease imports – collectively resulting in an upswing of domestic capacity utilisation.[11] Local industry stakeholders have identified no new plant coming on stream and, given that it takes up to nine years to bring new capacity to market, for the near future the supply side of the industry is fixed with the potential for demand conditions to improve.

Despite analysts predicting a more positive outlook, given current poor trading conditions in South Africa, the big four are focusing on their productive capacity in the rest of Sub-Saharan Africa, where growth prospects are viewed as being superior to those in South Africa. PPC for example is investing in new plants in non-South African markets, with an expected 6% annual growth rate due to current low cement per capita consumption and positive demand dynamics. The annual reports of all South African producers suggest a current view that future growth will be derived outside of South Africa.

3.4. Piping equipment

3.4.1. Plastic pipes

Plastic piping is used across a multitude of industries, from water and sanitation to mining, agriculture, telecommunication and construction. Plastic piping networks for water form a long-term and structural part of South Africa's infrastructure. The integrity of these networks, built up over decades, is of critical importance, serving the water supply and sewage disposal needs of many millions of people.

[10] This is leading to plant rationalisation in the domestic market.

[11] Analysis done pre-COVID 19.

Plastic has grown to a dominant position in piping systems worldwide **.** Market wise, plastic piping for water is utilised by state-owned enterprises (SOEs), government, municipalities and water boards as well as in mining and construction. Distribution networks in municipal areas are mostly done in plastic pipes (both PVC and HDPE). Sizes of pressure pipes range from 16mm up to 1200mm outside diameter. Sewage networks (non-pressure) are also mostly done in plastic (usually PVC) (SAPPMA, n.d.)

The industry records about R3 billion a year of sales. As shown in Table 3, at the industry's peak, it produced 104 000 tons of PVC piping in 2016. This has now declined to 78 000 tons as of 2019. In terms of HDPE piping, in 2014, production peaked at 56 000 tons. This has since declined to 48 000 tons in 2019.

Table 3: Plastics pipes production in South Africa (in tons)

Year	PVC	HDPE
2009	90 000	40 000
2012	81 000	50 000
2014	94 000	56 000
2016	104 000	50 000
2018	97 000	51 000
2019	78 000	48 000

Source: SAPPMA, 2020

The plastics pipes industry is led by South African Plastic Pipes Manufacturers Association (SAPPMA). SAPPMA aims at creating customer confidence in plastic piping, thereby ensuring long-term sustainability and dynamic growth in the industry.

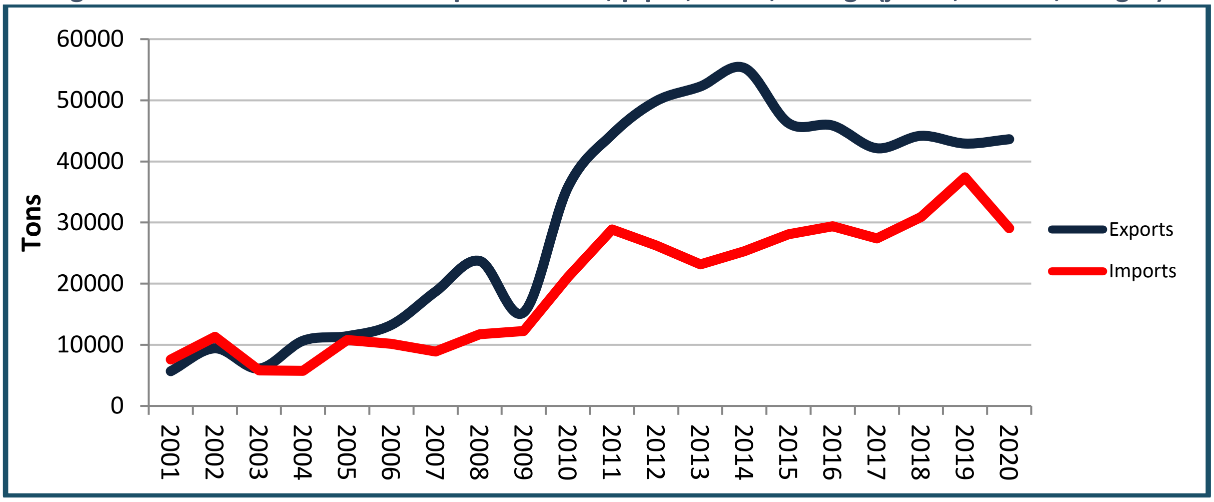
The market is concentrated with a few leading companies capturing the majority of market shares and revenues.[12] In 2018, based on production volumes, leading companies in the PVC piping market were Rare Plastics, Marley, Gradco, DPI and Flo-Tek. Similarly, for HDPE pipes, three major players exist, namely Swan Plastics, Flo-Tek and Sizabantu Plastics.

Domestic manufacturers compete generally based on price, quality and product availability. However, the concentrated nature of the industry has brought competition challenges in the past. The Competition Commission and Tribunal clamped down on anti-competitive behaviour in the sector in 2012. The Competition Commission found that DPI Plastics, Marley Pipe Systems, Petzetakis Africa, Swan Plastics, Amitech South Africa, Flo-Tek Pipes & Irrigation, Andrag, Gazelle Plastics, Gazelle Engineering and Macneil Agencies had meetings in which they fixed prices, rigged tenders and divided markets by allocating contracts and customers. Firms had to pay penalties amounting to just over R50 million.

Despite the challenges facing the plastics industry, there is a positive trade in plastics, tubes, pipes, hoses and fittings. More details are provided in Sections 4.3 and 4.4 on trade-related issues. Exports rose exponentially from 5 600 tons in 2001 to 55 000 tons in 2011. Since then, exports have been stable with average exports of 44 000 tons. Exports mainly go to the SADC region. Imports rose from a base of 7 600 tons in 2001 to 29 000 tons in 2019. Since 2019, imports have been on the decline. Imports primarily originate from Botswana, China, Spain and Italy. The current tariff rate for imports of plastic piping stands at 10.96%.

[12] In terms of plastic fittings used in the water and other industries, such as elbows and flanges, information and data is limited, with the exception of trade data.

Figure 24: South Africa's trade in plastic tubes, pipes, hoses, fittings (joints, elbows, flanges)



Source: Authors, based on data from Trade Map, Series for HS code 3917 "Tubes, Pipes, Hoses, Joints, Elbows, Flanges of Plastic".

3.4.2. Steel and concrete pipes

High-pressure lines of steel and concrete pipes are mostly used in the water value chain for major supply lines (e.g. from Rand Water). Steel piping faces strong competition from plastic piping, particularly for water distribution.

According to the Southern Africa Stainless Steel Development Association (SASSDA), stainless steel service pipes have a minimum lifespan of 60 years, compared to an average lifespan of 20 years for plastic service pipes (PE or PVC). Stainless steel water service pipes and tanks are also lightweight, flexible in application, and require fewer connections and fittings compared to traditional plumbing. They are also less susceptible to extreme temperature fluctuations and corrosive environments. In addition, water management authorities have recorded far lower life cycle costs if the correct stainless steel grade has been specified for a specific environment (SASSDA, 2020).

As illustrated in Table 4, the production of concrete pipes declined from 289 000 tons in 2009 to 220 000 tons in 2019.

Table 4: Steel and concrete pipe production in South Africa

YEAR	STEEL	CONCRETE
2009	NA	289 000
2012	250 000	245 000
2014	NA	NA
2016	175 000	293 000
2018	NA	NA
2019	115 000 (e)	220 000

Source: SAPPMA, 2020

Steel pipes are manufactured in two ways. Seamless pipes are manufactured at a steel mill during the steel manufacturing process (i.e. while the steel is hot and hence has no seam), while other pipes and tubes are manufactured from sheet metal cut and bent in the right size and then welded (either a straight line or else a spiralling weld for additional strength).

The South African bulk water industry makes use of large bore spiral submerged arc welded steel conveyance pipes made from hot rolled steel sheets in coils (made from an alloy of iron and carbon). These pipes are, for instance, used to convey water from bulk water supply to reservoirs. From the reservoirs, smaller electric resistance welded pipes are used to transfer the water for municipal supply to commercial and residential buildings.

According to the report *The Health and Growth Potential of the Steel Manufacturing industries in SA* (CEA, 2017), the overall pipe and tube industry is operating in two distinct sub-industries, that of large-diameter pipes, and that of small-diameter pipes and tubes.

The large-diameter pipe industry, predominantly destined for conveyance of liquid and gas, is usually contract-driven. These pipes are regarded as stock items and compete in the commodity market. To be successful in the tender bidding process, where international players are also participating, the correct benchmarked price for the input material is of the utmost importance. Therefore, the sub-industry is heavily dependent on support from the Committee of Secondary Manufacturers (COSM) fund, the steel mills and government.[13]

The smaller-diameter pipe and tube manufacturers[14] are competing aggressively among one another due to the huge overcapacity in the country as well as the substantial volumes of cheap products entering the domestic market. To survive, the industry has been trying to venture into a higher level of value addition to differentiate themselves from the cheap imports.

There are about 20 active tube and pipe manufacturers in South Africa of which Robor, Macsteel, Trident Tubular, Barnes and Group 5 Pipe are the largest players (STEASA, 2020). South Africa's large bore spiral submerged arc welded steel conveyance pipe industry consists of three manufacturers, namely Hall-Longmore, LB Pipes and Africa Pipe Industries.[15]

The production of steel pipes is shown is Table 4. Production has declined from 250 000 tons in 2012 to an estimated 115 00 tons in 2019. Despite this, there is still capacity from South African firms to meet market demand, except for fittings which are mainly imported.

According to STEASA (2020), the major water-related markets[16] supplied by the manufacturers of steel pipes are: water conveyance, mining, petrochemical industry, oil and gas industry, building and construction, power generation, and irrigation.[17]

Historically, South Africa has a relatively neutral trade balance for tubes, pipes, hallow profiles, seamless of iron and steel, as shown in Figure 25. A negative trade balance has materialised in 2020.

[13] The COSM fund is used as an export support mechanism and is funded by the steel mills. For every ton of steel produced, the companies contribute R43 to the fund. Companies who export can claim R173 per ton exported from the fund provided they added at least 20% value to the steel product and that the product is exported via ship and not overland. In essence, the aim of the fund is to help companies in South Africa export their products to foreign destinations.

[14] Pipes and tubes, while similar, are used for different applications. A pipe is used for the transportation of liquids or gasses. Corrosion resistance and durability are both important in this case. Tubes are used to support items and are found in a large number of applications within the construction and furniture industries. The major difference is in the quality of steel used which depends on the end-use application.

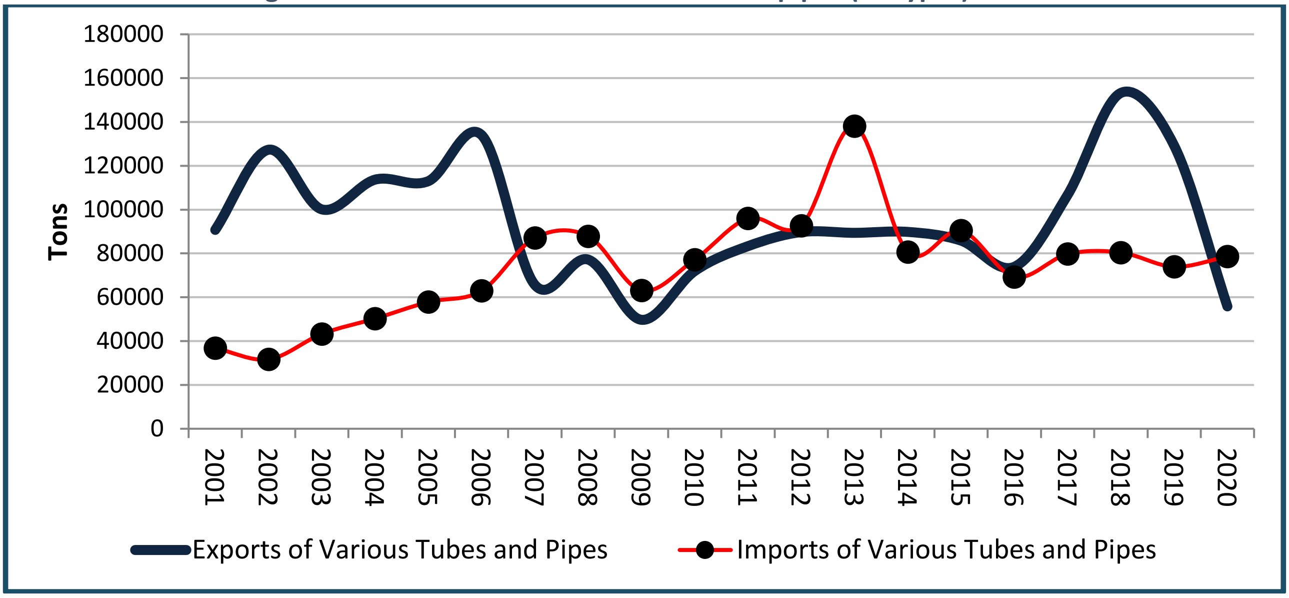
[15] The South African Tube and Pipe sector is represented by the Association of Tube and Pipe Manufacturers (ASTPM). ASTPM was established in 1983 and currently represents 11 members. The members account for 70% of the installed capacity for conveyance, mechanical and structural tubular products, which are supplied to international specifications (ASTPM, 2021). The association began an import replacement programme working with the dtic, the South African Bureau of Standards (SABS) and the South African Iron and Steel Institute. The programme largely looks at import substitution by strengthening and making manufacturing competitive in addition to ensuring fair and just tariffs.

[16] Market shares are not available.

[17] Other markets include the automotive industry (such as exhausts, shock absorbers), furniture and leisure, shop fittings, prams and toys, and scaffolding.

2018 saw the largest exports, which stood at 153 000 tons. Since then, exports have declined to just under 60 000 tons. Please see Sections 4.3 and 4.4 on trade-related issues for further analysis.

Figure 25: South Africa's trade of tubes and pipes (21 types)



Source: Authors, based on data from Trade Map, Series for HS code 73.

According to STEASA (2020), the designation of local steel content for state infrastructural projects as well as large bore spiral submerged arc welded pipes constitute two key opportunities for the local manufacturing industry (see Table 5). The dtic is investigating the benefits of designating all other carbon steel tube and pipes that can be manufactured in South Africa.

Table 5: Steel pipes and designation

CATEGORY	LOCAL CONTENT REQUIREMENT	DETAILS
Revised pipe fittings	100 %	Steel Pipe Fittings And Specials (100%) Galvanized (100 %) Lined and Coated (80%) Galvanized, Lined and Coated (80%) Forged (100%)
Steel products and components	100 %	Aluminium and steel

In consultation with the ASTPM, SARS has furthermore implemented an import reference price for steel tube and pipes from 1 August 2018. The monitoring system covers HS codes 73041900, 73051100 and 73061900. More HS codes are expected to be included going forward (ASTPM, 2021).

3.5. Valves

According to WOW (2018), the valve sector is worth approximately R4.5 billion annually. Market wise, the water and power generation industries account for about 43% of the valve market. The rest comprises of the transport and mining sectors. Valve manufacturers rely largely on SOEs for business and government infrastructure projects.

According to the South African Valve and Actuator Manufacturers Association (SAVAMA), housed under the Steel and Engineering Industries Federation of Southern Africa (SEIFSA), South African manufacturers can supply valves that meet international specifications and demand requirements – including spares and maintenance services in compliance with International Organization for

Standardization (ISO) 9001/2 quality systems. However, South Africa has faced increasing difficulties in competing with international manufacturers, owing to binding constraints, such as the decline of foundries and rising imports.

Members of the Valve and Actuator Manufacturers Cluster of South Africa (VAMCOSA)[18] account for approximately 80% of the valves and actuators manufactured locally. The number of members has, however, declined from 18 to 12 in recent years, due to manufacturing being eroded by Chinese imports and the declining number of foundries.

The following are the major firms in the valves industry: AC Valves cc; Ainsworth Engineering(Pty) Ltd; Aveng DFC; AZ Armaturen (Pty) Ltd; Cobra Isca (Pty) Ltd; Dual Valves (Pty) Ltd; A.R.I. Flow Control Africa; Floval (Pty) Ltd; Ithuba Valves cc; Mitech Control Valves (Pty) Ltd; Paltechnologies (Pty) Ltd; Premier Valves (Pty) Ltd; RGR Technologies (Pty) Ltd and Valco Group SA (Pty) Ltd.

Table 6: Foundries in South Africa

PROVINCE	2003	2007	2015
Gauteng	110	108	114
KwaZulu-Natal	20	26	20
Western Cape	26	16	4
Eastern Cape	16	10	8
Free State	10	7	5
North West	10	9	4
Northern Cape	6	3	3
Mpumalanga	15	15	2
Total	213	194	160

Source: SAIF, 2015.

Foundries are crucial in the manufacturing of valves and other steel products. According to the South African Institute of Foundrymen (SAIF), the number of foundries has declined drastically from a total of 213 in 2003 to 160 in 2015 (Table 6), notably hampered by fast-rising electricity prices. In 2022, the number of foundries in the country is estimated to be below 100. The hardest hit province has been the Western Cape, which saw foundries reduce from 26 in 2003 to four in 2015 and Mpumalanga from 15 in 2003 to a mere two in 2015. This acts as a binding constraint on the valves manufacturing industry for water and other liquids.

As detailed in Table 7, foundries of iron and steel have declined sharply from 110 in 2003 to 86 in 2014, foundries of aluminium, brass and zinc declined from 117 in 2003 to a mere 57, while high pressure die caters slightly declined by nine firms.

Table 7: Foundry by type in South Africa

FOUNDRY TYPE	2003	2007	2014
Ferrous (Iron and Steel)	110	110	86
Non-Ferrous (Aluminium, Brass and Zinc) Sand, Gravity, Low Pressure	117	119	57
High Pressure Die Casters	36	32	27
Investment Casting	7	4	4
Total number of Foundries	270	265	170

Source: SAIF, 2015

[18] VAMCOSA is the official cluster of valve manufacturing. It was formed in July 2011 as a cluster within the South African Capital Equipment Export Council to represent the country's valves and actuators manufacturers. VAMCOSA's focus is to bring local valve and actuator manufacturers together to create a common focus and goal for the respective industries.

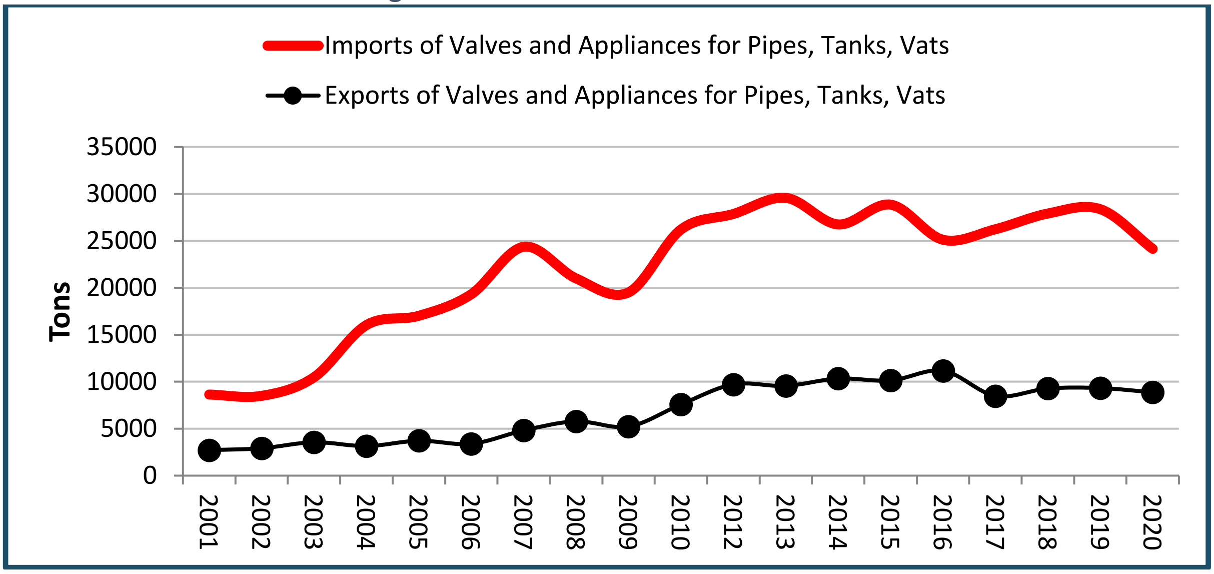
Skills availability, particularly the shortage of artisans, has been identified by industry associations as a key constraint to the industry. Both VAMCOSA and the South African Valve and SAVAMA have developed initiatives to address such a shortage. VAMCOSA has a skills development programme for artisans, working with colleges, universities, government departments, the Council for Scientific and Industrial Research (CSIR) and the South African Bureau of Standards (SABS) (VAMCOSA, 2018). SAVAMA has *The Working with Valves* course which has 10 modules that look at principles of valve design, application, characteristics, installation and other subjects. SAVAMA also offers online training courses, such as *Introduction to Valves*, *Working with Valves* and *Control Valves,* while SEIFSA skills centres offer training that encompasses apprenticeships, learnerships, skills development programmes, short courses, trade proficiency assessment services and trade testing, and the continuous upskilling of artisans.

Imports have been another binding factor for the industry. The rise in imports, highlighted in Figure 26, suggests either the industry is not competitive, cheap imports are entering the market, or dumping is occurring. General imports rose from R228 million in 2001 to R 1.5 billion in 2019 while exports grew more marginally. South Africa applies an 11.32% tariff rate to all its competitors, which mainly include China, Germany and the US.

As a way to support local manufacturing, valves have been designated at a 70% level. In addition, following engagement with the local industry, the use of locally sourced materials and local drilling, machining, coating, assembly and testing were added to the designation notice. The industry is divided in its views on the implementation of local content requirement. While VAMCOSA and SAVAMA support designation and local content requirement, the Association of Valve Importers South Africa has opposed such a policy (Engineering News, 2017).

The graph below shows a negative balance exists in the trade of various valves and parts. Despite this, South Africa is the 43rd largest exporter globally of valves and parts. Exports of valves grew from 2 700 tons in 2001 to 11 000 tons in 2016. Since then, exports have declined, with only 8 800 tons in 2020. The closure of foundries has affected competitiveness of valve exports. Current exports mainly go to the SADC region with other exports going to the US and Australia.

Figure 26: South Africa's trade in valves



Source: Authors, based on data from Trade Map (2020), HS code 8.4

3.6. Pumping equipment

The two main types of water pumps are the centrifugal pump and the positive displacement pump.[19] The value of the pump sector is estimated at about R1 billion per annum.

The sectors and industries that use pumps and spares span the economy and include metal, mineral and mining industries, power generation, water supply and purification, the pulp and paper industry, the agricultural sector, food and beverages manufacturers, the construction sector and petrochemical industry (WOW, 2018). Table 8 illustrates that pumps and valves mainly go to water (26 %), metals and mining (20%), power generation (17%), petroleum oil and gas (15%) and other (22%). Pumps and valves that go to water are mainly utilised by the government in water infrastructure projects.

Table 8: Industry allocation of pumps and valves

Industry	2014	2016
Water	26%	26%
Metal & Mining	29%	20%
Power Generation	17%	17%
Petroleum, Gas & Oil	26%	15%
Other – Specialised Valves	7%	22%

Source: WOW, 2018.

About 120 companies exist, of which 62 manufacture all or some of their products locally while others import and assemble (WOW, 2021). The increasing cost of production has resulted in many manufacturers ceasing manufacturing operations and becoming resellers of products imported mainly from the Middle East, India and China (WOW, 2018).

The Southern African Pump Systems Development Association (SAPSDA) notes the South African pumps industry is dominated by international companies, which limits the capabilities and capacity of smaller, local manufacturers. For instance, borehole pump manufacturers have reduced from 12 to two as the industry has become dominated by imports (WOW, 2018).

SAPSDA has developed a local manufacturing plan to try and revive the pump sector, including components manufacturers. The plan focuses on foundries, engineering works, fabrication, bearings and couplings, sealing systems, valves, electrical motors, controls, drives and electrical switch gear, as well as cables. The foundry industry is a key area that requires immediate attention. As with valves, the local manufacturing of pumps could not survive without it.

The lack of investment in new technology and products has also been identified as a key constraint (WOW, 2018). This stems from most of the manufacturers no longer focusing on manufacturing and opting to act as resellers of products imported mainly from China, due to the high cost of local production.

To revitalise manufacturing in pumps, the South African Pump Cluster was formed. It aims to promote local manufacturing, particularly to meet demand from local SOEs. To bolster this objective, pumps were designated by the dtic at a threshold of 70%.

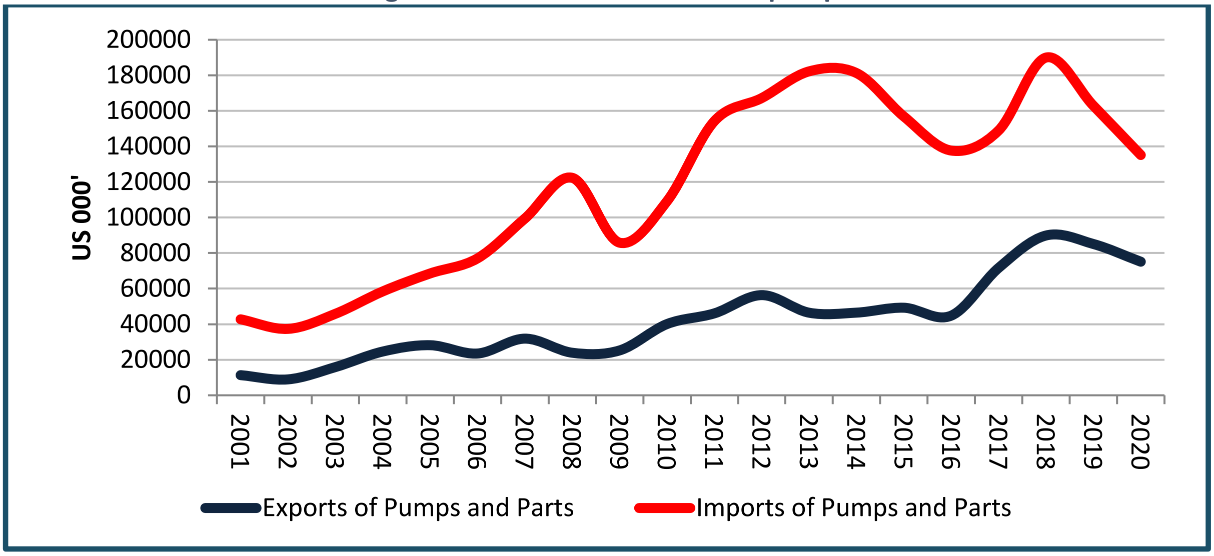
[19] Pumps are devices that raise, transfer, deliver, or compresses fluids, liquids containing solids or that attenuates gases especially by suction or pressure or both at a controlled in pipe-lines or pipe-line systems.

Table 9: Pumps and local content requirements

Pumps and MV Motors	70 %	Pumps (End Suction Centrifugal, Multistage Centrifugal, Horizontal split casing Pumps, vertical turbine pumps, slurry pumps, positive displacement, self-priming centrifugal, centrifugal process) (70%) MV Motors (Medium Voltage electric motor) (70-100 %)

The graph below illustrates a negative trade balance in various pumps (centrifugal pump and the reciprocal and rotary positive displacement pump). In US dollars, exports grew steadily from US$ 11 million to US$ 89 million in 2018. Exports have since begun to decline with only US$ 75 million exported in 2020. Similar to other water and sanitation goods, exports are largely destined for SADC with deep-sea exports to the US and Australia.

Figure 27: South Africa's trade in pumps



Source: Authors, based on Trade Map, 2020, HS 8413.

South Africa displays a negative trade balance for pumps. Imports have risen from nearly R1 billion in 2001 to just under R6 billion in 2019. Imports of pumps for liquids mainly originate from China, the US, Germany, Italy, India, Sweden, Japan, the United Kingdom (UK), France and Mexico. Exports of pumps have also been steadily rising to just under R5 billion in 2019, mainly to the SADC region.

Skills wise, SAPSDA has training courses that cover every aspect of the pump industry.

The content of the SAPSDA pump courses are as follows:

- The Basic (Introductory) Course covers: Basic Hydraulics – Pump Principles and how a pump works; Pump Types; Pumping Systems; Net Positive Suction Head; Installation and Maintenance of Pumps; Couplings and Drives; Mechanical Seals and Gland Packing; Basic Electric Principles; Erosion and Corrosion; Submersible Pumps; Basic Pump Testing
- The Advanced Course covers: Hydraulics applied to a pump system; Net Positive Suction Head; Affinity Laws Parallel and Series Operation; Pumping of various Fluids and Slurries; Erosion and Corrosion; Pump Types; Electric Motors and Variable Speed Drives; Submersible and Borehole Pumps; Pump Performance Testing; Pump Test Demonstration.

3.7. Borehole equipment[20]

UNICEF estimates that 67 million boreholes need to be drilled in Africa to meet the development goals related to accessing clean drinking water. If groundwater access for industrial and agricultural use is also factored in, the required number of boreholes needed in Africa exceeds 100 million in the next 15 years.

A borehole is a narrow shaft drilled vertically into the ground for the purpose of extracting groundwater. Once the shaft is drilled, a casing is used to line the shaft to prevent it from caving in. A screen is then placed atop the shaft to prevent pollution of the borehole water and finally a pump is installed to raise the water to the surface for use. Pumps may be electric, solar or manual. To drill a standard water borehole (which varies anything from 50m to 200m depending on geological formation) a piece of specialised capital equipment known as a drilling rig is used (Standard Industrial Classification (SIC) 357).

Drilling rigs vary in size from massive rigs used to drill kilometre deep mine shafts to small portable rigs which can be pulled and positioned by a single person. To reach a reasonable depth for a standard water borehole, a drill rig needs a minimum weight (four tons) and a minimum torque (4 000 newton meters). Currently, there are no locally produced borehole drilling rigs that meet such specifications and which are designed specifically for use in remote areas where access to parts, spares, and repair and maintenance services are hard to access. In addition, no local rigs meet the above specifications which are also reasonably priced in terms of the setup costs of a new SME drilling company.

There are many types of drilling techniques. Each technique requires a different type of associated drilling rig. The most common method of mechanical borehole drilling in South Africa and the rest of Africa is known as percussion rotary air blast drilling. In rotary air blast drilling, the drill uses a pneumatic piston-driven “hammer” to energetically drive a heavy drill bit into the rock. The drill bit has very hard buttons on the end made of tungsten carbide, which pulverise the rock as the hammer strikes the bit down against the rock. The drill bit is hollow. Compressed air sucks up the pulverised rock which is then blown up the outside of the drilling bit and collected at the surface. As the bit eats through the rock, rods are added above the hammer so that depth can be achieved. The bit, the hammer and the rods used in drilling are consumables and have a limited lifespan requiring regular replacement.

The drilling rig itself must provide the hammering motion to pulverise the rock, but also a rotating motion to create a round shaft. There are three crucial systems in a drilling rig. The first comprises an engine which drives hydraulic pumps to create high pressure hydraulic fluid which drives a motor. The motor turns the rods above the drilling hammer, adding a rotating motion to the hammer like a striking motion so as to produce the actual round shaft. This is known as the hydraulics of the drilling rig. Second the drilling rig needs to produce the hammer-like up and down movement to fracture and break up the rock. This is achieved by connecting the rig to a compressor. The compressor pushes air down the rods and lifts the piston up and down to make the hammer move and to push up pulverised rock to the service. The third important function of a drilling rig is known as pullback power. This provides the power to pull rods back out of the hole once water has been reached. This pull-back strength is created using the hydraulic power from the rig’s engine. As such, in engineering terms, the hydraulic system of a rig is central to its operation and functionality.

Production of a drilling rig falls within SIC code 357 – the manufacture of special purpose machinery. The key components required for a drilling rig are: an engine, a hydraulic motor, a hydraulics system, a hammer, a drill bit, rods, piping metal, piping plastic, casings (metal and plastic), bearings, nuts,

[20] This section is extracted from Lowitt, 2020b.

bolts, hoses and skid steers (chassis on which everything is attached). All these inputs are locally produced excluding: the engine, the hammer and the drill bit. Engines are not currently made in South Africa, but Toyota engines are used as spares and are easily accessible in most African countries. The hammer is made of hardened steel and could in principle be manufactured locally, although currently no steel mills produce the grade of steel necessary to meet hammer specifications. Drill bits are imported because no-one in South Africa produced tungsten carbide buttons.

The downstream industries that would benefit from the production of local content driven drilling rigs would be specialised engineering firms, metal piping firms, plastic extrusion companies, plastic piping companies, hose manufacturers, rig engineers and skid steer manufacturers. Both the metal fabrication and plastics sectors would enjoy increased upstream demand.

In addition to a drilling rig, a compressor and transport equipment are required to successfully drill a borehole. Compressors are crucial to the operation of a drilling rig and differ in size depending on their air pressure and movement of air per minute. Typically, to drill a standard borehole requires a 21 bar of pressure and air movement of 850 cubic feet per minute. Compressors meeting these specifications are large and heavy weighting up to 6.5 tons. There are locally produced compressors which are also designed specifically to be village level operated and maintained. It would be beneficial for local drillers to have access to such compressors to complement their easy-to-maintain rigs. However, South African compressors remain uncompetitive in price compared to Indian and Chinese imports. In the short run, it is therefore likely that compressors would be imported but local compressors could be produced to substitute imports if industry development and economies of scale occur.

Finally, the drilling rig and compressor must be transported onto site. A drilling operation thus requires a truck (to carry the compressor and rods) and a trailer to pull the rig. Standard heavy duty trailers produced locally in South Africa can be used and a 4x4 10-ton truck with a double axle would be required for the compressor.

United Nations and the International Red Cross reports on borehole drilling and development raise the issue of increasing the standards of boreholes which have been drilled to increase functionality and decrease failure (which is currently at more than 26% across 20 surveyed African countries); increasing maintenance of boreholes and borehole pumps; and the need to manage groundwater resources to prevent over abstraction. To this end, the reports document a crosscutting approach to groundwater development in a low to middle-income country including: establishing a strong institutional framework; collating and disseminating groundwater information; capacity building; project design, implementation and monitoring; dialogue awareness and financial investment (UNICEF, 2016). They also both provide specifications and minimum standards for drilling, casing, water development, testing, and pumps.

Poor borehole drilling and development and borehole mechanical failures are attributed to: a lack of access to spare parts; a lack of basic maintenance; operation and management which is deemed “too difficult”; and a lack of finance (UNICEF, 2016). In the same year, the International Water Association stated that “there are not enough appropriately skilled water professionals to support the attainment of universal access to safe drinking water and sanitation .... the developing world alone will need an additional 3.3 million professionals to achieve universal coverage” (IWA, 2016).

3.8. Sanitation ware

3.8.1. Pedestals

The sanitation manufacturing industry produces user interfaces, such as toilet pedestals and urinals, for people to use and then facilitates the treatment and disposal of human excreta. The different components that are used at each stage are characterised in Table 10.

Table 10: Components in the sanitation value chain

FUNCTIONAL GROUP	DESCRIPTION	EXAMPLES	SYSTEM TEMPLATES
User interface	The type of toilet, pedestal, pan, or urinal with which the user comes in contact	• Dry Toilet • Urine-Diverting Dry Toilet • Urinal • Pour Flush Toilet • Cistern Flush Toilet • Urine-Diverting Flush Toilet	• Single Pit System • Waterless Pit System without Sludge Production • Pour Flush Pit System without Sludge Production • Waterless System with Urine Diversion • Biogas System • Blackwater Treatment System with Infiltration • Blackwater Treatment System with Effluent Transport • Blackwater Transport to (Semi-) Centralised Treatment System • Sewerage System with Urine Diversion
Collection and storage	Collect, store, and sometimes treat the products generated at the user interface	• Urine Storage Tank/Container • Single Pit • Single Ventilated Improved Pit • Double Ventilated Improved Pit • Twin Pits for Pour Flush • Dehydration Vaults • Composting Chamber • Septic Tank • Anaerobic Baffled Reactor • Anaerobic Filter • Biogas Reactor	
Conveyance	The transport of products from one functional group to another.		
(Semi-) centralised treatment	Treatment technologies that are generally appropriate for large user groups		
Use and/or disposal	The methods by which products are ultimately returned to the environment	• Irrigation; Aquaculture; Macrophyte; Disposal/ Recharge • Sludge: Land Application; Surface Disposal • Soak Pit / Leach Field and Dispose to garden	

Source: Mudombi, 2020.

There are two types of sanitation ware manufacturing in South Africa: traditional sanitation ware and Next Generation Sanitation (NGS). Traditional sanitation ware manufacturing is dominated by two companies in South Africa: Betta (which claims 50% of the regional market share) and Vaal Potteries (which claims 30% market share). These two companies are now subsidiaries of multinational companies.

However, the traditional sanitation ware industry is being challenged by NGS technologies. NGS technologies are described as sanitation systems that are innovative, off the grid, affordable and sustainable (Sanitation Matters, 2014). In South Africa, new entrants into the NGS market include vibrant entrepreneurs and small, medium and micro enterprises (SMMEs), led by Envirosan (largest NGS pedestal producer in South Africa). Its main product offerings include injection moulded plastics (rather than high quality ceramics), strong product development and some reliance on traditional sanitation ware manufacturers for components.

The raw materials used in sanitation manufacturing are sourced locally. Good quality products are then produced by domestic manufacturers, with competitive prices. However, in terms of foreign competition, cheap sub-standard sanitation ware is increasingly imported from China, Vietnam and South Korea. In addition, high-quality and expensive traditional sanitation ware is imported from Europe, for its exquisite design and brand loyalty.

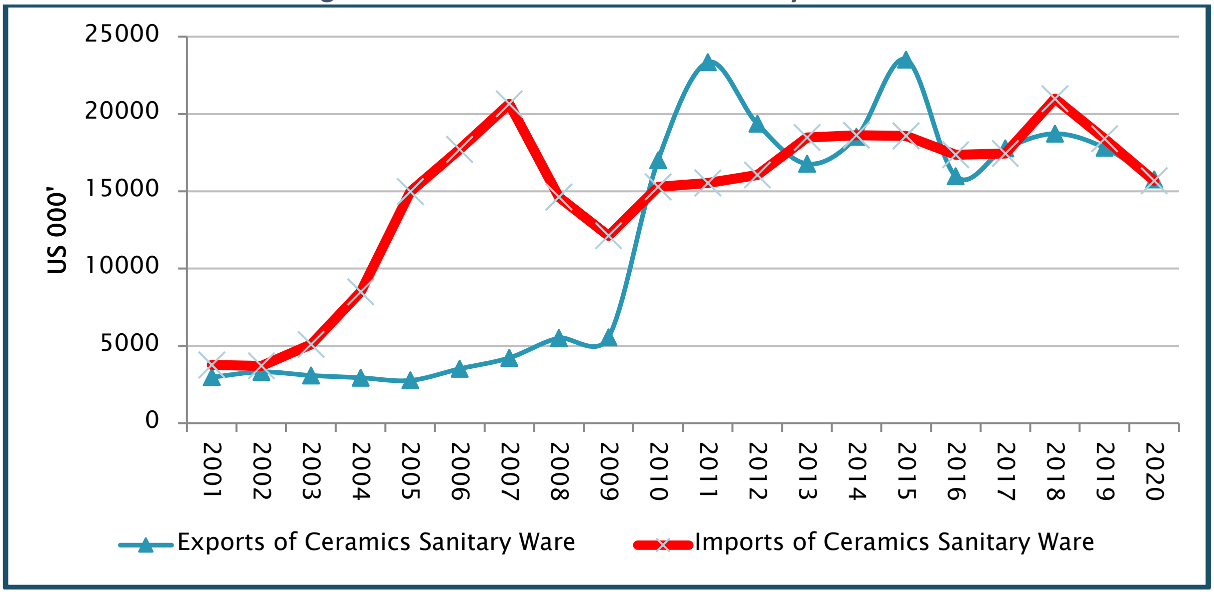
3.8.2. Ceramic components

The manufacturing of ceramics is categorised into traditional (most dominant) and advanced manufacturing. Traditional ceramics manufactures materials from inorganic, non-metallic materials that are subjected to heat (DMR 2010:3), and materials for these are mostly sourced locally.

Advanced manufacturing produces materials using additive manufacturing technologies, such as 3D printing and nanotechnology, to produce a progressive range of ceramic products from medical equipment to cellphones. These are used in NGS technologies to manufacture the test pedestals only, after which traditional ceramics or injection-moulded plastics are used to manufacture the products.

In the ceramics market, tiles account for half of the market, followed by bricks, pipes and sanitary ware. Figure 28 shows the South African trade in sanitary ceramics. Imports of ceramics were on a continual rise from 2003 and peaked in 2007. Thereafter, the trade balance has fluctuated.

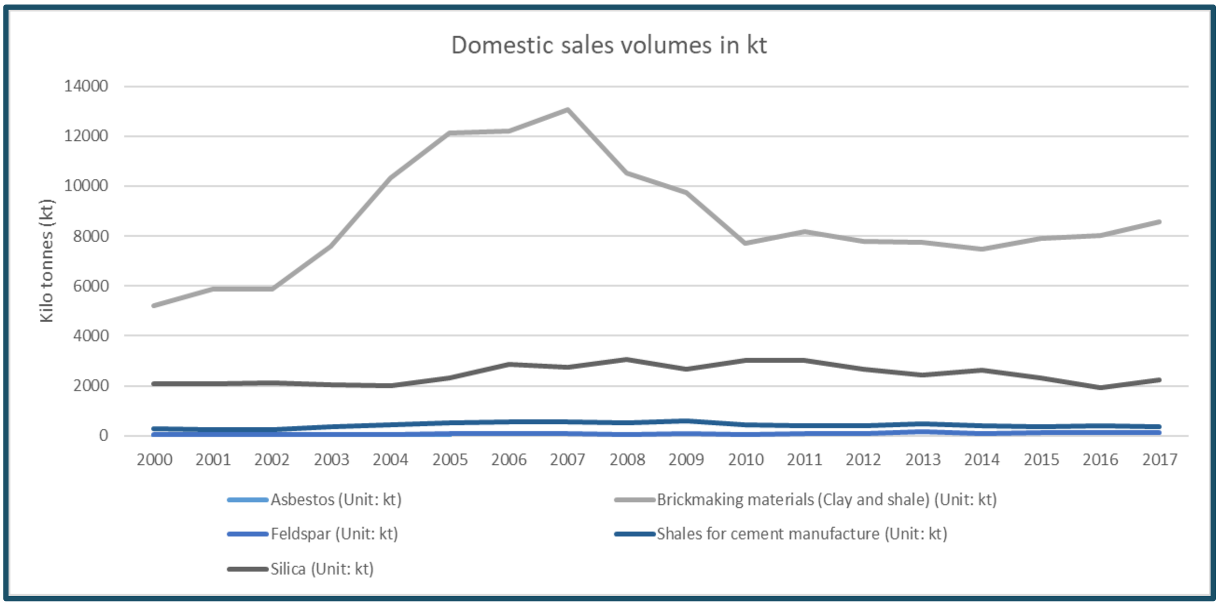
Figure 28: South Africa's trade in sanitary ceramics



Source: Authors, based on data from Trade Map, 2021.

The raw materials used in traditional ceramics are clays, feldspar, kaolin, ball clays and silica. South Africa has abundant and high-quality reserves of these materials, and this is shown in Figure 29 below, which shows sales of key ceramic minerals.

Figure 29: South African sales of key ceramic-related minerals



Source: Authors, based on data from the Department of Mineral Resources and Energy.

3.9. Water management and efficiency

3.9.1. Meters

Major users of water meters are the municipalities and government, the agriculture sector, water boards and developers especially in housing estates. About 85% of meters end up at the municipal level. According to the South Africa Water Meter Manufacturers' Association (WMMA), the country utilizes the following type of water meters:

- Domestic water meters (piston meters, multijet meters, ultrasonic meters);
- commercial and industrial meters (woltmann bulk meters, irrigation meters, combination meters, electromagnetic meters);
- Water meter boxes (domestic water meter in either a surface box (used in coastal regions) or above ground box (used inland); and
- Smart meters (automatic meter reading, water management device, prepaid water meters).

The water meter industry in South Africa is currently categorised as an oligopoly, with two of the biggest players (Honeywell Kent and Xylem Sensus) enjoying around 65% of the market share, two mid-level players (Precision Meters and Amanzi Meters) having around 10% each of the market share and the balance coming from a handful of smaller players (see Table 11).

The big players are subsidiaries of international entities that are able to supply the local entities with capital at low interest rates, thereby giving them the opportunity to maintain their positions by having more inventory on hand, an ability to further develop and improve their products via R&D, and an ability to improve their competitiveness via new and improved machinery. Furthermore, it is reported that Incledon has the largest consolidated quality product offering in its industry and is well positioned to take advantage of the infrastructure and industrial development spending programmes.

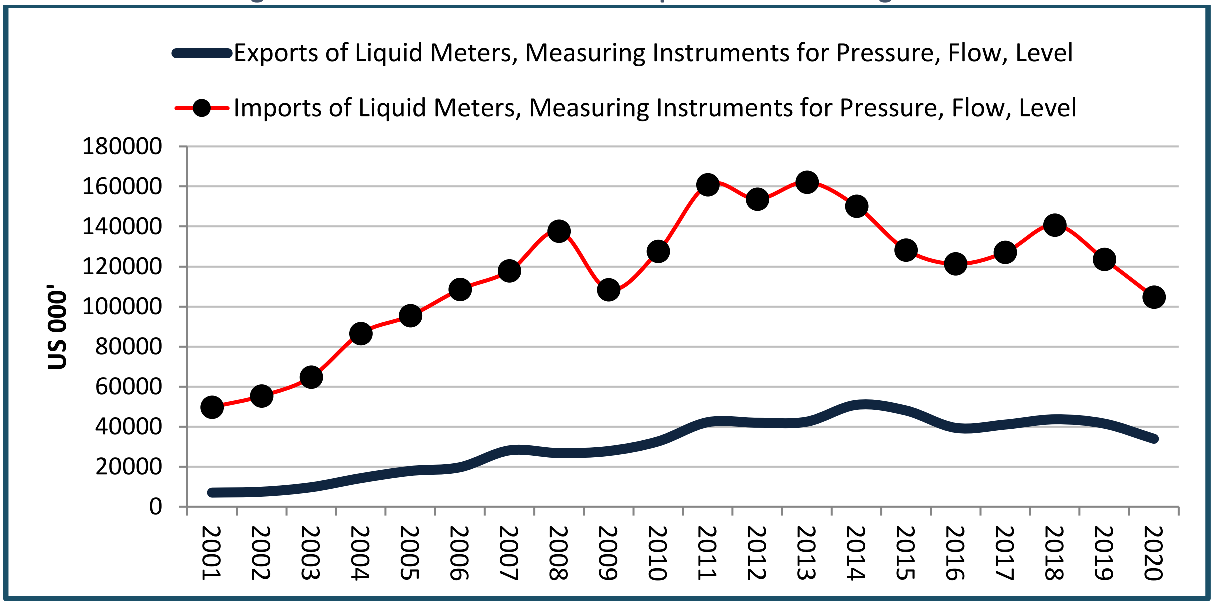
Table 11: Non-exhaustive list of water meter companies in South Africa

NAME OF FIRM	MAIN FOOTPRINT	NAME OF FIRM	MAIN FOOTPRINT
Lesira-Tech	Gauteng	Waterwach	Gauteng
Incledon	National	Sensus metering	Gauteng
Precision meters	Cape Town	Honeywell Kent	National
Inzalo Utility Systems	National	Xylem Sensus	National
BridgIoT	Cape Town	Dupleix Liquid Meters	Gauteng
Citiq Prepaid Water Meters	National	Ideal prepaid	Gauteng
Spatial Planning Agency of Southern Africa	National	Meter Mata	Gauteng
AC/DC Dynamics	National	Elster Kent Metering	Gauteng
Aqua Lock	Gauteng	The Meter Man	Gauteng
Flow Metrix SA	KwaZulu-Natal	Amanzi Meters	KwaZulu-Natal

Source: Authors.

The graph below illustrates a negative trade balance in liquid meters. However, despite that fact, South Africa is the 26th largest exporter globally of liquid meters. Exports grew from a base of US$7 million in 2001 to US$50 million in 2014. Since then exports have been showing a declining trend with only US$33 million exported in 2020. Exports are largely geared to SADC with some exports destined for the United Arab Emirates (UAE) that could be a potential market in future.

Figure 30: South Africa's trade of liquid and calibrating meters



Source: Authors, based on data from Trade map, 2020, Liquid Meters (HS 902820) and Measuring Equipment (HS 9026).

In terms of standards, the WMMA notes that for a water meter to be approved for sale in the South African market, the meter requires Type Approval on the SABS standards, which is managed via the South African National Accreditation System (SANAS)/National Regulator for Compulsory Standards (NRCS). Currently, SANAS and the NRCS only have one test bench available for companies to test new products in the market. The cost (around R100 000) and timeline to get approval (around eight months) are considered as key stumbling blocks to the smaller players.

Each meter sold (under 50mm in size – domestic meters) is also required to be tested via a SANAS accredited laboratory. Due to the time required to receive such an approval (about one year), companies have to carry extensive additional expenses (buy/rent premises, install equipment and pay all staff, equipment, rentals for around one year) before being allowed to release their products onto the market.

Due to the constraints in testing and the ability of NRCS to "police" the market, some small players in the industry are selling meters that have not been approved for sale. In some cases, meters are tested, but not in an accredited SANAS laboratory, which allows them to lower prices and be competitive against the players that are obtaining approvals and testing in accordance with the regulations. By contrast, the lack of enforcement of testing and certification requirements, notably at the municipal level, has led to the trade of non-approved meters, largely by importers-resellers.

Other key issues in the industry include:

- Not enough support of local companies by government.
- Numerous major consumers (e.g. municipalities) unable or taking time to settle their accounts.
- Import of cheap products from Asia (partly linked to cost advantage, partly to an advantage in R&D).

Smart water meters are designated in South Africa at a threshold of 50% to 70%. Although designations have helped to build capabilities in manufacturing, the dti (2016) notes in its designation report that meters supplied to procuring entities are still imported in large numbers.

3.9.2. Water efficient devices

Water efficiency in South Africa is backed up by two industry associations:

- The Institute of Plumbing South Africa is involved in regular consultations and co-ordination with the plumbing industry, governmental and regulatory bodies. It is recognised and represented on most national and several international plumbing and legislative bodies.
- The Plumbing Industry Registration Board (PIRB) is a registered professional body for plumbers. PIRB is registered under the South African Qualifications Authority Act of 1995. Plumbers registered with the PIRB can obtain professional status. While plumbers self-certify that their work meets all requirements, the PIRB performs audits to promote compliance.

Water efficiency technologies represent a major opportunity to address water scarcity, and promote resource efficiency policies, therefore playing a major role in advancing sustainable development. Combating water scarcity involves implementing supply and demand management measures which adopt water-efficient technologies, and encourage a change in behaviour that contributes to water conservation. Demand-side management policies can be either price demand management or non-price demand management policies.

Some of the demand-side water efficient methods and technologies applied in South Africa include:

- Desalination technologies (Mudombi and Montmasson-Clair, 2020) – for example Anglo American already processes effluent mine water into drinkable water at its Witbank plant, and is reselling it to the municipality, Glencore, which similarly supply Hendrina, and Sasol's Secunda Synfuels operations.
- Adoption of low-flow showerheads and toilets;
- Water-saving devices in taps, toilets and showers;
- The installation of automatic water shut-off valves;
- Implementation of a leak management programmes;
- Rain and greywater collection systems (wastewater coming from baths, showers, kitchen sinks, and washing machines), and in-house greywater treatment technologies; and
- Water-wise landscaping.

Table 12 shows some of the developments from companies towards water efficiency technologies (Timm, 2021).

Table 12: Reported water efficiency practices by selected entities in South Africa

COMPANY	DEVELOPMENT
Attacq	• Its malls and shopping centres have been equipped with water contingency measures, which have two-days' worth of water supply on hand in case of water cuts.
Arrowhead	• Six office parks have backup water systems with a seventh currently under construction.
Vukile	• To address water outages in rural areas, it has linked boreholes and water treatment plants to its shopping centres, providing 85 million litres of water, resulting in annual savings of R1.4m.
Growthpoint	• It has invested in a large amount on fire safety infrastructure as a result of insufficient municipal water pressure. To comply with safety regulations, it has built its own water tanks at several properties. In addition, it has installed tanks for ablution facilities to function during outages.
Redefine	• Reduced total water usage by 16% in 2020 using groundwater (which accounts for 3.4% of all water used, up from 2.4% in 2019) and wastewater treatment facilities.
Growthpoint, Fortress and Redefine	• Have installed smart water meters to measure water consumption accurately and to detect leaks. Redefine says that 44 properties have received smart metering installations, five properties have smart valve systems and that sensors have been installed in the toilets of 13 properties.
Property owners	• Are installing grey-water systems, in which water from sinks and showers is reused. The University of Cape Town's new 500-bed Avenue Road residence includes a partial grey-water system and heat pumps, as well as water-saving toilets. There is also a borehole on site which will allow the building to continue to operate by using groundwater in case of a drought.
Resilient	• Has started harvesting fire sprinkler water. During maintenance, alterations to shops, or fixing of leaks a substantial amount of water is lost when it is drained from sprinkler pipes. In response, Resilient has installed infrastructure to harvest the drained water, recycle and then recharge the sprinkler system with the same water, minimising water loss and removing the need to replace lost water with fresh water.
Liberty Two Degrees	• Launched a rooftop aquaponics farm district at Eastgate mall at the end of 2019. The farm uses 90% less water than conventional farming, while carbon emissions are reduced as the fish can be eaten at source, without needing to be transported by road.
Property developer Flanagan & Gerard	• Has partnered with nearby Redhill School to create a rooftop urban garden at Morningside Mall. The farm is in part watered using condensation from the centre's air-conditioners

Source: WOW, 2021.

3.9.3. Water efficiency regulation

All water system design and construction in South Africa is regulated by the National Building Regulations (NBR) under the National Building Regulations and Building Standards Act No. 103 of 1977.

According to Clasp (2021), South African National Standards (SANS) 10252-1 is the mandated standard to which all plumbing installations must comply. In addition to this, individual product standards contain requirements relating to performance including efficiencies and flow rates. There is also SANS 10400 (originally SANS 0400-1978) – Code of Practice for Buildings, which includes Part X that relates to water efficiencies as below:

a. Part XA informs energy efficiency and states that hot water supply must be regulated, where no more than 50% of the annual volumetric requirement of domestic hot water may be supplied by means of electrical resistance heating. The rest could be heated by any means of water heating.
b. Part XB will cover water efficiency but it is still under approval. To be approved, Part XB must be integrated into the NBR under the dtic. Part XB will be based on SANS 308829, which provides maximum flow rates for different types of fixtures and fittings.

Looking ahead, some of the key constraints include:

- No standards are available for showers or shower heads, leaving these components largely uncontrolled. In order to implement water efficiency products, product standards for showers and shower heads must be introduced.
- Limited funding for standards development results in extended development process. To address this issue, SABS recently introduced a time limit of 18 months.
- NBR development, which goes along with the standard implementation, requires training for Building Control Officers to ensure the regulations are applied through building plan approvals and results in implementation delays.
- The misalignment between national legislation and local authority legislation, as well as the fragmented enforcement of such legislation.
- South Africa's various water standards are outdated and focused on providing minimum instead of maximum water flows and pressure requirements. As a result, any product which aims to be water-efficient may contravene the existing SANS standards.

3.9.4. Tanks

Water tanks are manufactured as part of the pressure equipment manufacturing industry. They are mainly used in areas with a water supply shortage. The demand for tank and reservoir solutions for water storage, water treatment has been on the rise due to:

- An increase in agro-processing to satisfy the rising population's food requirements.
- An increasingly inconsistent quality and supply of water for food processing, heating, steam generation and human consumption and biogas production.

According to Rand Water, the cost for the supply of a 5 000 litre tank ranged between R4 500 and R5 400 (SAnews, 2020). Meanwhile, the cost for the supply of a 10 000 litre tank ranged between R9 000 and R10 800.

Locally produced tank technologies include (Timm, 2021):

- Calorifiers used to heat and supply large quantities of water, steam and electrical hot water heaters, domestic electric, solar or gas hot water geysers and steam sterilisation units.

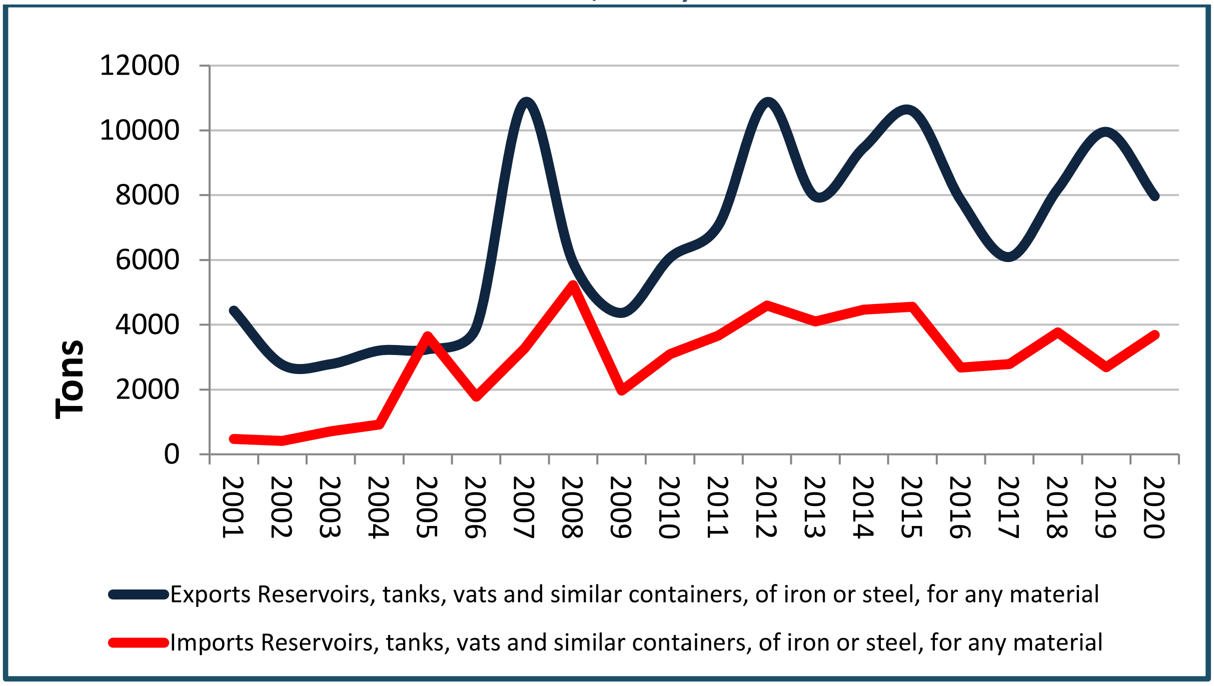
- Water filtration vessels used in the water purification process and are normally fitted with various filter plates. Vessel types include sand filters, carbon filters, ion and cation exchangers, buffer and saturator tanks and demineralisation filters.
- Storage tanks containers that hold liquids, solids or mediums under atmospheric conditions. Storage tanks are designed according to various international standards. Common storage vessel types include silos, diesel, petrol and oil collection tanks, water tanks, helium tanks and cryogenic tanks.

The big players in the water tank industry in South Africa include: Actom (Pty) Ltd; Abeco Tanks (Pty) Ltd; Aquasteel (Pty) Ltd t/a Aquadam Steel Tanks International; SBS Corporate Services (Pty) Ltd; Hydra-Arc (Pty) Ltd; and Skywater Dimensions CC t/a Rainbow Reservoirs.

In terms of constraints, installed water tanks have been faced with continuous vandalism and theft, especially the daily theft of taps, thus causing disruption in water supply for communities (Gov.za, 2020).

Trade wise, there has been a positive trade balance in steel tanks. There is a concern, however, with exports declining from 2019 to 2020. Exports are mainly destined to the SADC region with the exception of the Netherlands.

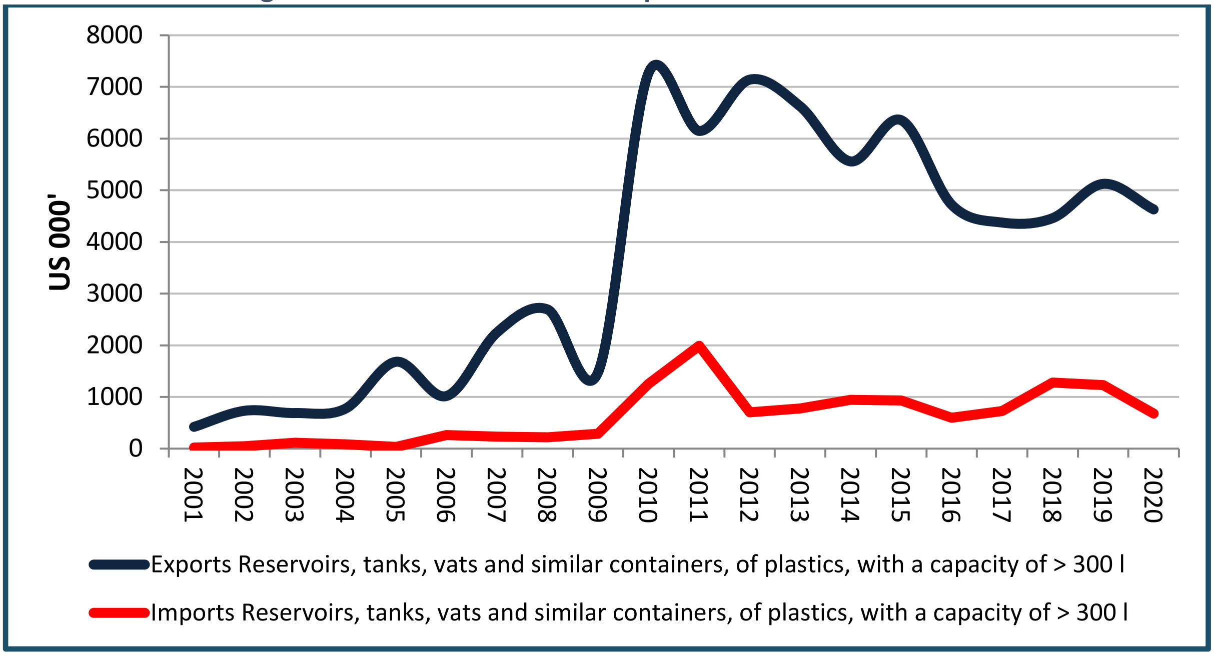
Figure 31: South Africa's trade in reservoirs, tanks, vats and similar containers, of iron or steel, for any material



Source: Authors, based on data from Trade Map, 2021 HS 7309.

In terms of plastics tanks, the country has reported a positive trade balance in the last 20 years. Exports rose sharply from 2009 to 2010. Since then, exports have been on a gradual decline. However, with the Plastics Master Plan in place, exports are expected to recover in future. Exports are mainly destined for the SADC region.

Figure 32: South Africa's trade in plastic reservoirs and tanks



Source: Authors, based on data from Trade Map, 2020 HS 392510.

3.10. Laboratories

Water testing is undertaken by private and government laboratories across the country. It is estimated that there are over 200 water testing laboratories. As shown in Table 13, most laboratories are located in Gauteng (44) and KwaZulu-Natal (41). A shortage of laboratories could lead to inadequate testing of drinking water.

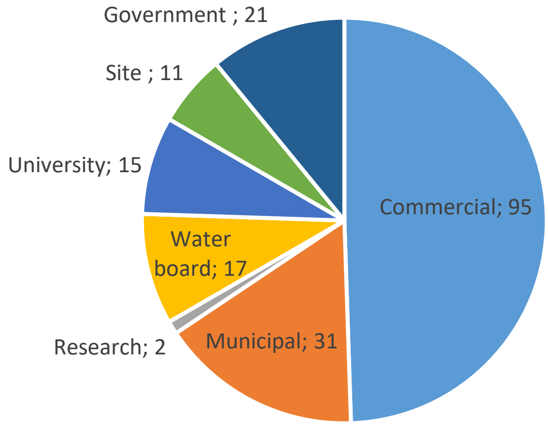
Table 13: Number of laboratories in South Africa per province

PROVINCE	TOTAL LABS	ISO 17025 ACCREDITED
Gauteng	44	29
KwaZulu-Natal	41	10
Western Cape	32	14
Mpumalanga	16	4
Northern Cape	16	1
Free State	15	4
Eastern Cape	15	1
North West	7	2
Limpopo	6	0
Total	**192**	**65**

Source: WRC, 2011.

An estimated 95 laboratories are commercial while 31 are municipal, 21 are owned by government, 17 by water boards and 15 by universities.

Figure 33: Number of laboratories in South Africa per province per ownership



Source: WRC, 2011.

Accreditation is a major constraint with laboratories in South Africa. The process and cost of ISO 17025 accreditation with SANAS has been highlighted as a stumbling block for many laboratories. Of the 200 laboratories in the country, it is estimated that only 65 are accredited for testing some or all parameters (physical, chemical and microbiological content) prescribed in SANS 241. Only a limited number of laboratories test for organic contaminants as this requires advanced, costly analytical instrumentation, such as GC-FID/ECD/MS and LC-UV/MS, as well as skilled staff (Fernandes-Whaley et al, 2015). According to Fernandes-Whaley et al. (2015) “a key requirement for a laboratory to obtain accreditation is the ability to demonstrate the continued competency of the measurement procedure and of the staff performing the measurements, through participation in proficiency testing schemes (PTS). However, laboratories struggle to obtain accreditation due to PTS costs or the lack of appropriate PTSs to address their specific analytical needs. There are to date a limited number of PTSs organised and coordinated in South Africa for local laboratories and for those in the Africa region” (p.1).

Other constraints associated with accreditation include the stock of chemicals. To be accredited, one extra sample from each chemical is needed from the stock for quality purposes. Every 10th sample is used for quality control purposes, which means that for every 10 samples one of them will not produce any profit. The financial implications of this may be a significant factor for laboratories when deciding to become accredited (WRC, 2011).

In addition, other constraints of blockages include: skills shortages, development of staff, retaining skilled people, quality control and quality assurance, calibration of water lab equipment, laboratory safety and waste disposal and equipment, and maintenance of equipment.

3.11. Membranes

Membranes are used in the separation, concentration and purification of a vast number of materials across a wide spectrum of industries. In the 1990s, there were only five membrane manufacturers in the world, but there are now hundreds, including some in South Africa.

South Africa developed the first water and sanitation membranes in the world during the 1990s and has continued to innovate. However, a lack of capital and business development (combined with what is reported as intellectual theft) resulted in these not being taken up, or being manufactured in other countries.

There is no membrane manufacturers association in South Africa at present. Most companies that retail membranes in South Africa (including Africa Membranes, Memcom, Process Plant Technology, and Huber) all serve as local agents that supply imported membranes. The main drivers for the membrane market are population growth/water scarcity, with a rising need for wastewater reuse and environmental standards governing industrial effluence.

3.11.1. Water

Recent developments in water treatment membranes have seen the introduction of various wastewater treatment technologies for industry effluent and sea water. Water treatment membranes are filtrating barriers that allow water to pass through, while blocking other substances. The gap in the water filtration membranes market lies in small-scale, low-cost applications.

Membrane technology involves filtration processes in which feed water is forced through a semi-permeable barrier (membrane) at high pressure to separate specific materials from the solution. The different types of technologies include: microfiltration (MF); ultrafiltration (UF); nanofiltration (NF); and reverse osmosis (RO). Membrane technology is highly capital-intensive, requiring substantial investments.

One South African innovation has been a woven fabric microfiltration membrane that filters pathogens from wastewater. It was piloted in South Africa (providing clean water to schools and households) as well as Vietnam (filtering water from contaminated rivers). This innovation (funded by the Water Research Commission (WRC), developed at universities and being commercialised by VulAmanz) started production in 2021.

3.11.2. Sanitation

Sanitation membranes are water filtering technologies from human waste. This includes separation, concentration and purification of human waste. Most companies that retail membranes in South Africa serve as local agents supplying imported membranes (Africa Membranes, Memcon, Process Plant Technology, Proxa, and Huber). Imports based on company profiles are from Europe, mainly Italy and Germany. Despite imports of the technology, South Africa is making some headway in manufacturing (RO) membranes (10 firms known to date including Gramatek, Quality Filtration Systems and Aquamat).

Some companies in the membrane space have reported a reduction in capacity utilisation, largely due to cheaper sub-standard imports (from Europe and Asia). For example, local company Derbigum uses 70% limestone (the key ingredient in the quality of waterproofing membrane) while imported products use substantially less. This impacts on product lifespan and replacement costs. In addition, quality standards are poorly specified in public tenders and there are no SABS standards in place for waterproofing membranes. In this case, companies such as Derbigum use Agrément certification, whereas imported products are not locally certificated.

3.12. Chemicals

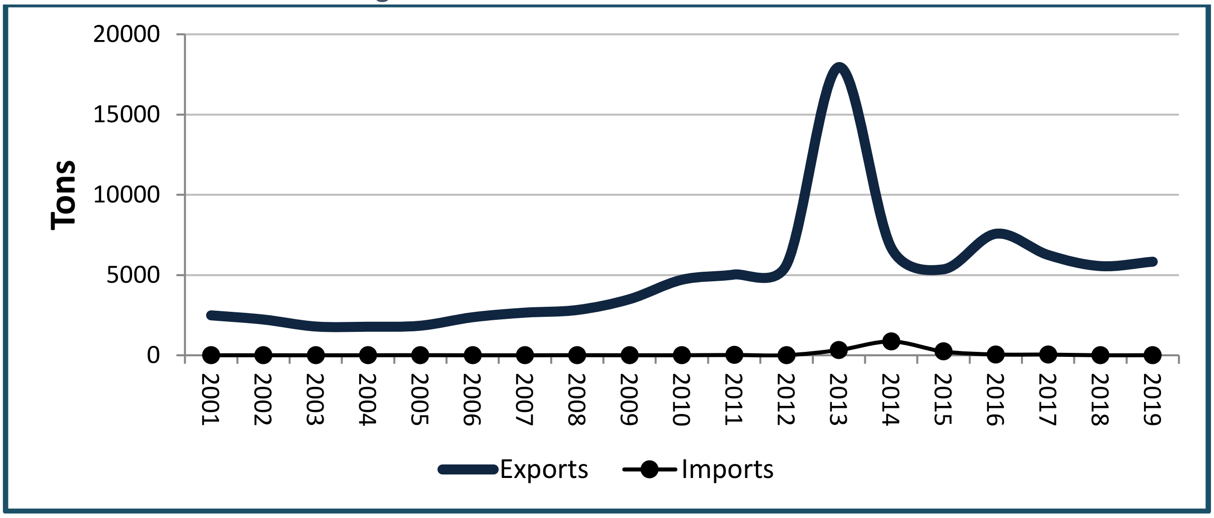
Institutional water treatment uses primarily commodity type chemicals, such as chlorine and caustic soda, followed by other chemicals such as sodium hypochlorite, ferric chloride, lime and aluminium sulphate. South Africa has six major water chemicals firms: Buckman Laboratories, Floccotan, Improchem, Clariant/Süd Chemi, Syntachem (previously Bonchem) and Veolia Water Solutions & Technology (previously Vivendi Water Systems/Chematron Products) (South African Government, 2020.

Local firms are able to supply most chemicals, such as chlorine, required for water treatment. However, there is insufficient production capacity of caustic soda, leading to the shortfall being imported.

For caustic soda, ITAC (2018) notes that there are only two manufacturers in the Southern African Customs Union (SACU), namely Sasol and NCP Chlorchem. In addition, there are high barriers of entry for new entrants into the market given the hazardous nature of the products. As such, a tariff rebate on caustic soda was passed in 2018 to facilitate imports. However, a new firm in Richards Bay, Elegant Line Chemicals, has been in the process of forming a caustic soda plant in collaboration with Tata India. As of August 2021, the plant was under construction.

In terms of trade, South Africa is a net exporter of the chemical chlorine (Figure 34). In 2001, firms exported over 2 000 tons of chlorine, with a peak at 18 000 tons in 2013 before exports declined to 6 000 tons in 2019. Exports of chlorine mainly go to the SADC region, in particular Mozambique, Eswatini, Zambia, Namibia and Zimbabwe. Imports have mainly been flat illustrating firm competitiveness in the country and adequate supply.

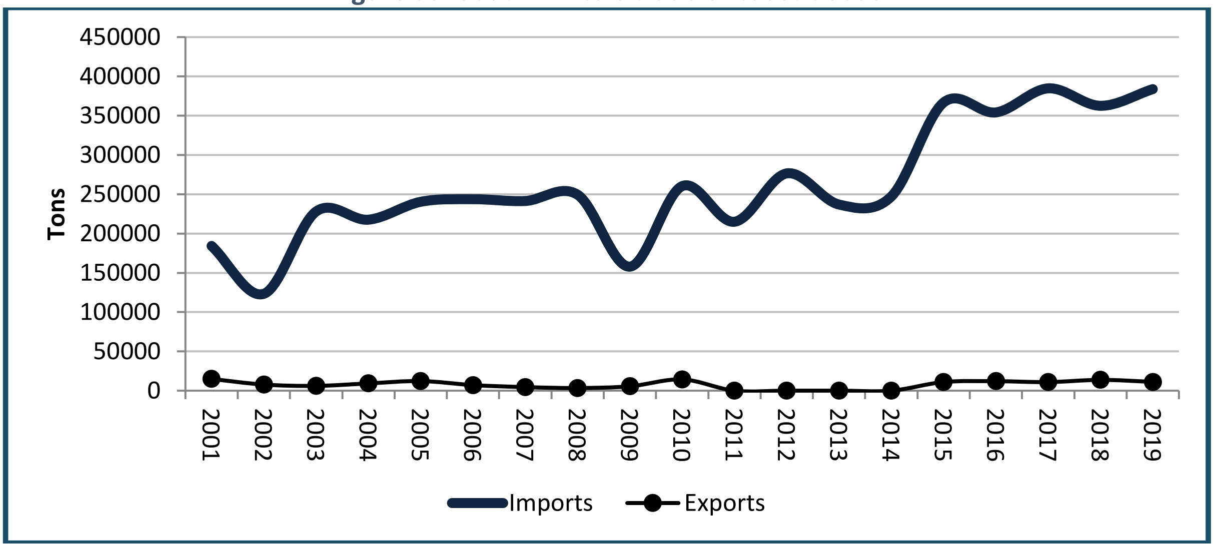
Figure 34: South Africa's trade of chlorine



Source: Authors, based on data from Trade Map, 2020 based on HS 280110.

Linked to the limited local production, imports of caustic soda have been on the rise (Figure 35). In volume, imports stood at 184 000 tons in 2001 and reached 400 000 tons in 2019. Imports in 2001 were worth R175 million and have since risen to just over R1 billion. Imports of caustic soda mainly come from the US, Qatar, Japan, China and the Netherlands. The new plant being built by Elegant Line Chemicals for caustic soda should have an impact on imports going forward.

Figure 35: South Africa's trade of caustic soda



Source: Authors, based on data from Trade Map, 2020 based on HS 2815.

4. KEY THEMATICAL ISSUES

Building on the value chain analysis, the following subsections unpack six key pillars proposed for the Water and Sanitation Industry Master Plan. These pillars were developed in consultation with stakeholders:

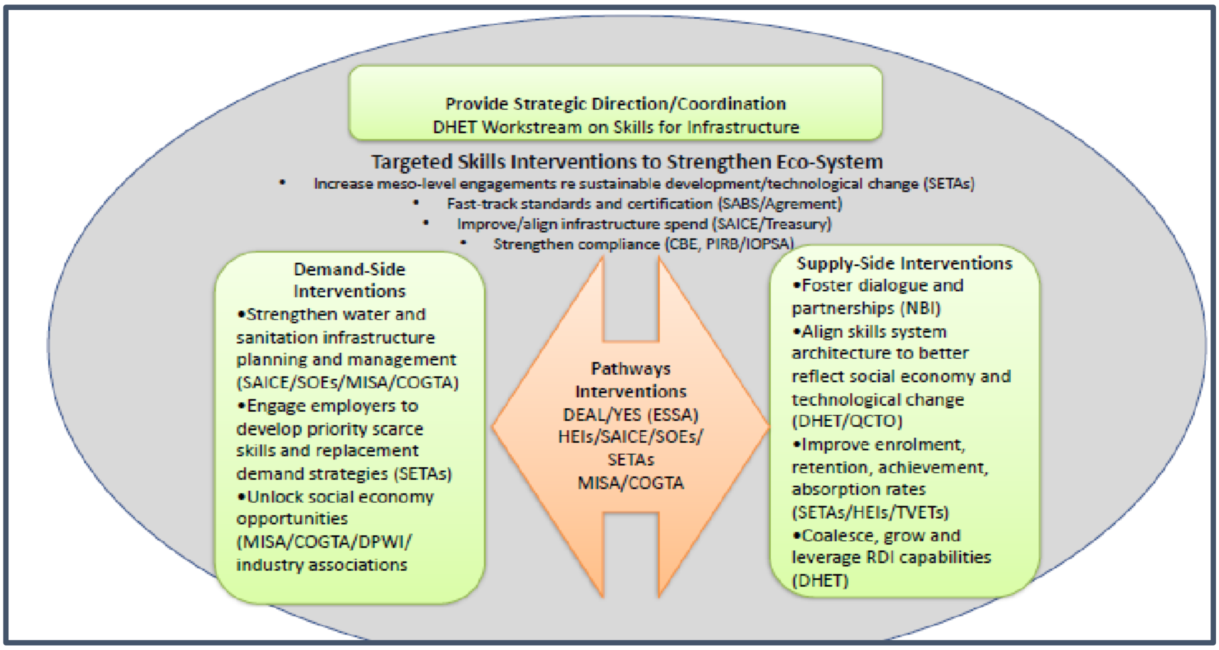
- Developing and retaining skills;
- Improving industry competitiveness and capacity utilisation;
- Reducing cheap and sub-standard imports;
- Promoting export of local products/technologies;
- Strengthening R&D, standards and certification; and
- Improving infrastructure spend and procurement processes.

In each case, this report provides an analysis of the state of play issues, identifying key strengths and weaknesses as well as key issues to be addressed.

4.1. Developing and retaining skills

Thinking about developing and retaining skills requires to map demand-side needs and supply side interventions, and bridge multiple workstreams. The Department of Higher Education and Training (DHET), which has established a workstream to develop a national infrastructure skills plan (including water and sanitation), linked also to the National Infrastructure Plan 2050, is the natural lead on such issues. The overall strategy is reflected in the diagram below.

Figure 36: Framework for Water and Sanitation Industry Master Plan skills pillar



Source: Authors.

Note: Acronyms in brackets refer to "champions" who are leading particular components.

4.1.1 Informing skills development and retention

DHET has adopted the following principles:

- Balance short- and long-term objectives (respond to the short-term imperatives while continuing to strengthen the system);
- Include public and private education and training providers as well as workplaces; and
- Coordinate responses across government and social partners.

In coordination with Sector Training and Education Authorities (SETAs), built environment professions, and specialist scientific and technical organisations as well as other state, private sector and development agencies, DHET leads the overall approach to ensure interventions:

- Are demand-led;
- Build on current skills development capabilities/initiatives;
- Coalesce skills ecosystems to support state, public and private sector interventions; and
- Monitor, implement and report on progress through Apps, Medium Term Strategic Frameworks and other existing mechanisms.

4.1.2 Skills needs in water and sanitation

The main focus of demand-side analysis and interventions includes:

- Water and sanitation services;
- Manufacturing (especially chemicals, plastics and metals); and
- construction.

Skills needs were also identified as constraints in particular parts of the industrial ecosystem. These include water and infrastructure planning; procurement; standards; and enforcement of compliance with water and sanitation standards.

The water and sanitation sector is key to unlocking associated domestic industrial development opportunities. The industry includes over 431 different organisations (from DWS and municipalities through to water boards, laboratories and research and development agencies). Priority skills needs include water and sanitation infrastructure planning and delivery; specific occupations (such as water process controllers and laboratory workers); through to stimulating research, development and innovation within the sector.

Although still heavily reliant on traditional goods and services, the water and sanitation industries are in transition toward smarter, more sustainable and developmental solutions. Skills development also reflects these transitions. "Digital skills" are emerging as priorities across all the industries, for which inadequate skills pipelines exist. The need for increased digital literacy among workers is also widely reported. Sensor technologies, cloud computing, artificial intelligence, big data and digital twinning are linked to transitioning water and sanitation in buildings and cities toward smart and sustainable solutions.

Governance of skills development for the sector is currently dispersed across the Energy and Water Sector Education and Training Authority (EWSETA) and the Local Government Education and Training Authority (LGSETA). A wide range of other public and private agencies also play a role. Their goals are to:

- Identify and increase production of skills for priority occupations to support infrastructure development;
- Increase worker participation in various learning programmes through Recognition of Prior Learning programmes to professionalise and enhance the current pool of skills in the sector;
- Facilitate skills development support aimed at promoting entrepreneurial activities;
- Support the increase of water networks through supplying skills related to the laying and maintenance of equipment connecting unserved areas, and the smart, efficient and finance/risk-integrated solutions evolving in urban areas; and
- Support scientific research in key disciplines enhancing technological advancement, products and related services (including off-grid, smart and sustainable solutions).

Civil engineers, water process controllers and software developers are identified in the 2022 EWSETA Sector Skills Plan as three priority scarce skills. The latter reflects the increasing levels of technological change in the sector.

4.1.3 Manufacturing skills needs

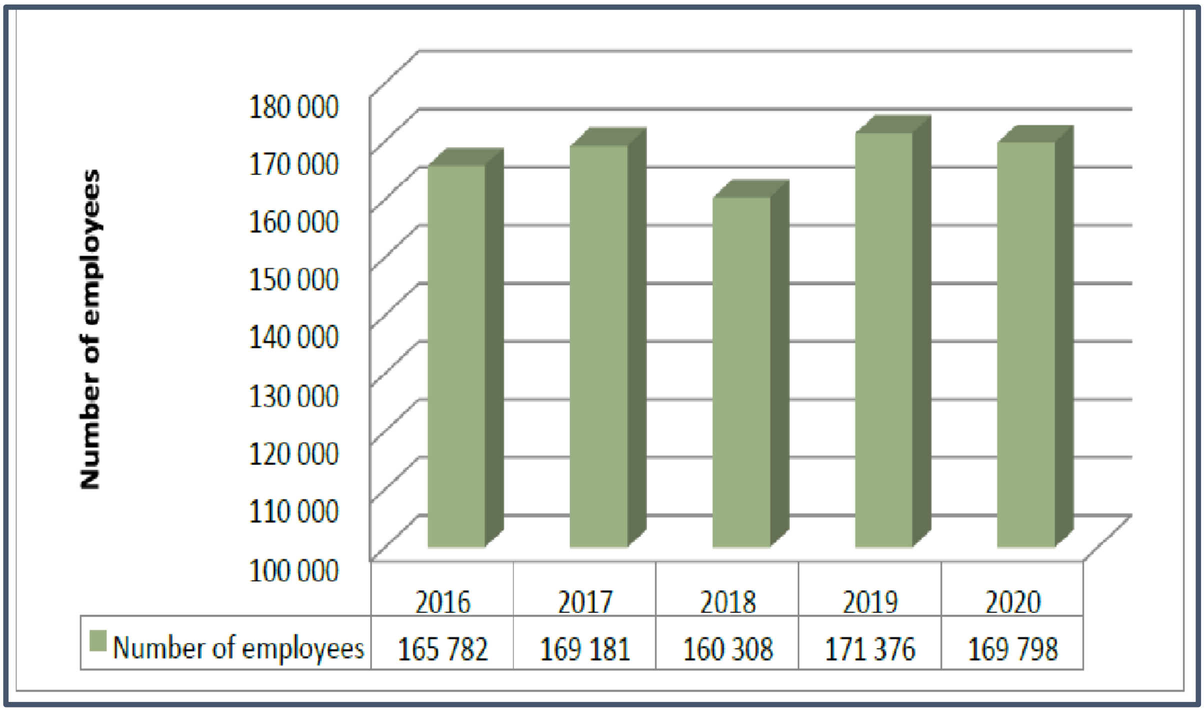
Key components of the manufacturing system include chemicals; plastics; and metals.

The chemicals industry

Chemicals used in water and sanitation are only one part of the overall chemicals industry.

- The number of microenterprises in the chemicals industry decreased from 34 in 2016 to eight in 2017. In 2018, the figure slightly increased to nine and continued to increase to 35 and 39 in 2019 and 2020 respectively. The number of organisations employing between five and 49 people (categorised as small enterprises) increased from 479 to 518. In the following three years, there was a decrease to 509 then to 470 to 382 respectively. The number of organisations employing between 50 and 149 people saw a general increase from 212 in 2016 to 335 in 2020.
- The estimates of total employment in the chemicals sector from 2016 to 2020 are shown in the graph below. The employment figures include all employees – those with permanent appointments as well as those on term contracts.

Figure 37: Employment in South Africa's chemicals industry (2016 – 2020)



Source: CHIETA, 2020, Sector Skills Plan.

Between 38% and 48% of the employees in the sector have post matric qualifications (NQF Level 4 and Level 5 and above). People with educational levels below NQF Level 1 formed less than 1% of the employees in the sector in 2016, 2017, 2018 and 2019. This figure increased to less than 3% in 2020.

CHIETA reports occupations in which five or more vacancies were reported over the five-year review period (CHIETA Trends Analysis):

- The following managerial occupations were reported in all five years: health and safety manager, quality systems manager, sales and marketing manager, sales manager, research and development manager, production/operations manager (manufacturing), engineering manager, supply and distribution manager, and laboratory manager.

- In the engineering field, the list includes chemical, industrial, and mechanical. Some of the stakeholders in the sector are of the opinion that the lack of articulation between the professional registration categories of engineering technician, engineering technologist and professional engineer is one of the reasons why there is a shortage of engineering skills. Another reason put forward for the difficulty in recruiting engineers is that certain positions require engineers who are registered as professional engineers with (ECSA), yet there is a gap between qualification and professional registration – a concern around bridging into work rather than an absolute scarcity.

The table below reflects the age distribution of workers in the chemicals sector over the five-year period 2016-2020. In the first year and second year, 39% of all workers were younger than 35. This figure decreased to 38% in 2018 and 2019. In 2020, this figure decreased again to 37%. The workers between ages 36 to 54 constituted 48% of the workforce in 2016 and 2017. In 2018, the figure increased to 49% before increasing slightly to 50% in 2019 and 51% in 2020. Eight percent of employees were close to retirement (between 55 and 59) in 2016. The figure decreased to 7% in 2017 and remained constant for the following three years. Five percent of workers were 60 years and older in all the years under review.

Table 14: Age distribution of employees in chemicals

Age	2016		2017		2018		2019		2020	
	N	%	N	%	N	%	N	%	N	%
< 35	64 298	39	66 521	39	61 648	38	64 805	38	63 038	37
36-54	80 321	48	81 541	48	78 472	49	85 313	50	86 248	51
55-59	12 769	8	12 409	7	11 414	7	12 105	7	11 406	7
60+	8 395	5	8 710	5	8 774	5	9 153	5	9 106	5
Total	165 782	100	169 181	100	160 308	100	171 376	100	169 798	100

***Source: CHIETA** data system. June 2020.*

Retirement trends in the chemicals industry thus suggest a possibility for employment opportunities for more than 9 000 people in the next five years, and another 11 000 in the subsequent five years. The hard-to-fill vacancies suggest possibilities for employment in these occupations that are likely best addressed through bridging unemployed graduates into work rather than further foundational training.

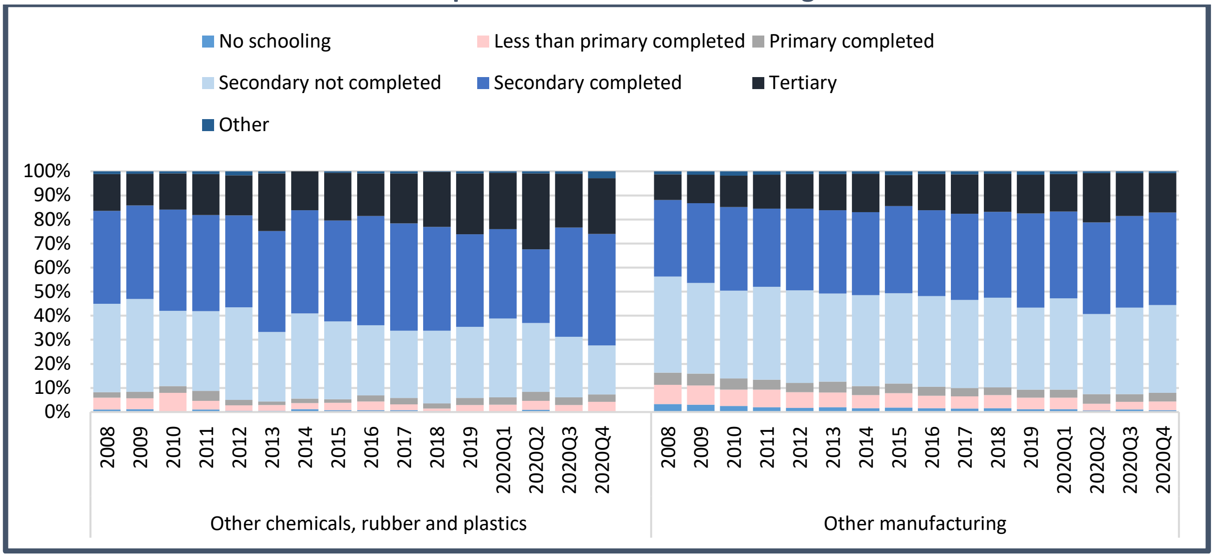
The plastics industry

The plastics industry provides employment to an estimated 60 000 workers in the formal economy and a further 58 000 other workers in the social economy.

- A total of 330 companies in the plastics sector employ 39 459 staff. Of these, 72 large companies employ 25 285 staff. 120 medium-sized companies employ 10 475 staff. 138 small companies (many family-owned) employ 3699 people.
- Roughly 3 000 of these are over the age of 55, spread across all occupational categories.

- Recycling has created another 58 100 jobs in the social economy via waste pickers and entrepreneurial collectors.

Figure 38: Employment by education level in other chemicals, rubber and plastics compared to other manufacturing



Source: Authors, based on data from Statistics South Africa. Quarterly Labour Force Survey. Q4 2018 to Q4 2020. Series on employment by industry. Electronic databases. Downloaded from www.statssa.gov.za Nesstar facility in January 2021. Note: Statistics South Africa does not report data for ships and boats in the final quarter of 2020, so 2020 average may be incorrect.

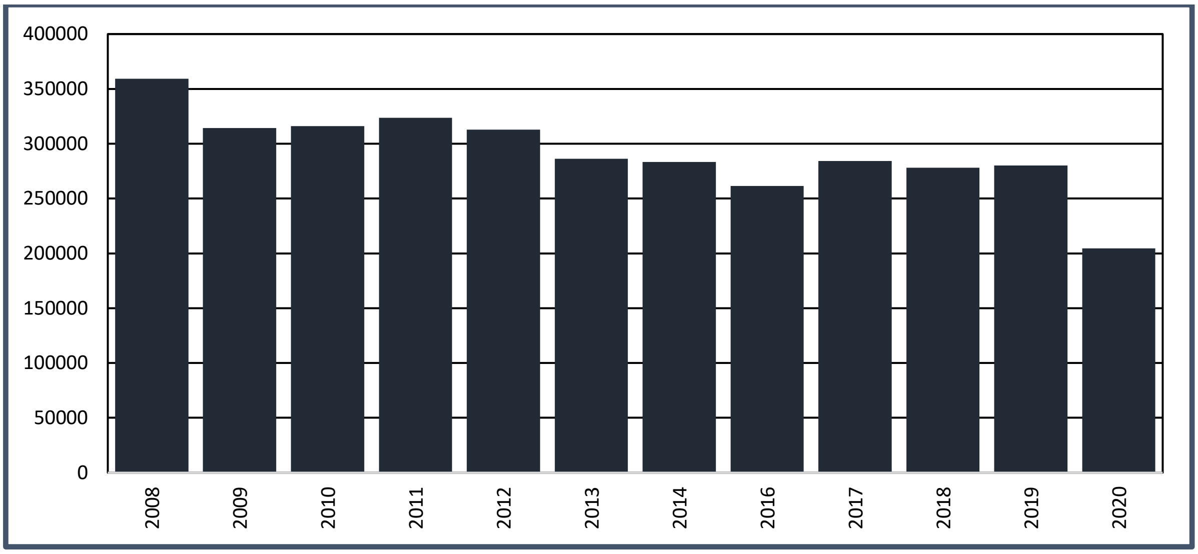
Skills needs in the social economy are the primary driver of employment growth, linked to circularisation of the plastics economy (and currently poorly provided for within the existing skills architecture). Specific skills needs in the formal economy include scientific, technical and chemical engineering skills required to reposition the domestic plastics industry toward compliance with emerging global standards (but these also depend on recapitalising/re-engineering existing production capabilities).

The metals industry

The data in this subsection is drawn from the Metals, Engineering and Related Services Education and Training Authority (merSETA) Sector Skills Plan 2021, as well as TIPS research.

- The metals industry includes 2 599 employers. This includes 338 large enterprises; 657 medium enterprises; and 1 604 small enterprises.
- The industry employs around 200 000 people, about 130 000 of whom are employed in large enterprises. The graph below reflects a gradual decline in employment.
- There are no disaggregated statistics on metals waste pickers, but these are known to be comparable to those cited for plastics (the same people usually do the picking).

Figure 39: Employment in metal and metal products, 2008 to fourth quarter 2020

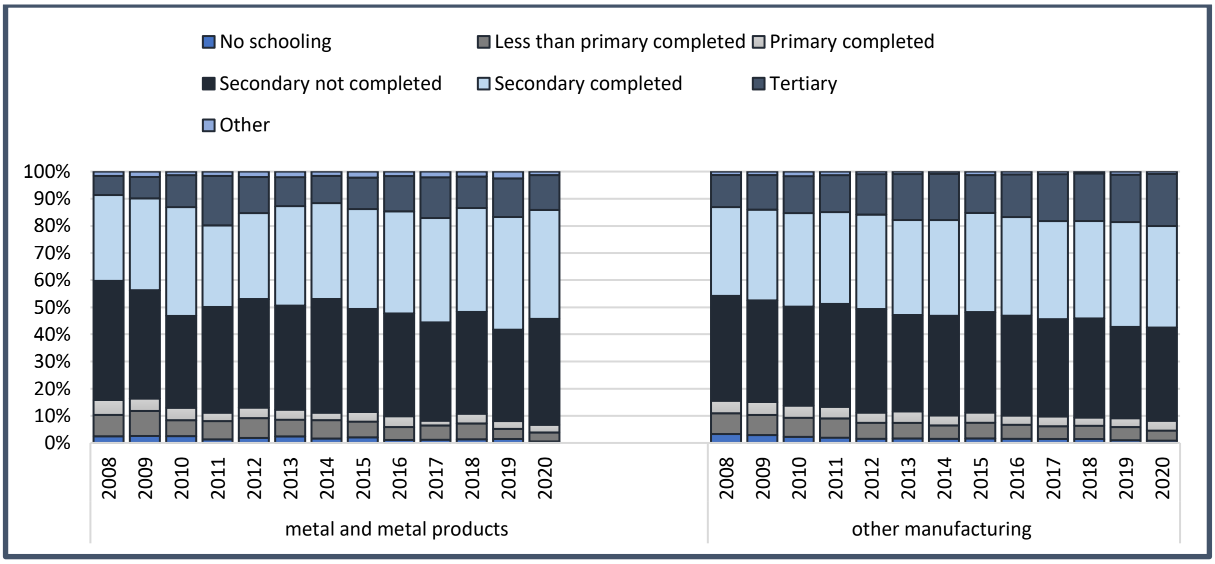


Source: Authors, based on data from Statistics South Africa, Labour Market Dynamics. 2008 to 2019. Series on employment by industry. Electronic databases. Downloaded www.statssa.gov.za Nesstar facility, January 2021; and Quarterly Labour Force Survey. Q1 2020 to Q4 2020. Series on employment by industry. Electronic databases. Downloaded www.statssa.gov.za Nesstar facility, January 2021.

Looking at education levels within employment in metals and metal products, in 2019, 42% of workers did not have matric, compared to 43% in the rest of manufacturing. The share with post-matric education was somewhat lower than the manufacturing norm (TIPS, 2021).

Employees in refining have lower levels of education than other formal workers. Between 45% and 50% of workers in these industries do not have matric, compared to under 40% for other formal employees. Most of the rest have matric, while 12% to 13% have a diploma or degree. In machinery and equipment, in contrast, education is generally higher than for other formal workers. The share of employees with a higher education (diploma or degree) is about a third, compared to a quarter for formal workers in other industries.

Figure 40: Employment by education level in metal products compared to other manufacturing

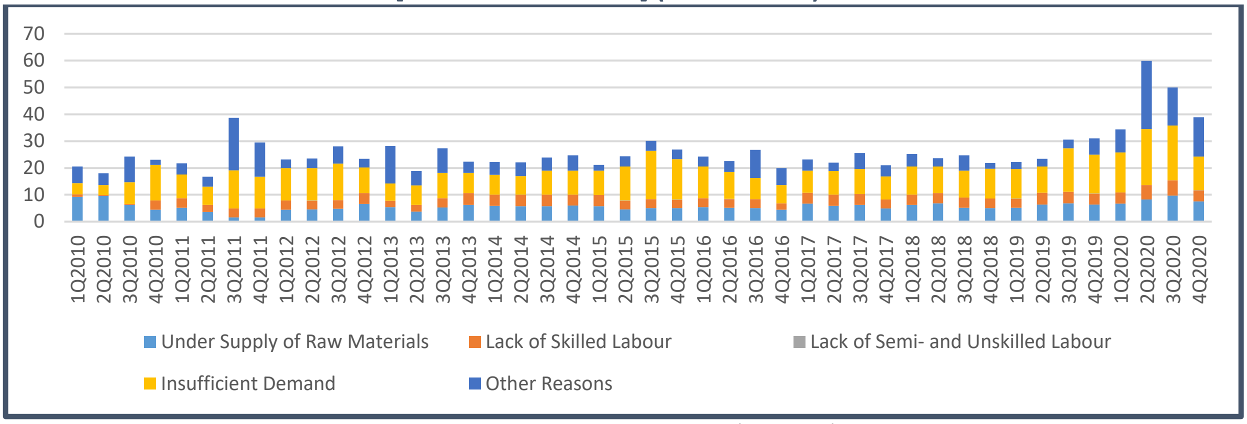


Source: Authors, based on data from Statistics South Africa, Labour Market Dynamics. 2008 to 2019. Series on employment by industry. Electronic databases. Downloaded www.statssa.gov.za Nesstar facility, January 2021; and Quarterly Labour Force Survey. Q1 2020 to Q4 2020. Series on employment by industry. Electronic databases. Downloaded www.statssa.gov.za Nesstar facility, January 2021.

There are no disaggregated statistics for retirement trends in the metals industry. However, the industry itself reports that retirement demand is not a major factor at aggregate level – but there are individual occupations (such as roll turners) where the industry needs to urgently intervene. The metals industry has initiated a set of interventions under the Steel Master Plan to drive artisan development; strengthen partnerships between employers and providers; and promote career path development.

Skills shortages are cited as an important factor in under-utilisation of metals manufacturing.

Figure 41: Reasons for under-utilisation of production capacity – metals and engineering [basic iron and steel] (2010 – 2020)



Source: Authors, based on data from Quantec RSA Economic Data (Stats SA). published by Quantec EasyData. Downloaded from www.quantec.co.za.

There are not significant replacement demand needs in the metals industry. Hard-to-fill vacancies in the metals industry include: managers; mechanical engineers and industrial engineers; skilled trade workers (metal fitters and turners, machine operators, boilermakers, welders); and engineering production system workers. Many of these require long-range planning and non-formal/informal strategies.

Workstreams in the metals industry are in the process of developing a set of strategies to:

- Attract youth into technical areas such as steel fitters and toolmakers;
- Strengthen career pathing and career path development;
- Upgrade skills programs and provider capacity, especially in relation to artisan skills;
- Upgrade the general education levels – higher levels of digital literacy are reported.

4.1.4 Construction skills needs

The construction industry statistics below (from CIDB and CETA, 2021) reflect all construction, not only water and sanitation related construction.

- The construction sector includes roughly 59 000 companies (but these include construction materials suppliers, CIDB reports only 51 000 registered construction companies)
- Total employment in the sector is at roughly 1 350 000 employees.
- The age profile of employees in the industry differs across occupational categories, but sits at an aggregate of 21 908 employees who are likely to retire within the next five to 10 years.

The industry has been durably labour-intensive (and CIDB has guidelines in place to promote labour intensity). Industry transformation strategies include women-in-construction projects. Hard-to-fill vacancies include:

- Engineering managers, construction project managers and contract managers.
- Civil engineers, civil engineering technologists, architects and quantity surveyors.

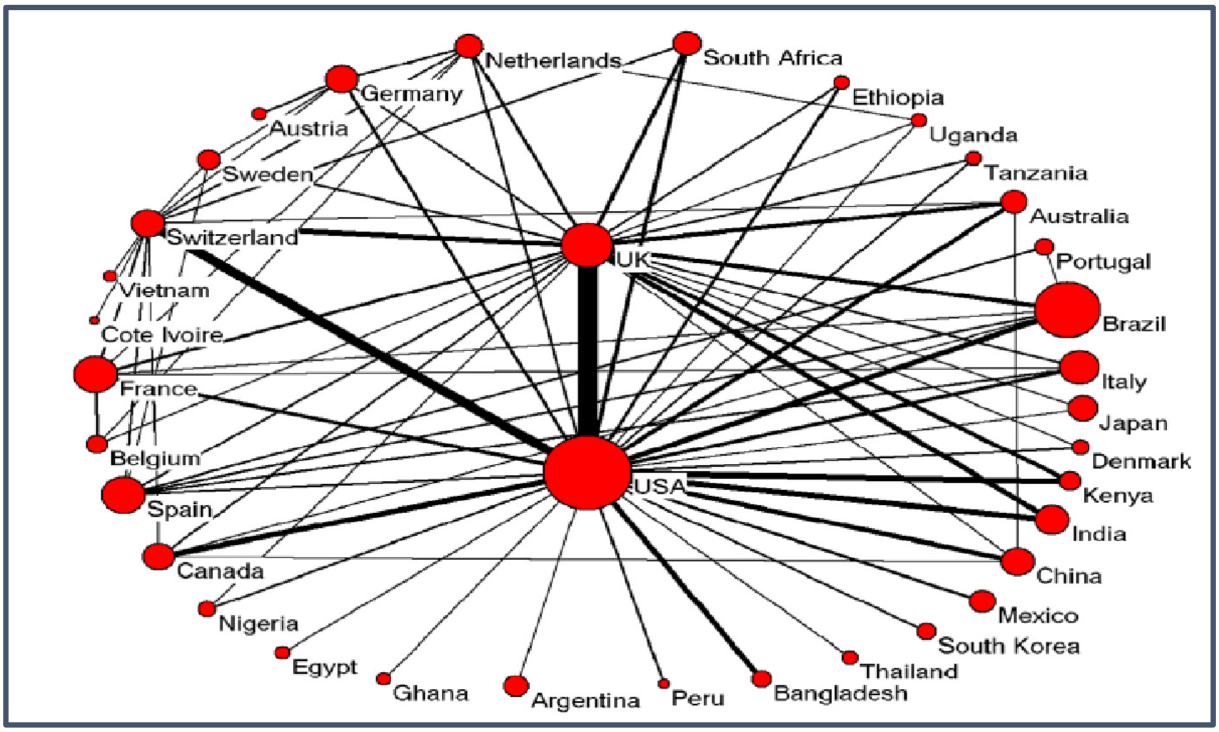
Identified scarce and hard-to-fill vacancies in construction are relative rather than absolute scarcities. Transitioning emerging construction sector players into more formal roles requires contractor development.

4.1.5 Supply-side analysis

The supply-side analysis suggests that:

- South Africa has competitive advantages in relation to some water and sanitation technologies (see figure below). Many of these research, development and innovation capabilities sit within higher education institutions (although these are as yet poorly interfaced, and could benefit from more targeted bursary and research chair funding from the skills sector).
- Higher education and Technical and Vocational Education and Training (TVET) water and sanitation infrastructure spend itself could be better focused on water and sanitation, to provide "living laboratories" for Scientific, Technical, Engineering and Mathematics (STEM) education (and expose students to smart and sustainable technologies they themselves can research).
- The existing skills system architecture is at odds with emerging needs. For planning purposes, there is still a reliance on Water and Sanitation Program (WSP) data which does not adequate reflect non-levy payers (SMMEs) or the emerging social economy. At a quality assurance level, existing processes (and the highly bureaucratised processes for developing Organising Framework for Occupations (OFO/qualifications/curricula and accrediting providers or assessing learners) do not yet reflect key transitional dynamics.
- The current poor student retention, completion and absorption rates could be improved through exposing students to "real world" challenges along these lines.
- Universities, TVETs and community colleges need to adopt more multi-disciplinary and transversal curriculum development strategies, to better equip students for the changing world of work.
- The National Business Institute (NBI) is fostering dialogues at municipal levels between the state, private sector and education/training providers that could assist in coalescing ecosystems.

Figure 42: Publications and collaborations in water and sanitation research



Source: Zhou et al, 2018.

4.1.6 Pathway interventions

Many of the skills challenges reported above are relative rather than absolute scarcities. The solution is not always to train more people through foundational education; rather, the solutions lie in providing better pathways for (current or unemployed) graduates into workplace experience, professional registration, and structured on-the-job professional development opportunities.

The Department of Employment and Labour's Employment and Services System (ESSA) has spent two decades building databases of unemployed graduates, and linking these to:

- Internships.
- The National Youth Employment Scheme.
- The Expanded Public Works Programme and Community Work Programme.

Both these two pathway interventions are included in the proposed interventions.

4.1.7 Strengthening the industrial skills ecosystems

Specific ecosystem skills needs were identified during stakeholder dialogues. These include:

- Increasing meso-level engagements at industry level. Most companies report they learn about new developments and technologies through industry newsletters, at conferences or through training programmes. This implies that South African industries are lagging rather than leading in innovation. SETAs should also embrace "expansive learning" strategies (rather than only formal training programs) – and the National Skills Development Plan should provide for this.
- Standards and certification are currently hindering product innovation and market access. The skills sector needs to capacitate SABS and Agrément to fast-track such work.
- Improving procurement and infrastructure spend may require National Treasury/ Office of the Chief Procurement Officer to expand their current skills development interventions with bid procurement, evaluation and adjudication officials, to incorporate designated products.
- It may be possible to strengthen compliance to prevent cheap and sub-standard imports by strengthening Building Control Officer capabilities at local government level (South African Council for Architectural Professions has a strategy in place in this regard).
- Improving state infrastructure planning and delivery capabilities remains the most important factor in unlocking demand.

4.1.8 Policy implications

Key policy implications in relation to skills for water and sanitation are:

- Current SETA Sector Skills Plans are not always surfacing the emerging skills priorities. There is a need for DHET to explore how skills planning can do so better.
- Most of the categories of provision provided for in the National Skills Development Plan are formal – bursaries, skills programmes, artisan programmes, internships and Work Integrated Learning. Many of the challenges reported by industries cannot be adequately addressed through such programmes, or are better addressed through delivery modes such as communities of practice, continuous professional development, micro-credentialling of workplace learning, long-range mentorship programmes, and increasing digital literacy. These avenues are probably more suitable, yet are not provided for hence not funded.
- Also impacting the form of delivery has been the rapid shift toward virtual learning and blended learning. Several SETAs are doing work on this; the Infrastructure Skills Workstream has published a plan; and progress has been made on the quality assurance of virtual learning by the Quality Council for Trades and Occupations.

- EPCM is experiencing high shortages. These, however, appear to be relative rather than absolute demands. The South African Institute for Civil Engineers has argued that long-range mentoring is needed, with a focus on retention and development in more remote municipalities. through smart twinning and mentorship programmes.
- Funding needs to focus on developing high-end/specialist skills aligned to niche areas through a range of mechanisms, such as investment in research chairs, research institutes, specialised postgraduate bursaries, and expanded professional development support.
- Current practitioners (municipalities, utilities, planners) need to be connected with niche innovation learning and outputs through targeted training and practical exposure to sites.
- Aligning funding to develop skills linked to niche experiments to support artisanal skills via TVET colleges, SETAs and associations.
- Funding is also required to build to community of practice platforms to transfer industry skills linked to niche experiments from university centres to innovators, small businesses and operators to align to policy and institutional environments. WRC has been in discussion with the Bill and Melinda Gates Foundation about this.
- Grant funding and/or support is needed for grassroots innovators, start-ups and small to microenterprises to provide skills development for new skills and future skills to support water and sanitation sector – aligned to accepted material developed through research on emerging water sector focus areas.
- Uptake of graduates can be improved by implementing: 1) effective skills demand scanning; 2) upskilling students in workplace skills and readiness (expanded professional development); and 3) resourcing effective graduate and internship employment programmes that have sustainable employment prospects post the contract period.

4.2 Improving industry competitiveness and capacity utilisation

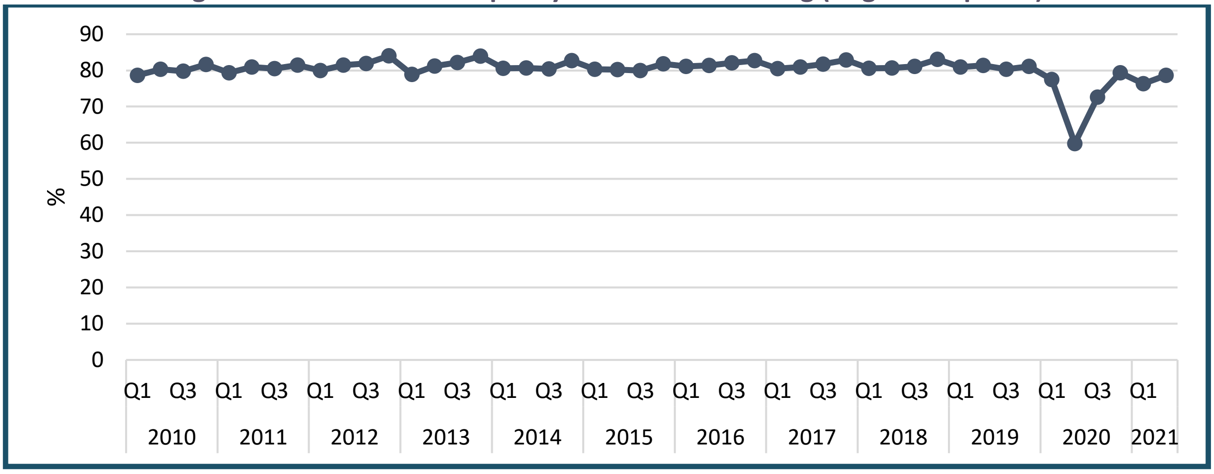
Streamlining manufacturing capacity utilisation and strengthening competitiveness in water and sanitation would bring strong gains to the industry. This subsection seeks to identify the capacity of South Africa's industries, how much of it is being utilised, and how competitive the industries are.

4.2.1 Capacity utilisation in South African manufacturing industries

The aggregate utilisation of production capacity in South Africa's manufacturing sector is shown in Figure 43. The data comes from Statistics South Africa's capacity utilisation survey of large enterprises with a turnover of over R100 million per annum. Because of this, the data in the graph is not representative of all manufacturing companies, as it does not show utilisation in small to medium manufacturing companies. Capacity utilisation fluctuated from 2010 until 2019, with an average of 80%.

There was an obvious sharp decline in capacity utilisation from 2020, largely due to the COVID-19 pandemic that resulted in many manufacturing plants halting production and a general decline in economic activities, as well as disruptions to global supply chains. In Q4 2020, capacity returned to pre-pandemic levels and then a reduction in capacity utilisation was seen in Q1 2021, as a result of the impact of the third wave of the pandemic as well as social unrest, among other things.

Figure 43: Utilisation of capacity in all manufacturing (large enterprises)



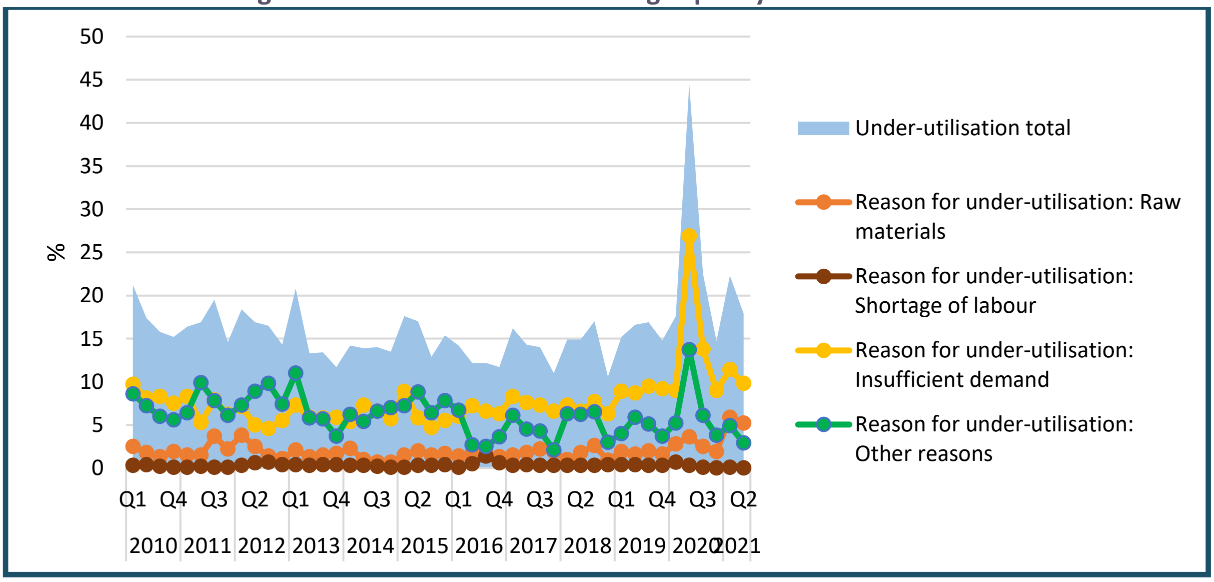
Source: Authors, based on data from Statistics South Africa, Capacity Utilisation Survey, 2021.

In contrast to this, anecdotal information from interviews with different medium to small enterprises painted a different picture. Far lower capacity utilisation levels are reported on the ground, particularly for medium to small companies. For example, SEIFSA reported that capacity levels were below 70% before the pandemic hit, and some reported as bad as 50%.

The difference in capacity levels shown in the graph (averaging 80% for large enterprises) and the anecdotal figures of 50% to 80% for smaller companies points to the distributional impact on capacity utilisation – small to medium companies may be more impacted than their larger counterparts.

According to the South African Economic Reconstruction and Recovery Plan, these declines in capacity utilisation also imply that investment plans and projects that were affordable before the impact of the crisis face the possibility of not being affordable with prolonged subdued capacity utilisation.

Figure 44: Chemical manufacturing capacity under-utilisation

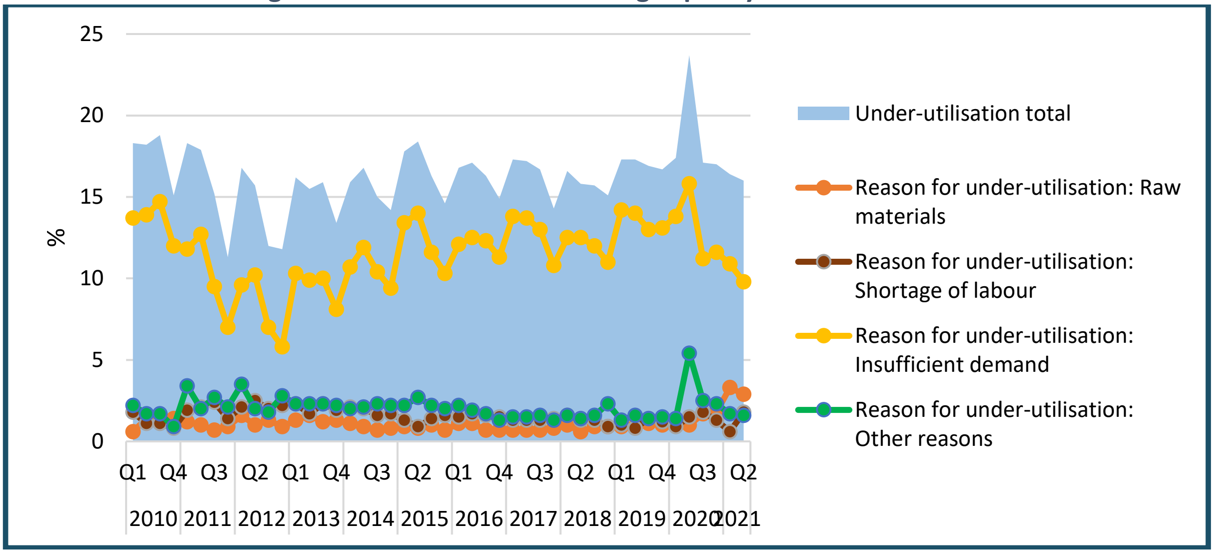


Source: Authors, based on data from Statistics South Africa, Capacity Utilisation Survey, 2021.

The same data from Statistics South Africa categorises reasons for under-utilisation according to: insufficient demand, insufficient supply or costly raw materials, shortage of labour and other reasons. Figure 44 shows the chemicals sector, where under-utilisation averaged 15% before the pandemic. This is again for large enterprises. There was a sharp increase in under-utilisation of capacity to 45%

in Q1 2020 and then recovery in Q4 of 2020. The data shows that the main reasons for under-utilisation over the years are insufficient demand and other reasons.

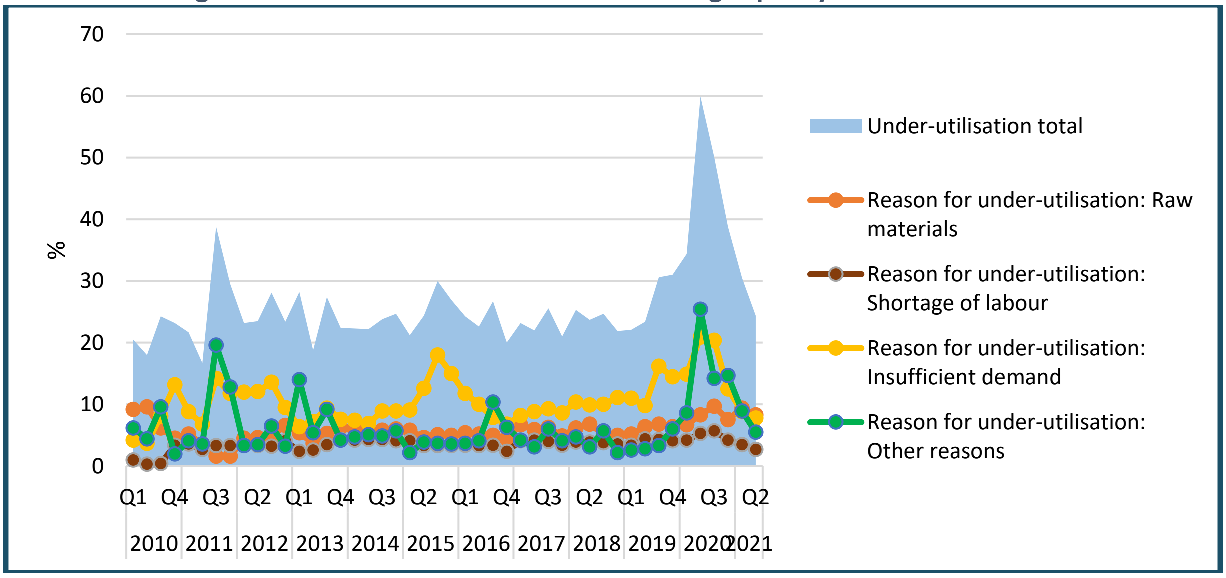
Figure 45: Plastics manufacturing capacity under-utilisation



Source: Authors, based on data from Statistics South Africa, Capacity Utilisation Survey, 2021.

In the plastics sector (Figure 45), under-utilisation for large manufacturing enterprises averaged 16% before the pandemic. Again, there was a sharp increase in under-utilisation of capacity to 24% in Q1 2020 and then a recovery in Q4 2020. The data shows that the main reasons for under-utilisation over the years is largely insufficient demand, and then to a lesser extent raw materials, shortage of labour and other reasons.

Figure 46: Basic iron and steel manufacturing capacity under-utilisation



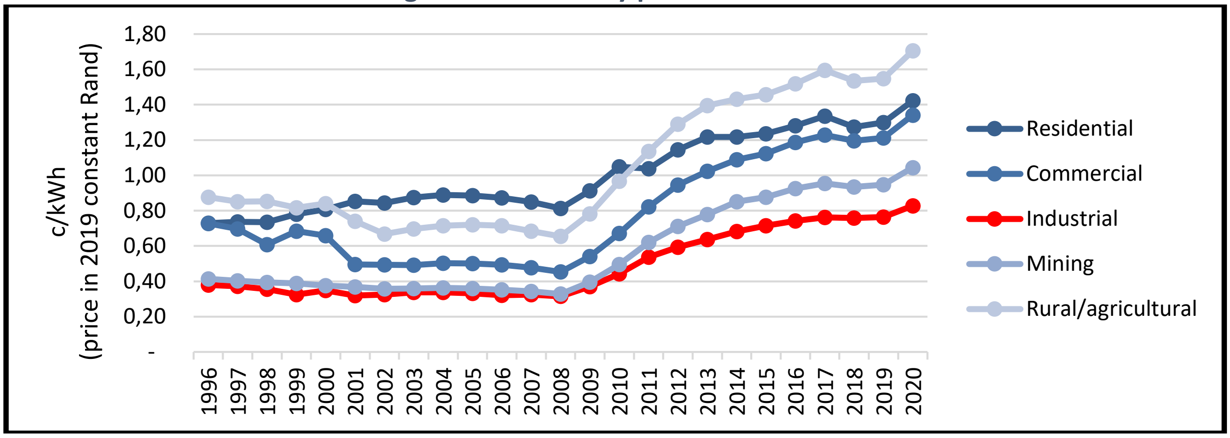
Source: Authors, based on data from Statistics South Africa, Capacity Utilisation Survey, 2021.

In the iron and steel sector (Figure 46), under-utilisation for large manufacturing enterprises averaged 24% before the pandemic. A sharp increase in under-utilisation of capacity to 60% occurred in Q1 2020, before a recovery in Q4 2020. This shows that the steel industry was comparatively more affected than chemicals and plastics. The data shows that the main reasons for under-utilisation, especially during the pandemic, are weak demand and other reasons. In addition to this, research conducted in 2020 by TIPS shows that liquidity is the main constraint in the steel industry due to reduced industrial activity and trickle-down effect of non-payment from construction companies and effectively non-payment from first tier steel users.

4.2.2 Competitiveness

Before the COVID-19 pandemic hit, South African manufacturers were constrained with ongoing high electricity prices and unreliable supply evidenced by loadshedding.

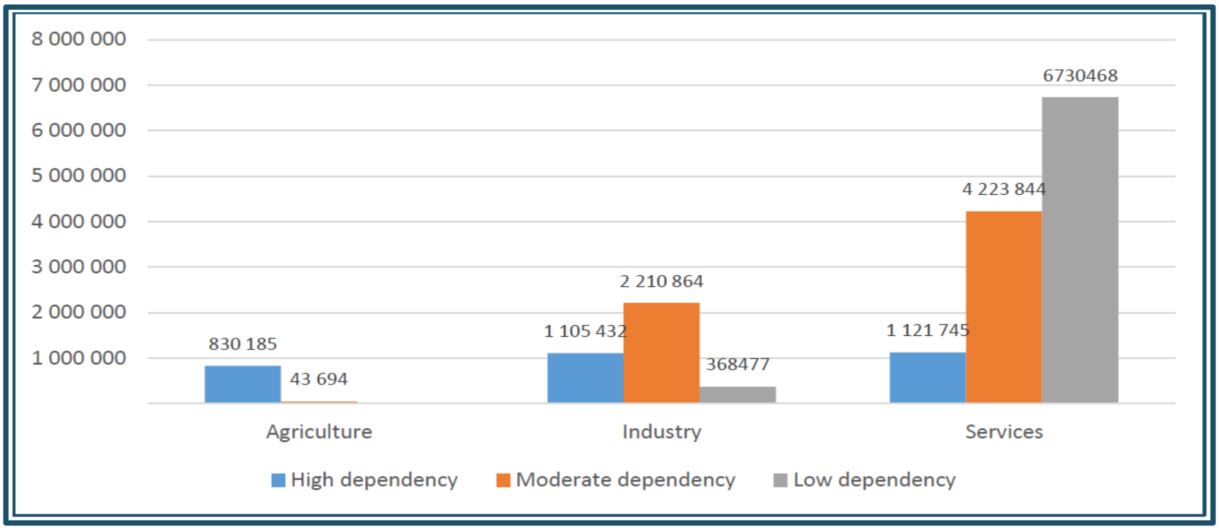
Figure 47: Electricity prices over time



Source: Authors, based on data from Statistics South Africa, 2021.

Figure 47 shows the trend in the price of electricity since 1996. This is measured in cost per kilowatt-hour, in constant Rand terms. Prices differ according to usage, with residential tariffs always higher than for other uses. A sharp increase in prices of electricity from 2008 can be noted.

Figure 48: Number of water dependent jobs

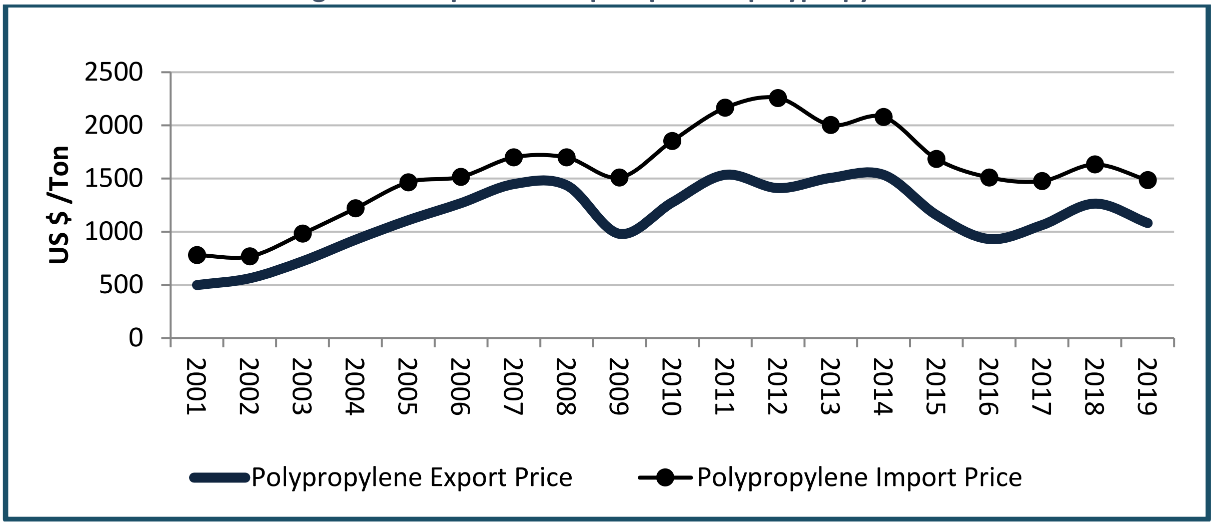


Source: Ward and Mudombi, 2018.

Water supply shortages are another big constraint, especially in highly water dependent manufacturing companies. Anecdotal information reveals that some companies have reduced their capacity by reducing shifts according to the water availability. Figure 48 shows the number of jobs that are water dependent and affected by water supply shortage. In manufacturing, an estimated 1.1 million jobs are highly dependent on water supply, and 2.2 million jobs are moderately dependent. These figures give a picture of the impact of water shortages on capacity levels in manufacturing.

Another reason for under-utilisation of capacity, which is evident in steel and plastic piping, is import parity pricing. For example, Sasol's price of propylene on the domestic market is reportedly higher than the export price. This disadvantages local plastic piping manufacturing.

Figure 49: Import and export price of polypropylene



Source: Plastics Master Plan, the dtic, 2021.

Capacity utilisation and competitiveness in the water and sanitation industry

Looking at capacity utilisation and competitiveness in the water and sanitation industry, Table 16 summarises the different components in the value chain.

Table 16: Current capacity and limitations in the water and sanitation industry

COMPONENT	CURRENT CAPACITY	LIMITATIONS
Skills	One engineer per 3 166 population.	Lack of skills, brain drain Limited investment into training Unattractive public sector working conditions
Construction of dams and reservoirs	Industry is capable of planning, designing and constructing dams	Negative trade balance for self-propelled bulldozers, angle dozers, graders, levellers, scrapers, mechanical shovels and excavators
Steel piping	Production decreased, yet there is capacity to meet market demand, except for fittings	Shortage of intermediate inputs Overpricing of local steel compared to the selling price in SACU Lack of infrastructure spend Competition from HDPE and PVC plastic piping; Inefficient border controls
Plastic piping	Manufacturers supplying PVC and HDPE water piping	Lack of government funding Import parity pricing of polymers – excessive pricing of propylene and polymers Insufficient R&D Influx of imported products
Valves	Credible suppliers of valves meeting international specifications Vertically integrated Local content designation of 70%	High utility charges and labour costs Labour unrest Sub-standard imports from China

Chemicals	Sufficient capacity to supply chlorine – positive trade balance New firm forming a caustic soda plant in collaboration with Tata India.	Insufficient local supply of caustic soda Production of caustic soda highly hazardous nature and very prohibitive government regulations
Pumps	120 firms, of which 62 manufacture all or some of their products locally while other import and assemble.	Closure and downsizing of foundries Lack of investment in new technology Cheap imports High production costs Uncompetitive local raw material costs
Water meters	Oligopoly market, then few smaller players 50%-70% designated	Weak demand New entrants have increased industry supply capacity at a time of low demand. Cheap imports Increases in the cost of energy, labour New carbon tax
Membranes	Few manufacturing firms Raw materials are locally sourced	
Pedestals/ Sanitation ware	Traditional sanitary ware (Betta with 50% and Vaal Potteries 30%) New entrants in NGS	Cheap imports Brand loyalty
Cement	Five cement producers 70% capacity	Weak demand New entrants have increased industry supply capacity at a time of low demand Cheap imports Increases in the cost of energy, labour New carbon tax

Source: Authors.

The construction of dams and reservoirs is overseen by the South African National Committee on Large Dams. It reports that there is sufficient capacity in the local industry to plan, design and construct dams. However, the equipment and machinery used (self-propelled bulldozers, mechanical shovels and excavators) show a negative trade balance.

In plastic piping, an additional reported constraint is import parity pricing from Sasol of polymers and propylene, which are main ingredients in the manufacturing of plastic pipes. The valves industry has competitive local production capacity, with manufacturers vertically integrated and a local content designation of 70%. The main constraints are high utility charges, high labour costs and labour unrests, and an influx of sub-standard imports.

The local chemicals industry has sufficient capacity to manufacture chlorine, and there is a new entrant in the production of caustic soda. The main constraint is that the production of caustic soda is highly hazardous, resulting in stringent regulations.

The pumps industry has also witnessed a reduction in capacity because of the closure and downsizing of foundries, cheap imports, high production costs and uncompetitive local raw materials. The production of water meters, which is designated at 50%-70%, is constrained by weak demand and increased local suppliers, cheap imports, and increased input prices. The manufacturing of membranes, pedestals and cement are also limited by weak demand, cheap imports, and increased input prices.

4.2.3 Policy implications

A general reduction in capacity utilisation and competitiveness in South Africa's industries can be seen from the data, interviews and analysis. The research has also shown the different constraints each component of the value chains faces. Most constraints are cross-cutting. With this in mind, Table 17 highlights key policy instruments. Some are already included in the plastics, steel and/or chemicals master plans.

Table 17: Cross-cutting policy implications

SOURCE	POLICY IMPLICATIONS
Cross-cutting issues	Shifting to more sustainable energy sources Growing exports to other African countries Strengthening logistics as well as resolving border post constraints Liquidity and cash flow intervention, especially for steel
Plastics	Value chain localisation Industrial incentives packages Testing and R&D
Steel	Infrastructure drive Localisation Export promotion Development of industry value chains Government funding Establish Steel Industry Competitiveness Fund Consideration of input costs Improving intel and information Capacitating key institutions
Chemicals	Increasing localisation and industry development Increasing competiveness of local producers and attractiveness of new investment Support for local production under threat from low-cost imports Export promotion Improving the existing level of transformation in the chemical value chain

Source: Levin 2021; Lowitt 202Oc; Master Plans (Chemical, Plastics, Steel); Montmasson-Clair, 2018.

To mitigate electricity and water constraints, more effort in shifting to sustainable energy and water sources are required, so as to resolve the unreliability and high costs of electricity and water shortages.

To reduce input prices, discussions with key local suppliers should be initiated to review input prices, especially for the plastics, pumps and steel components.

To mitigate cheap sub-standard imports, capacitating and aligning key institutions is paramount. A number of agencies and institutions play an important role in supporting the manufacturing industry: SABS, NRCS, ITAC, SARS and the Industrial Development Corporation (IDC). Streamlining these institutions to deal with illegal and sub-standard imports is critical to the success of the industry.

To grow demand, encouraging value chain localisation and increasing export promotion to other African countries are crucial avenues. This could include facilitating a national drive for Proudly SA and buying South African. Retailers should identify product ranges where locally manufactured products can replace existing imports. Investment in local competitiveness and capacity should also be ramped. This includes strengthening the transition to a digital economy, which would bring reduced business costs, innovation and ease of communication and service delivery. Last, liquidity and cash flow interventions would be helpful to increase capacity utilisation and competitiveness, for instance through a temporary lending facility (especially for the iron and steel value chain).

4.3 Reducing cheap and sub-standard imports

This section provides an analysis of the contribution of water and sanitation imports to overall imports, the state of imports in water and sanitation goods, drivers for imports and current interventions by the Chemicals, Plastics and Steel Master Plans.

Generally, imports (except for intermediate goods and inputs) can have a negative impact on firms, employment and the quality of infrastructure provided by local, provincial and national government:

- They erode the local market share.;
- Can lead to firm closure (as seen with some valves and meter companies closing down).
- Can lead to job losses through firm closure.
- Cheap and sub-standard products contribute to poor service delivery due to breakdowns and constant repairs depleting already constrained financial resources of municipalities.

Table 18 illustrates the type of water and sanitation goods imported by South Africa.

Table 18: Main types of water and sanitation goods imported by South Africa

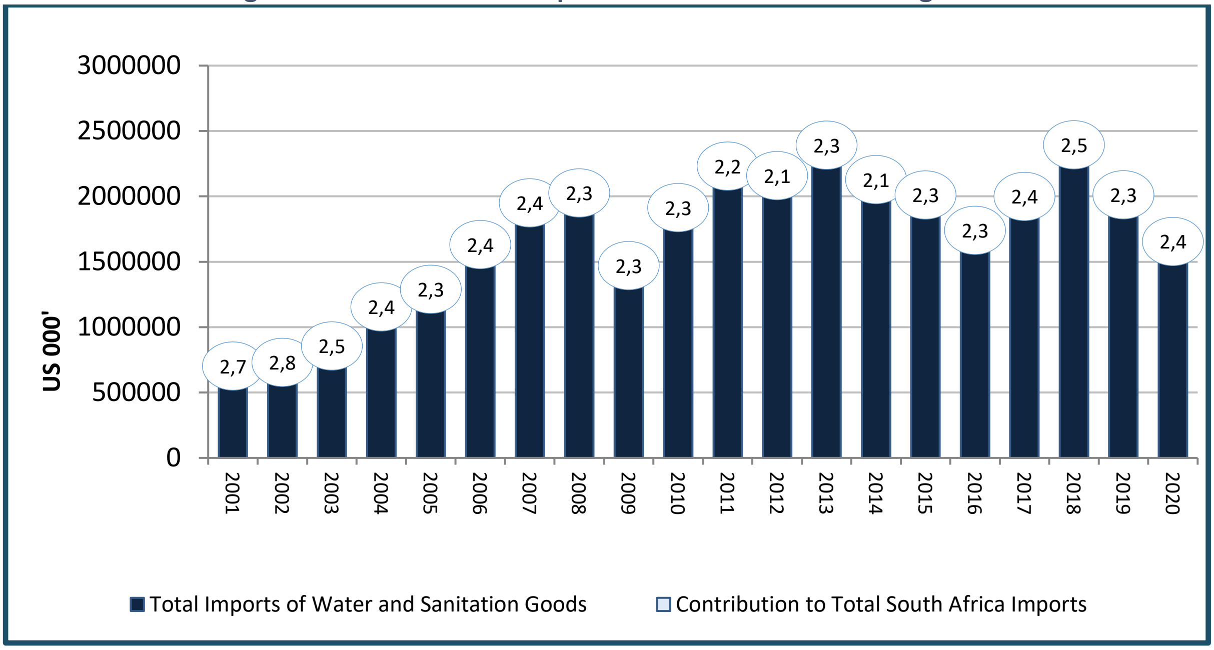
Water abstraction, conveyance and collection	1. Plastic pipes 2. Iron and steel pipes 3. Valves 4. Pumps
Water and wastewater purification	1. Chemicals 2. Filtering and purification
Water storage	1. Plastics reservoirs and tanks 2. Iron and steel reservoirs and tanks
Sanitation ware	1. Iron and steel basins, baths, 2. Plastics lavatory seats, covers, bidets, lavatory pans, flushing cisterns, shower baths, wash basins 3. Ceramic sinks, washbasins, washbasin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures
Liquid meters and water measurement instruments	1. Instruments and apparatus for measuring or checking the flow, level, pressure 2. Liquid meters

Source: Authors.

4.3.1 Contribution of water and sanitation goods to South Africa's imports

Figure 50 illustrates that total imports of water and sanitation goods grew sharply from 2001 to 2008. Imports contributed 27% and 2.3% respectively to total imports of South Africa. From 2009, imports declined before climbing again to 2013. Imports declined until 2016 with a 2.3% contribution to total South African imports. Since 2016, imports grew until 2018. From 2018, imports have been on a decline. In 2020, water and sanitation goods accounted for 2.4% of total imports (US$1.6 billion).

Figure 50: South Africa's imports of water and sanitation goods

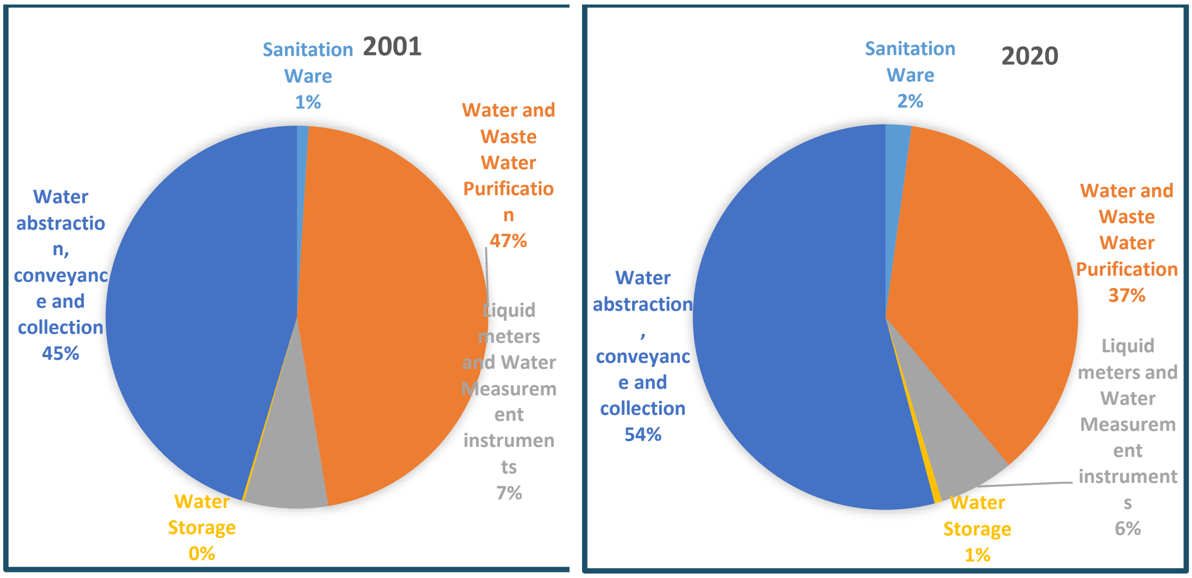


Source: Authors, based on data from Trade Map, 2021.

4.3.2 Composition of water and sanitation imports

Figure 51 shows that the composition of imports is largely dominated by water abstraction, conveyance and collections goods (pipes, pumps, valves). The contribution of these products has grown from 45% in 2001 to 54% in 2020. Further to this, imports are driven by water and wastewater purification goods (largely chemicals), however, the imports of these type of goods have declined from 2001 to 2020 at 47% to 37% respectively.

Figure 51: Composition of water and sanitation imports



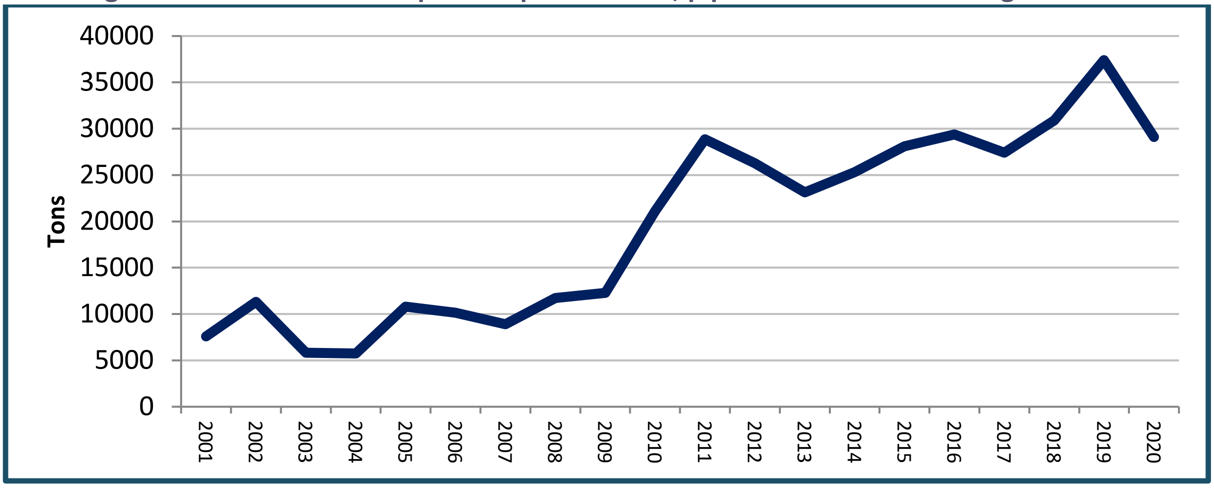
Source: Authors, based on data from Trade Map, 2021.

4.3.2.1 Imports of water abstraction, conveyance and collection goods

Imports of plastic pipes, hoses, tubes, fittings

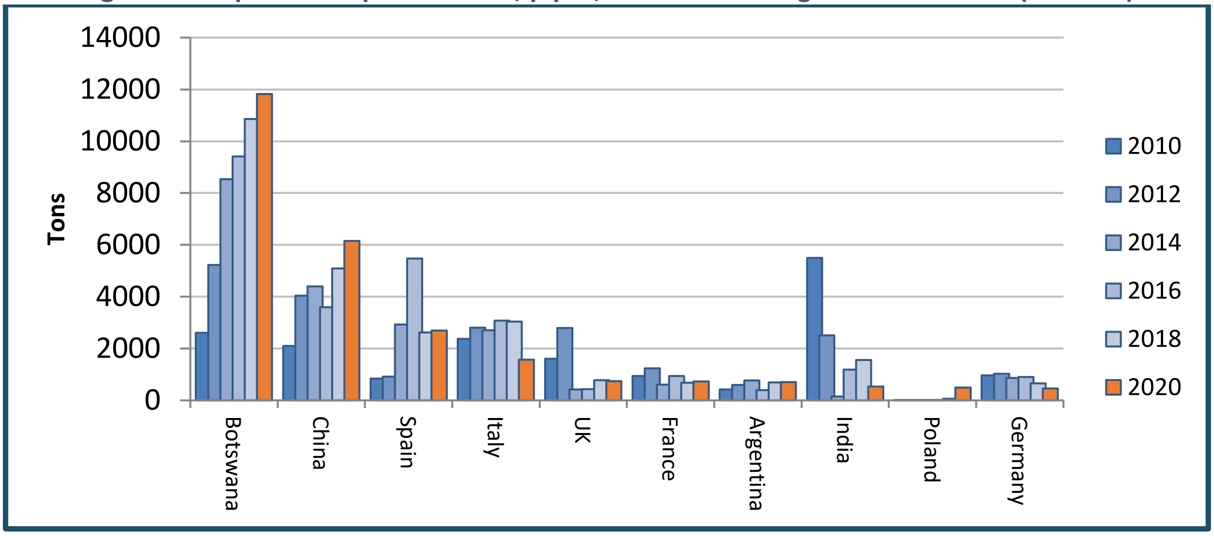
Data on the HS code 3917 (Figure 52) illustrate a rise in imports from a base of 7600 tons in 2001 to 29 000 tons in 2019. Imports have largely emanated from China and Botswana.

Figure 52: South Africa's imports of plastic tubes, pipes and hoses and fittings HS 3917



Source: Authors, based on data from Trade Map, 2021.

Figure 53: Exporters of plastic tubes, pipes, hoses and fittings to South Africa (HS 3917)



Source: Authors, based on data from Trade Map, 2021.

The import price of the above category illustrates cheap imports have been entering South Africa. South Africa's current tariff duty ranges from 0% to 15%.

Table 19: South Africa's import prices for plastic tubes, pipes and hoses and fittings

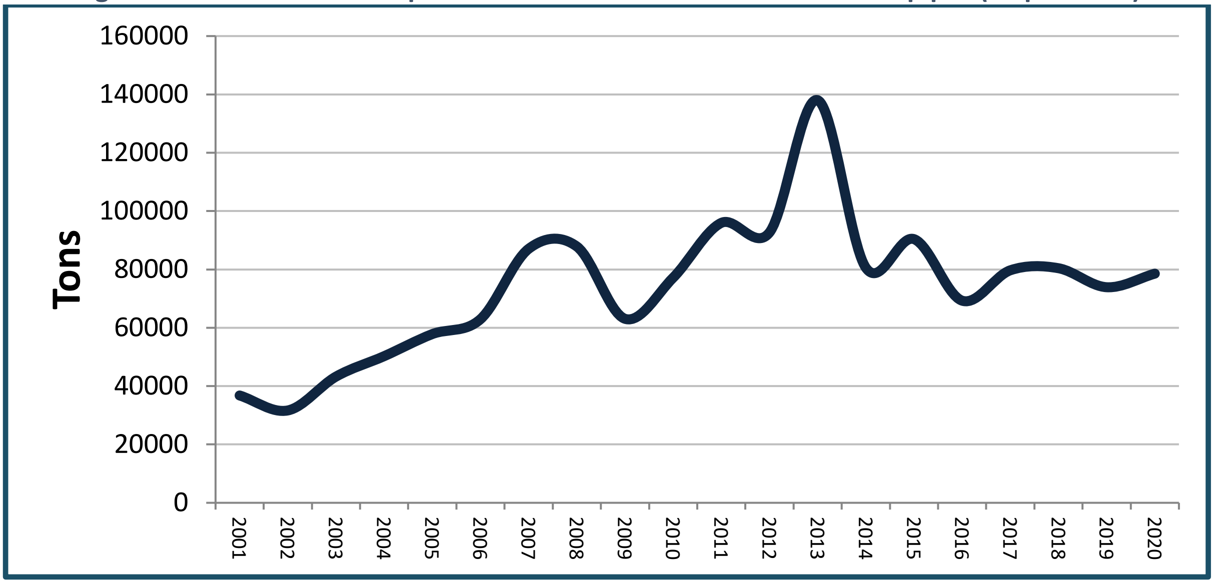
US/Ton	2016	2017	2018	2019	2020
World	3891	4210	4226	3589	3544
China	3088	3173	3411	3391	2487

Source: Authors, based on data from Trade Map, 2021.

Imports of iron and steel pipes and tubes

Figure 54 illustrates imports of various iron and steel pipes and tubes. It shows an increase from 2001 to 2013 from about 40 000 tons to 140 000 tons. Since then, imports declined to 80 000 tons in 2020.

Figure 54: South Africa's imports of various iron and steel tubes and pipes (21 products)



Source: Authors, based on data from Trade Map, 2021.

Table 20: Exporters to South Africa of iron and steel pipes and tubes

HS 7306 (OPEN SEAM)	HS 7304 (SEAMLESS)	HS 7307 (TUBE OR PIPE FITTINGS)	HS 7303 (CAST IRON)
China Mozambique Taipei, Chinese Portugal India United Kingdom Viet Nam Italy Germany Spain	China Germany Italy Netherlands India Romania Czech Republic Angola UK Spain Korea Argentina	China India Italy Taipei, Chinese Germany US Spain Thailand France Hong Kong, China Poland	China United Arab Emirates Ukraine India Austria Spain France Germany Turkey Lesotho

Source: Authors, based on data from Trade Map, 2021.

The import prices (see tables below) of the above category illustrates cheap imports have been entering South Africa from China. The tables below show the import price from the globe compared to China.

Table 21: South Africa's import prices for HS 7307 steel tubes or pipe fittings

US/Ton	2016	2017	2018	2019	2020
World	2703	3185	3276	3207	3154
China	1695	1955	2214	2103	2056

Source: Authors, based on data from Trade Map, 2021.

Table 22: South Africa's import prices for HS 7304 Tubes, pipes and hollow profiles, seamless, of iron or steel

US/Ton	2016	2017	2018	2019	2020
World	1118	1468	1606	1652	1487
China	759	996	1213	1149	1002

Source: Authors, based on data from Trade Map, 2021.

Table 23: South Africa's import prices for HS 7306 Tubes, pipes and hollow profiles (open seam or welded, riveted or similarly closed)

US/Ton	2016	2017	2018	2019	2020
World	1305	1452	1519	1540	1188
China	589	777	1027	945	789
Taiwan	1939	2167	2333	2156	1982

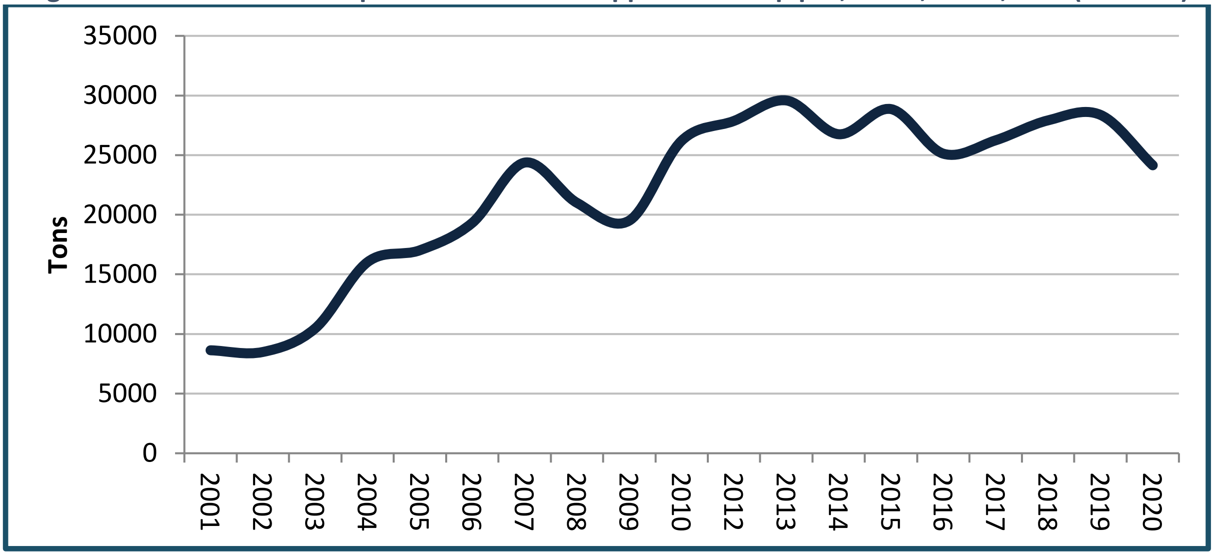
Source: Authors, based on data from Trade Map, 2021.

Currently, South Africa's tariff applied to the above products is between 10%-15%.

Imports of valves and appliances for pipes, tanks, vats

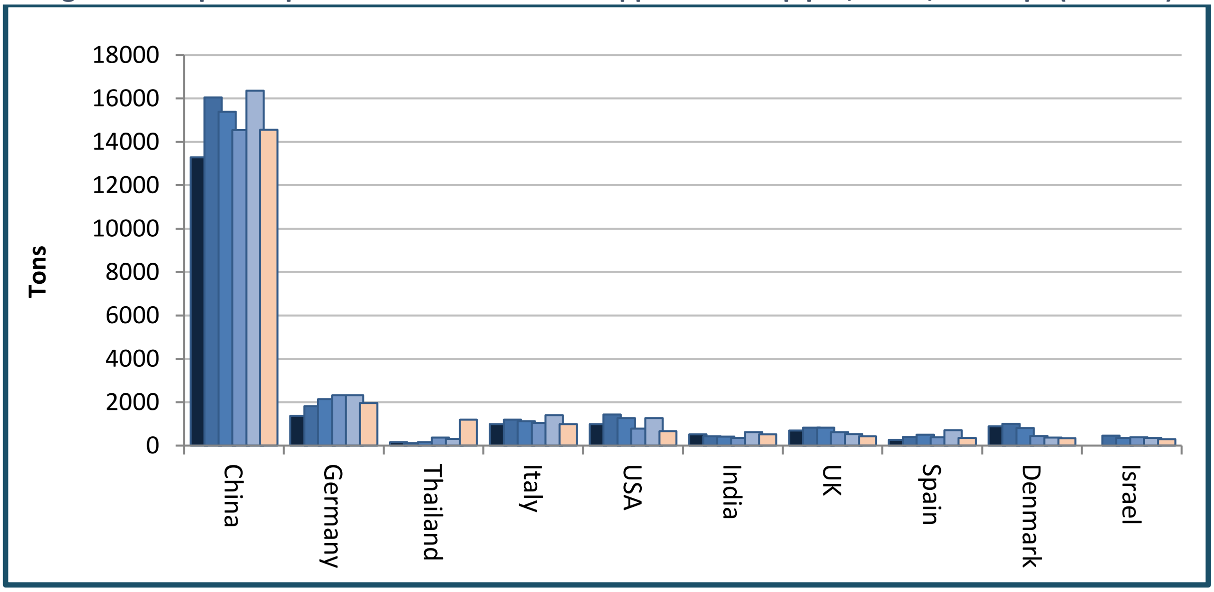
Imports of valves and appliances for pipes, tanks and vats (Figure 55) saw a jump from 8 500 tons in 2001 to 24 700 in 2007. Imports declined in 2009 but began to grow to reach a top peak of 30 000 tons in 2013. Recently, imports have declined with 24 000 tons imported in 2020. Most of the imports originated from China, followed by Germany and Thailand.

Figure 55: South Africa's imports of valves and appliances for pipes, tanks, tanks, vats (HS 8481)



Source: Authors, based on data from Trade Map, 2021.

Figure 56: Top 10 Exporters to South Africa of Appliances for pipes, tanks, vats taps (HS 8481)

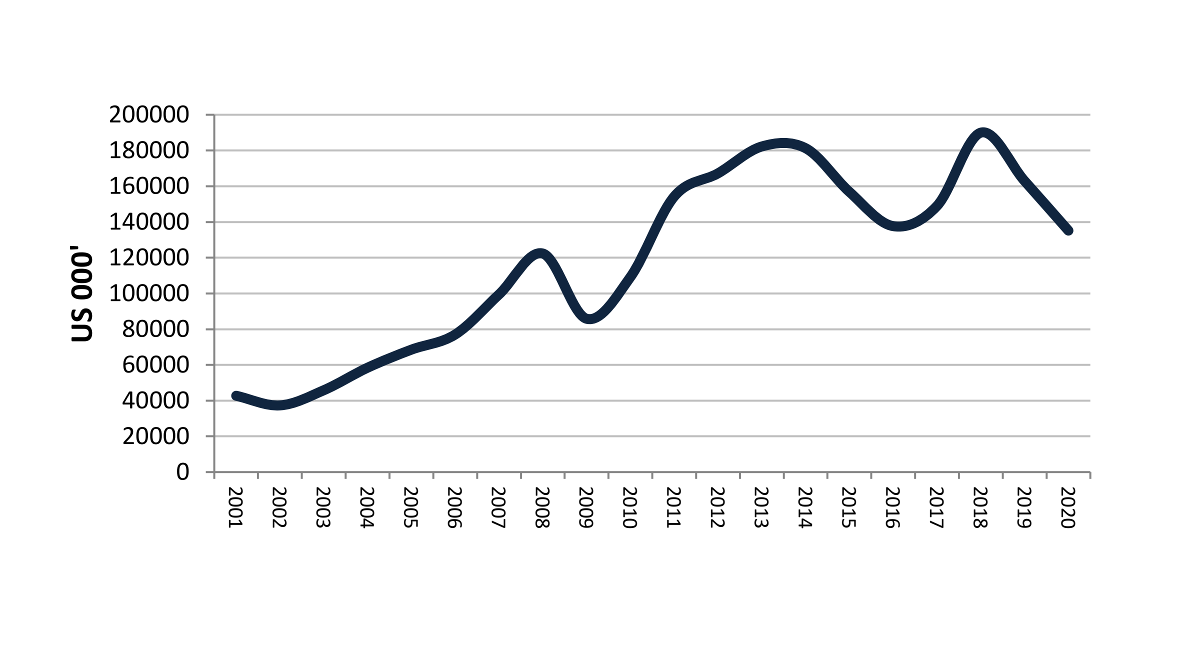


Source: Authors, based on data from Trade Map, 2021.

Imports of various pumps

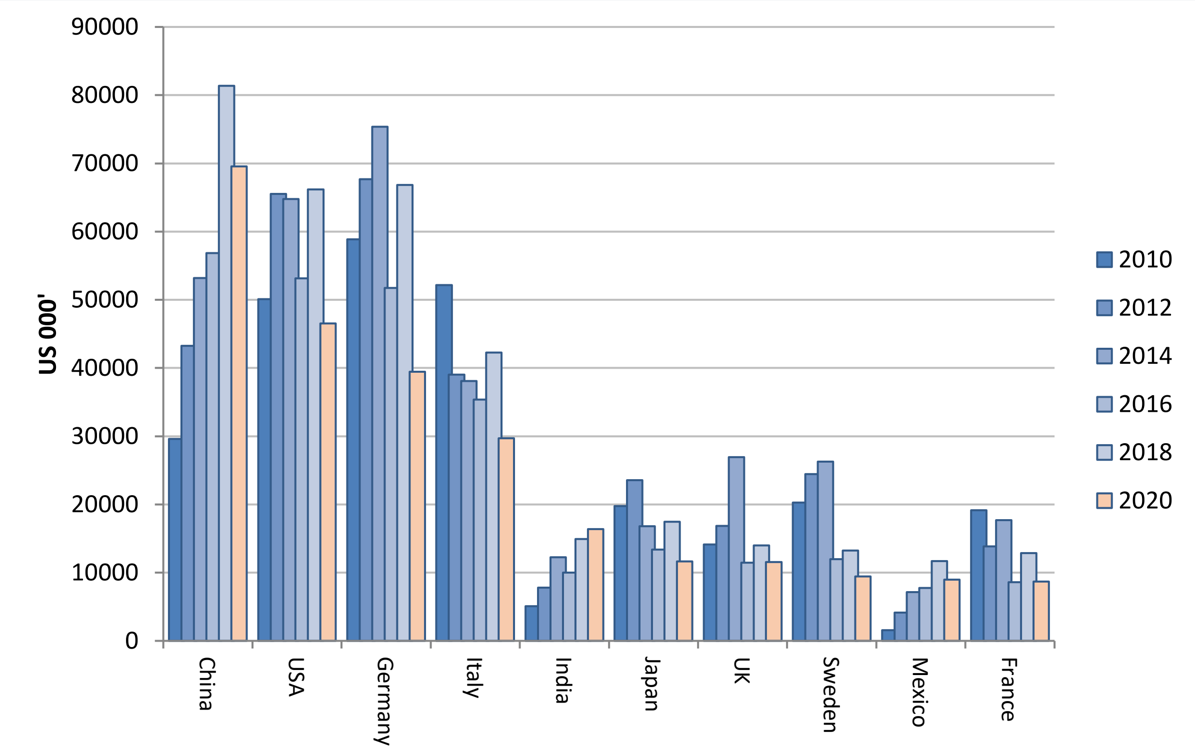
Imports of pumps used for water mainly include centrifugal pumps and the reciprocal, rotary positive displacement pumps. Imports were on a rise from 2001 to 2014. There was a drop from 2015 to 2016. Despite a rise in in 2018, imports have begun to decline. Four main countries account for South Africa's imports, that is China, the US, Germany and Italy.

Figure 57: South Africa's imports of pumps and parts (HS 8413)



Source: Authors, based on data from Trade Map, 2021.

Figure 58: Exporters to South Africa of various pumps (HS 8413)

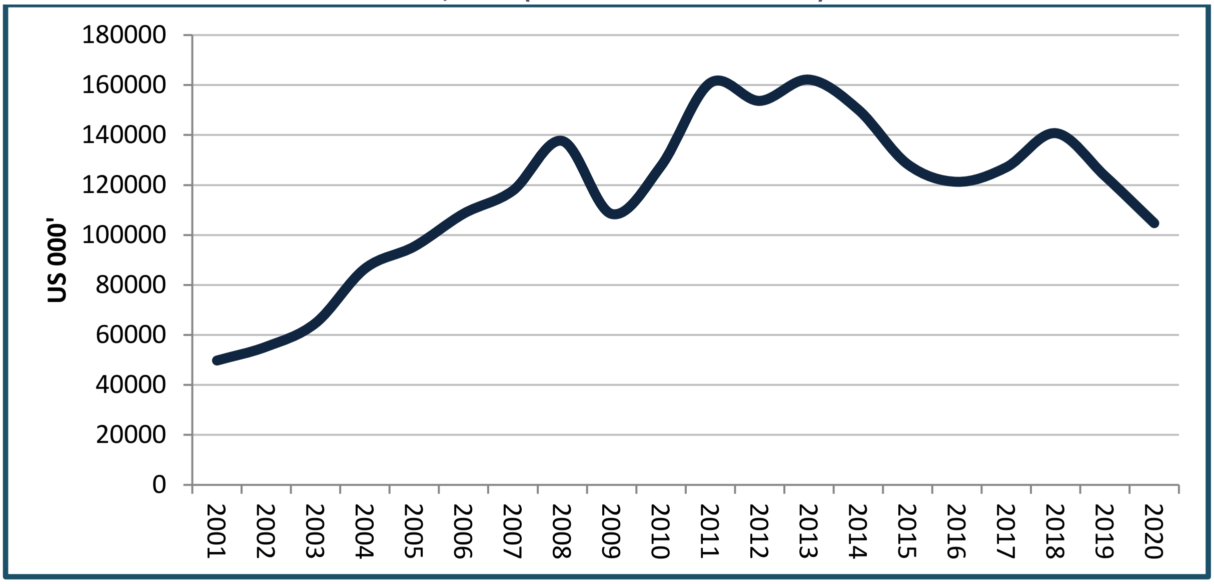


Source: Authors, based on data from Trade Map, 2021.

Imports of liquid meters and measuring flow, level, pressure equipment

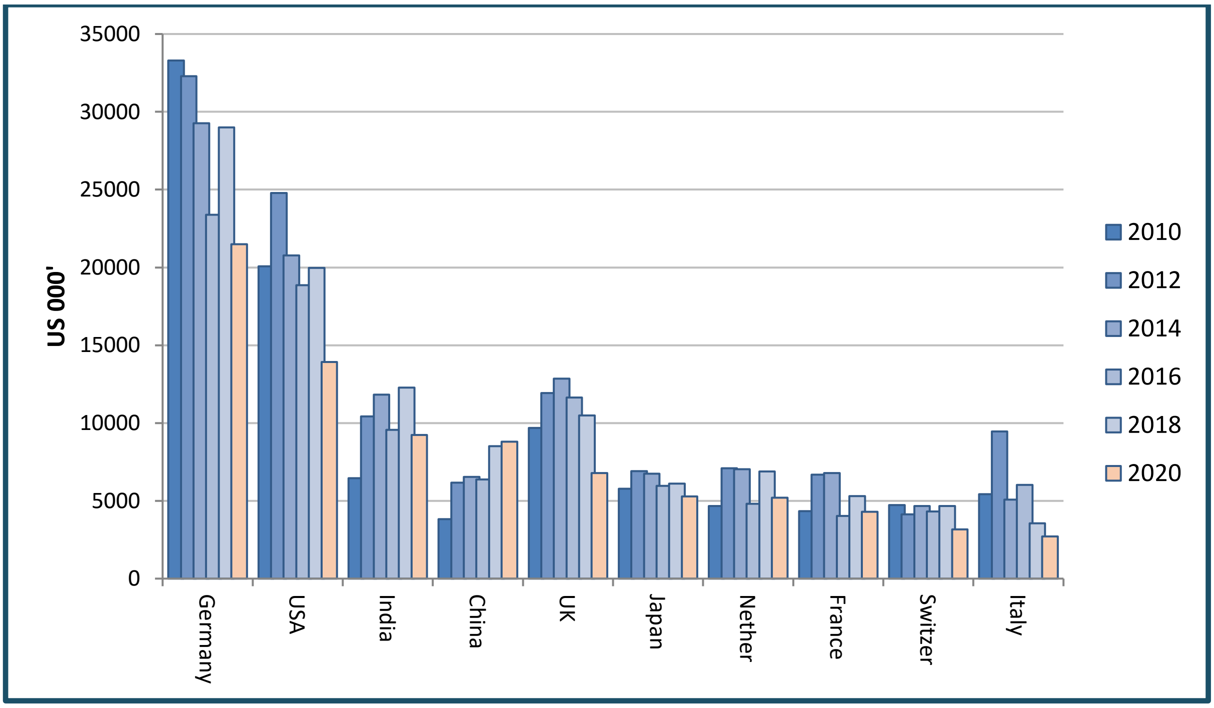
The graph below illustrates imports of liquid meters and measuring apparatus. It displays a general increase in imports between 2001 and 2013. From 2014 to 2020, imports have been on a decline. Imports have mainly emanated from Germany, the US, India and China.

Figure 59: South Africa's imports of liquid meters, measuring instruments for pressure, flow, level (HS 902820 and HS 9026)



Source: Authors, based on data from Trade Map, 2021.

Figure 60: Top 10 Exporters to South Africa of liquid meters and measuring instruments (HS 902820 and 9026)

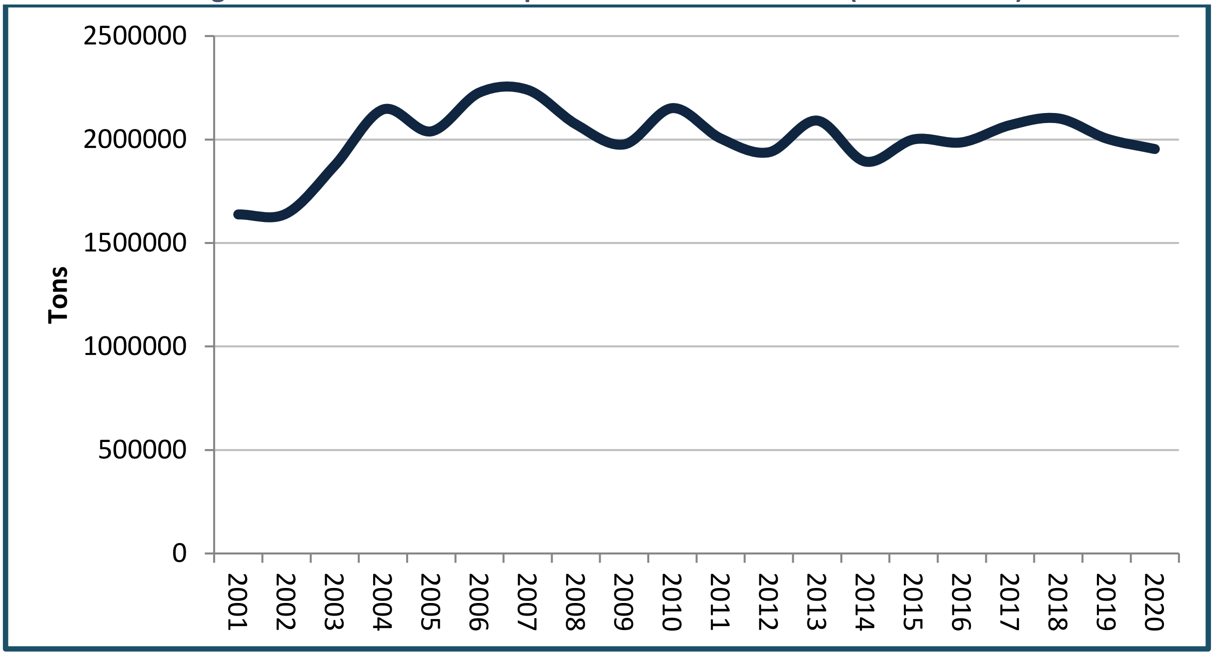


Source: Authors, based on data from Trade Map, 2021.

4.3.2.2 Water and wastewater purification

The graph below highlights that imports of various types of chemicals for water treatment and purification have remained quite steady over the last decade, averaging about two million tons. Imports have largely emanated from the European Union (EU), the US, China and, for ammonia, Trinidad and Tobago and Algeria.

Figure 61: South Africa's imports of various chemicals (HS 25 and 28)



Source: Authors, based on data from Trade Map, 2021.

Table 24: Leading exporters to South Africa of selected chemicals

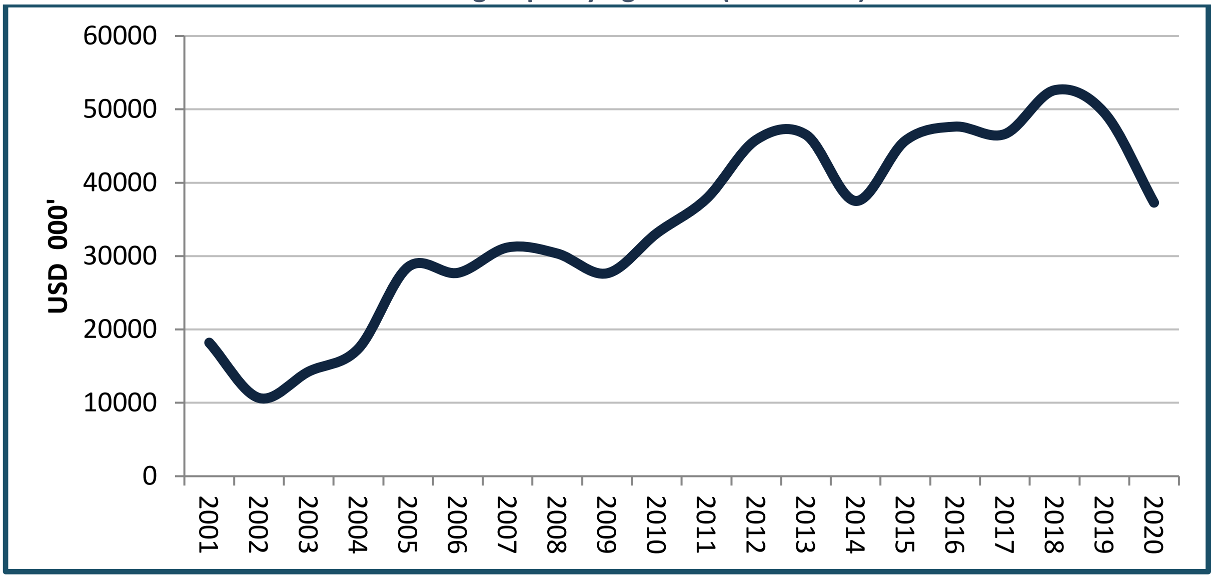
HS2522 LIME	HS 2818 ALUMINIUM OXIDE; ALUMINIUM HYDROXIDE	HS2815 CAUSTIC SODA	HS2814 AMMONIA, ANHYDROUS OR IN AQUEOUS SOLUTION
Portugal	Australia	United States	Trinidad and Tobago
Poland	China	Belgium	Algeria
Germany	Germany	China	China
Romania	United States	Indonesia	Argentina
Slovakia	Turkey	Japan	Zambia
Thailand	France	Netherlands	Germany
China	Brazil	India	Spain
Malaysia	India	Qatar	United Kingdom
Belgium	United Kingdom	Korea,	United States
United States	Slovenia	Iran,	Brazil
	Netherlands	France	Denmark
		Italy	

Source: Authors, based on data from Trade Map, 2021.

Imports of machinery and apparatus for water purification and filtering

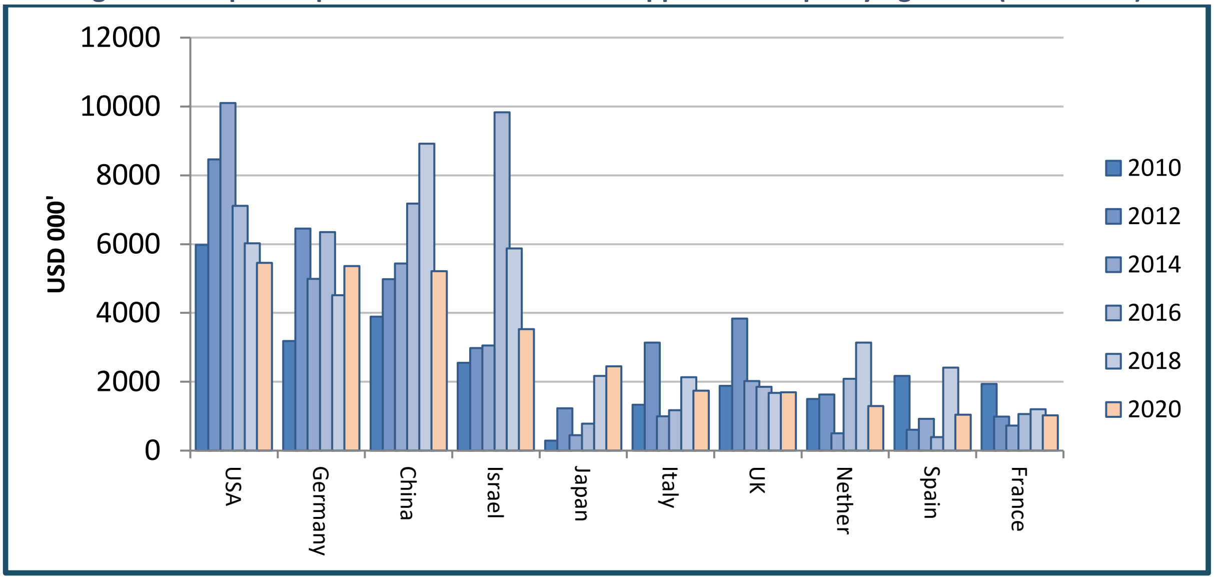
Imports of apparatus for filtering water were on the rise from 2002 to 2019. Since then, imports have showed a declining trend. Imports have largely emanated from the EU, China and the US.

Figure 62: South Africa's imports of machinery and apparatus for filtering or purifying water (HS 842121)



Source: Authors, based on data from Trade Map, 2021.

Figure 63: Top 10 Exporters to South Africa of apparatus for purifying water (HS 842121)



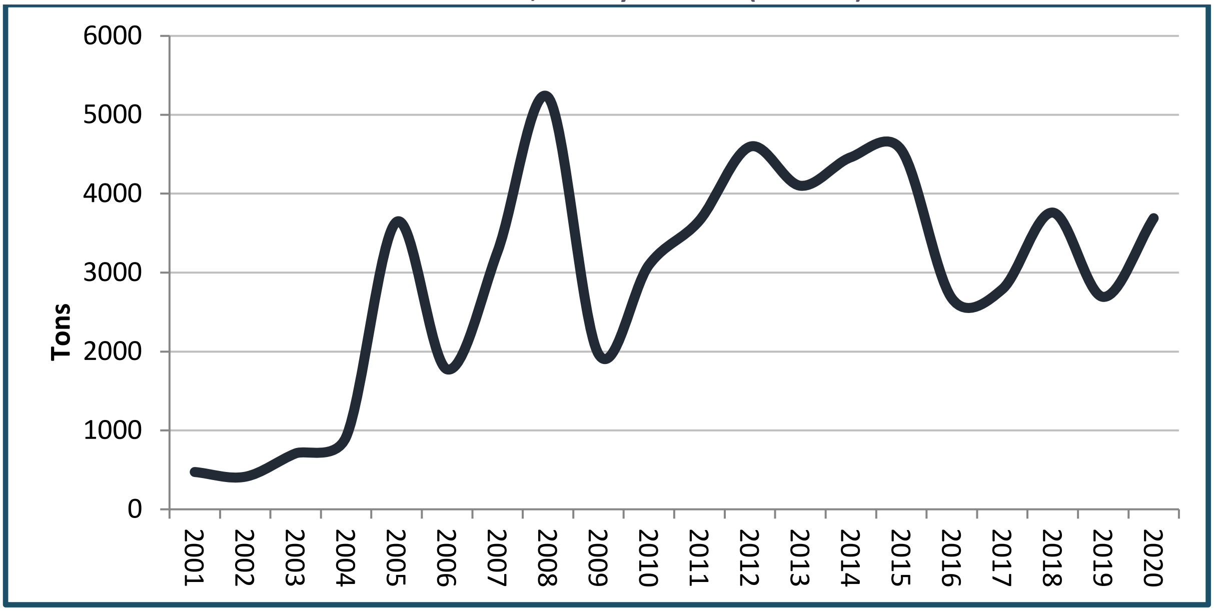
Source: Authors, based on data from Trade Map, 2021.

4.3.2.3 Water storage equipment

Imports of storage equipment: Iron and steel

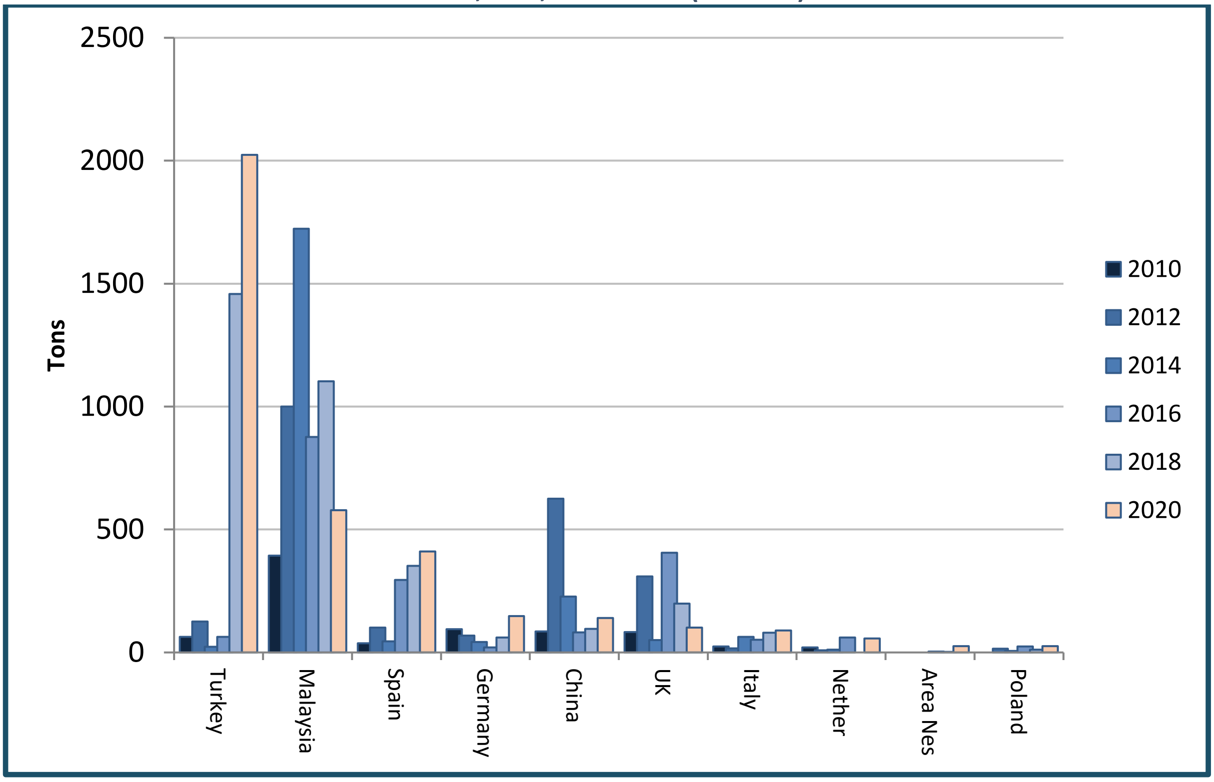
The graph below shows the volatility of imports of iron and steel reservoirs, tanks, vats and containers. Since 2019, imports have been on the rise to 3 600 tons. Imports have largely originated from the EU, Malaysia and China.

Figure 64: South Africa's imports of reservoirs, tanks, vats and similar containers, of iron or steel, for any material (HS 7309)



Source: Authors, based on data from Trade Map, 2021.

Figure 65: Top 10 Exporters to South Africa of iron and steel reservoirs, tanks, vats, containers (HS 7309)

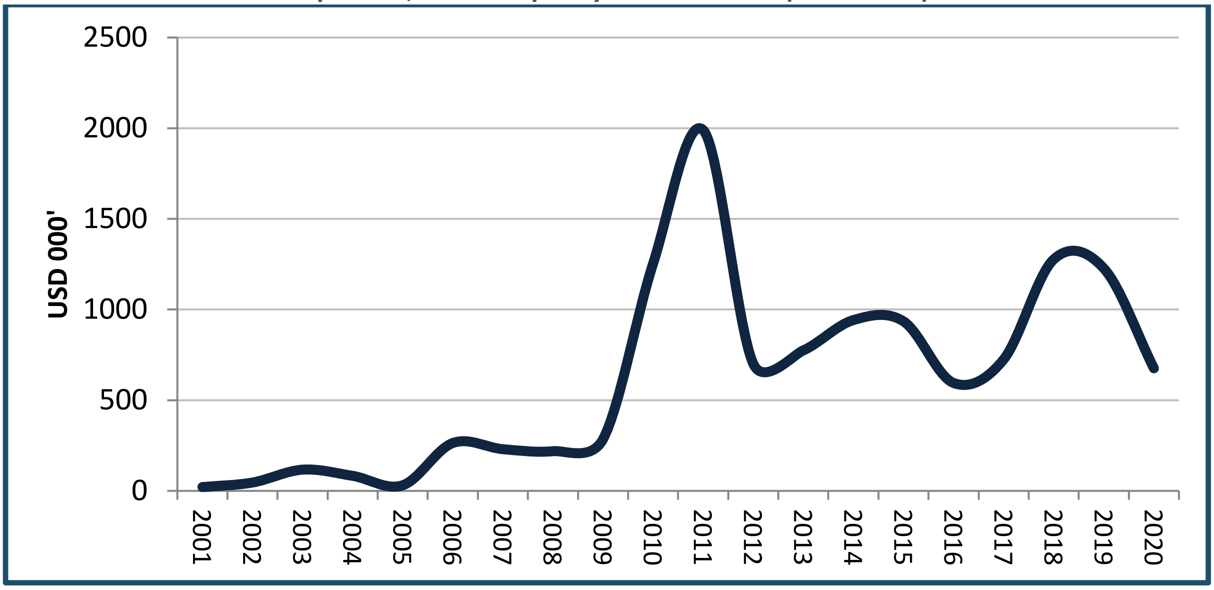


Source: Authors, based on data from Trade Map, 2021.

Imports of storage equipment: plastic

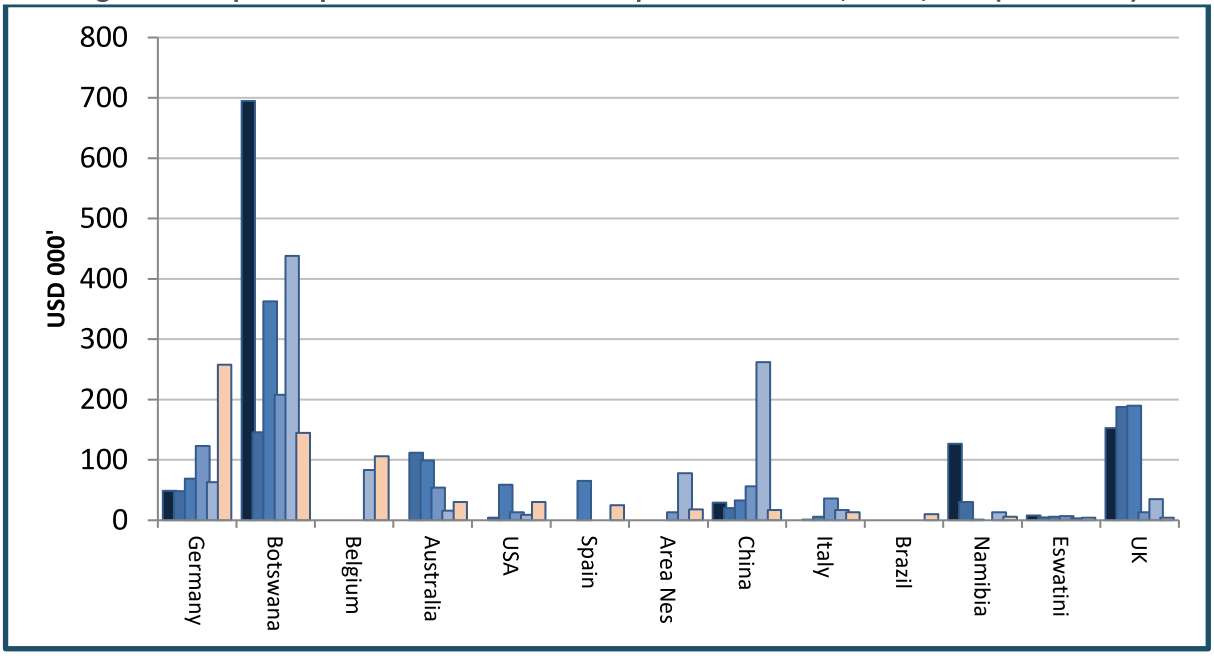
Imports of plastic reservoirs, tanks and vats (graph below) rose sharply from 2008 to 2011 before taking a plunge until 2012. Although there was a slight increase from 2016 to 2018, imports have been on the decline.

Figure 66: South Africa's imports of reservoirs, tanks, vats and similar containers, of plastics, with a capacity of > 300 litres (HS 392510)



Source: Authors, based on data from Trade Map, 2021.

Figure 67: Top 10 Exporters to South Africa of plastic reservoirs, tanks, vats (HS 392510)

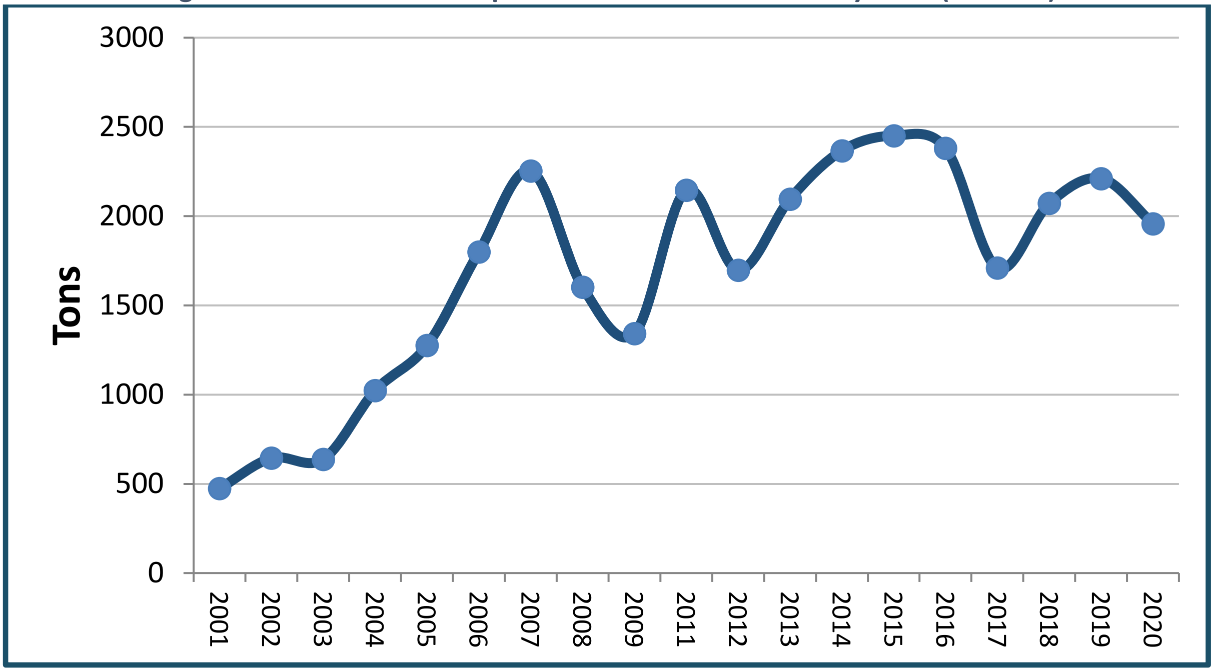


Source: Authors, based on data from Trade Map, 2021.

4.3.2.4 Sanitation ware

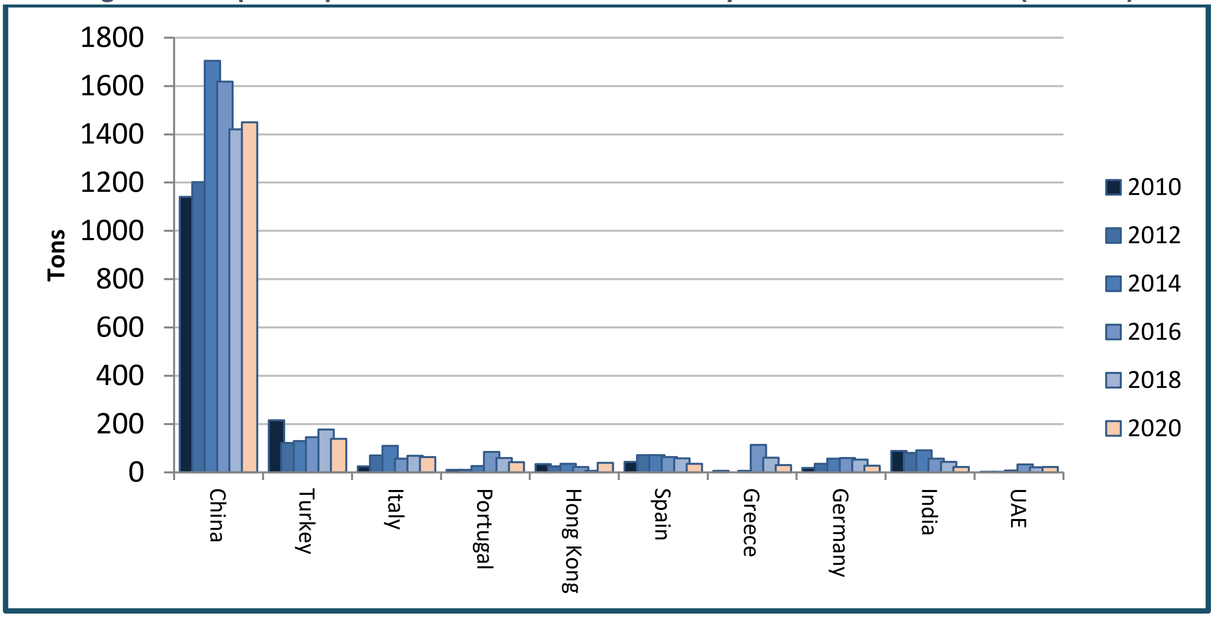
The graph below shows imports of iron and steel sanitary ware grew from a base of 500 tons in 2001 to 2254 in 2007. Imports faced some volatility between 2007 and 2012, before rising again for the next four years. Since 2019, imports have declined. Imports have largely emanated from China and the EU.

Figure 68: South Africa's imports of iron and steel sanitary ware (HS 7324)



Source: Authors, based on data from Trade Map, 2021.

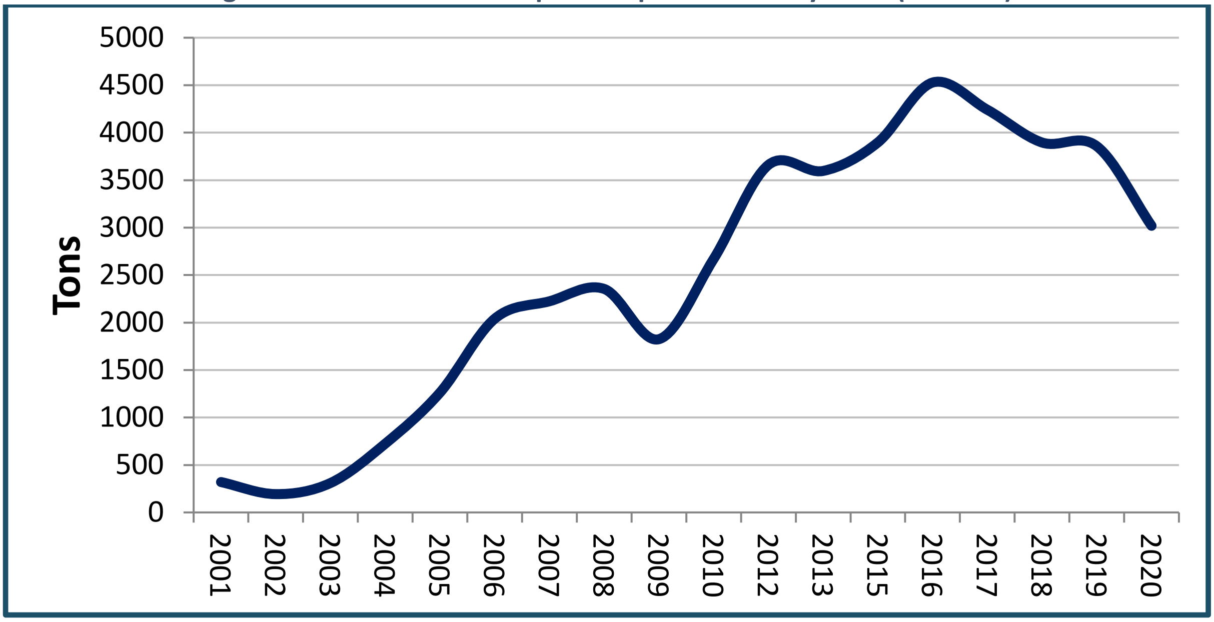
Figure 69: Top 10 Exporters to South Africa of sanitary ware of iron and steel (HS 7324)



Source: Authors, based on Trade Map, 2021.

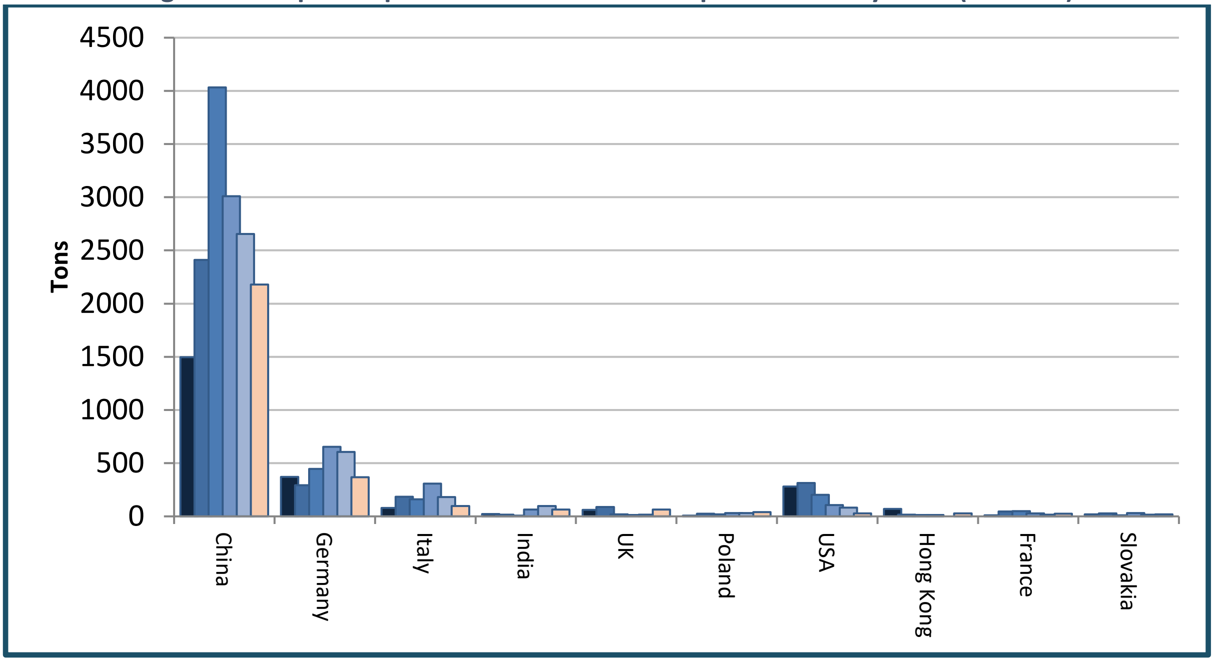
The graph below illustrates that import of plastic baths, shower baths, sinks and washbasins, bidets, lavatory pans, flushing cisterns and similar sanitary ware, lavatory seats and covers rose between 2001 and 2016 from 320 tons to 4 500 tons. Since then, imports have declined and, in 2020, South Africa imported 3 000 tons. Imports have primarily originated from China and the EU.

Figure 70: South Africa's imports of plastic sanitary ware (HS 3922)



Source: Authors, based on data from Trade Map, 2021.

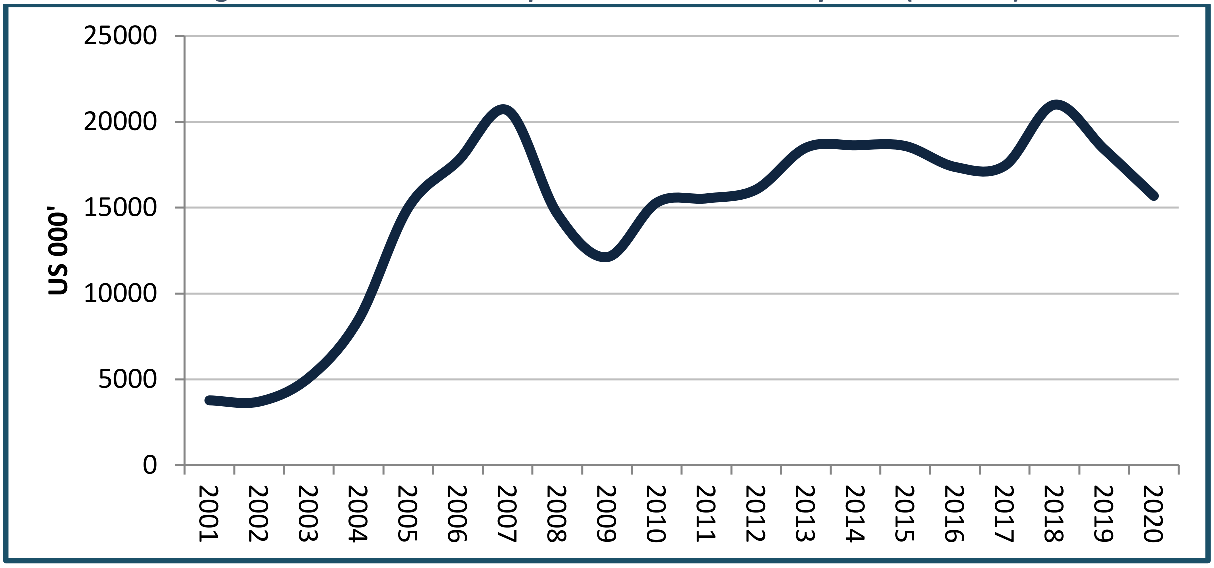
Figure 71: Top 10 Exporters to South Africa of plastic sanitary ware (HS 3922)



Source: Authors, based on data from Trade Map, 2021.

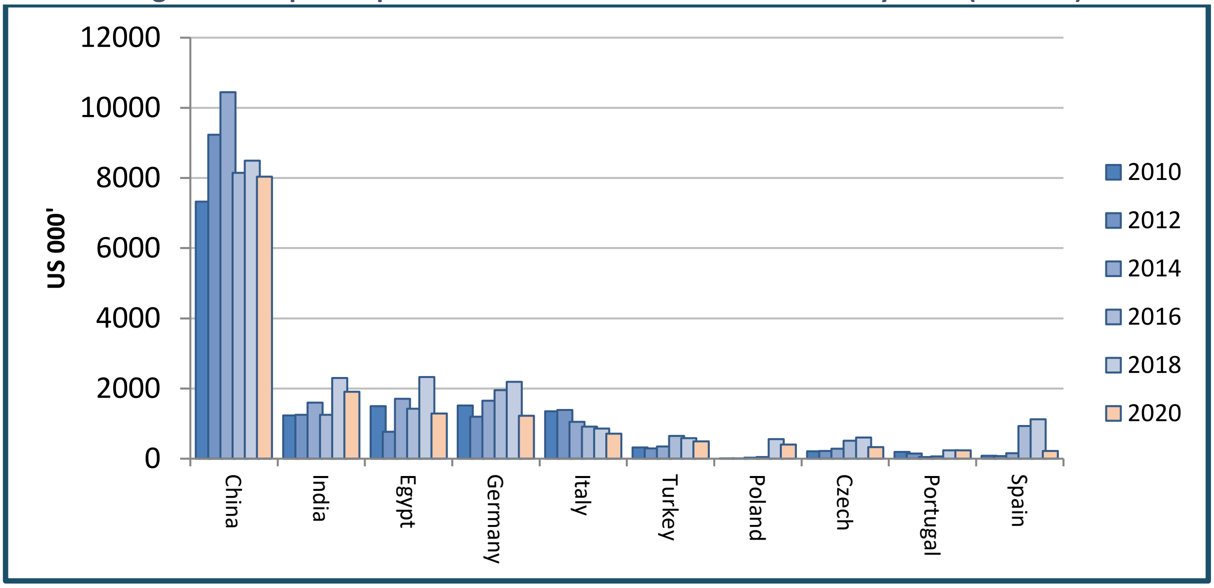
The graph below highlights imports of ceramic ware, including sinks washbasins, washbasin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures. Imports rose from 2001 to 2008 before dropping in 2009. Since 2009, imports increased from a value of US$12 000 to US$20 000 in 2019. Since 2019, imports have shown a declining trend. Imports have largely emanated from China, Indian, and the EU.

Figure 72: South Africa's imports of ceramic sanitary ware (HS 6010)



Source: Authors, based on data from Trade Map, 2021.

Figure 73: Top 10 exporters to South Africa of ceramic sanitary ware (HS 6010)



Source: Authors, based on data from Trade Map, 2021.

4.3.3 Current Master Plan actions to support exports of plastics, steel, chemicals

Relevant interventions from the Plastics and Steel Master Plans are listed below. No intervention specifically relevant to the water and sanitation industry value chain were identified in the Chemicals Master Plan.

Plastics Master Plan

1. The dtic, Plastics SA and SARS have created a platform mainly to deal with under-invoicing, mis-declaration and dumping.
2. The platform, similar to the structure established for clothing and textiles (SABS, SARS, NRCS and the South African Police Service), is also expected deal with sub-standard imports.
3. On the question of cheap imports, the master plan is looking at safeguarding the industry through adjusting the tariff.

Steel Master Plan

1. A Compliance Investigation Unit, which will support SARS, the dtic, the Auditor General and the National Prosecution Authority to enforce the trade measures on imports and the use of local production for designated products and to support local content verification, was recommended and is in process.
2. SARS has agreed to prioritise steel industry imports for investigation and enforcement, especially for under-invoicing and mis-declaration of goods. Discussions have taken place in the Inter-Agency Task Team concerning the level of resources available. SARS has been requested to set out what assistance it requires from the industry and how that can best be delivered. The industry will then seek to conclude a memorandum of agreement with SARS to support its activities.
3. The dtic is investigating the feasibility of asking SARS to provide information on imports of goods according to finer divisions of HS codes. Criminal prosecutions are important: penalties for illicit imports and exports are not regarded as adequate by the industry. The industry will have to support the SARS and the National Prosecuting Authority in providing information about unlawful activities and in preparing the dockets.
4. The dtic is investigating a proposal by the industry for a pre-surveillance system, whereby import permits are required and will be issued automatically. This will allow the industry to track imports and to plan for import replacement.
5. The industry has submitted proposals for additional HS codes to be subject to tariffs and for some tariffs to be raised to the bound rate. Specific problems are raised by the use of the code for alloy steel to import steel with minimal boron content exempt from tariffs and the use of the "other" category to cover a range of products inappropriately. ITAC is investigating these, and industry must provide information to ITAC on products where "other" categories require investigation.
6. ITAC was directed to conduct an analysis of the efficacy of the tariff structure across the value chain. Reciprocal commitments must be strengthened and monitored when tariff support is granted to minimise the cost-raising effect of import tariffs, especially on the downstream steel industry (e.g. flat steel weighted price basket). Impact assessments on tariff support provided to both upstream and downstream steel products should be conducted with a view to providing fact-based inputs to inform policy and not only unsubstantiated claims from the industry. ITAC will embark on the analysis of the tariff regime for industries targeted for a "buy local programme" with a view to identifying opportunities for import replacement and tariff support.

4.3.4 Current state of actions to curb imports: national strategy

The COVID-19 pandemic has disrupted global supply chains and trade, causing countries, including South Africa, to return to conversations about increased import localisation as a way to strengthen their industrial base. The South African government supports the localisation of goods to stimulate economic development.

On 21 May 2021, the dtic issued its Policy Statement on Localisation for Jobs and Industrial Growth. This notes that the reliance on imports is a challenge for the South African economy as it makes businesses and consumers vulnerable to supply shocks in other parts of the world, amply demonstrated during the COVID-19 pandemic. Reliance on imports also means longer lead times to get the necessary goods, and results in South African businesses being price-takers in international markets. It undermines the country's strategic autonomy, and means fewer jobs are created locally.

The dtic also issued a statement on 20 May 2021 on Trade Policy for Industrial Development and Employment Growth. The statement notes: "High levels of manufactured imports and a comparatively high import-propensity underscore not only the lack of diversified domestic production but also, if given appropriate focus and support, the possibilities for domestic industrial expansion". The statement aims to reduce imports in favour of upgrading value-added, labour-absorbing industrial production and diversifying the economy away from an overreliance on commodities and non-tradable services.

The department, in its 2020 annual report, notes that it aims to increase its localisation target to 75%. Proudly SA is working with the Consumer Goods Council, the Manufacturing Circle and the dtic to approach all retailers to consider an "import replacement" initiative for locally-made products as well as a localisation drive whereby shelf space will be ring-fenced in favour of locally made products and services. In addition, the dtic has a localisation and designation programme to drive import replacement as well as funding quarterly studies (conducted by TIPS). These reports are the Import Localisation and Supply Chain Disruption studies that identify: the list of imports, whether imported goods have previously been manufactured locally or not, and whether South Africa could possibly manufacture them going forward.

4.4 Promoting export of local products/technologies

This section provides an analysis of the contribution of water and sanitation exports to overall exports, the state of exports in water and sanitation goods showing South Africa's position in the world, drivers for exports and current interventions by the Chemical, Plastics and Iron and Steel Master Plans to promote exports. Both export and import data has been combined in graphs to assess the trade balance.

Government's Re-imagined Industrial Strategy, through master plans, has set an objective to drive exports for economic development to:

- Contribute to economic development;
- Reduce the overall trade balance and provide a source of foreign income;
- Help drive industry expansion though upgrading and boosting competitiveness;
- Provide fundamental products for South Africa, SADC and Africa to build (water and sanitation) infrastructure; and*
- Help achieve the Sustainable Development Goals (SDGs), including SDG 6 of providing clean water and sanitation for all.

The following table illustrates the type of water and sanitation goods exported by South Africa.

Table 25: Main types of water and sanitation goods exported by South Africa

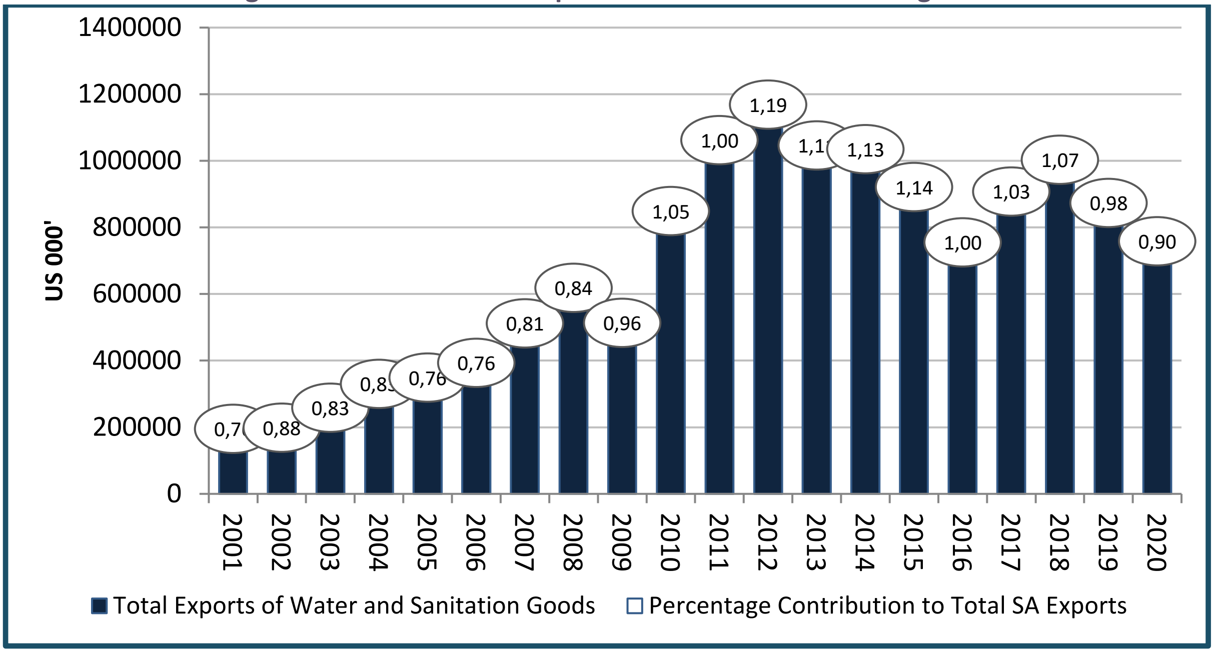
Water abstraction, conveyance and collection	1. Plastic pipes 2. Iron and steel pipes 3. Valves 4. Pumps
Water and Waste Water Purification	1. Chemicals 2. Filtering and purification
Water storage	1. Plastics reservoirs and tanks 2. Iron and steel reservoirs and tanks
Sanitation Ware	1. Iron and steel basins, baths, 2. Plastics lavatory seats, covers, bidets, lavatory pans, flushing cisterns, shower baths, wash basins 3. Ceramic sinks, washbasins, washbasin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures
Liquid meters and Water Measurement instruments	1. Instruments and apparatus for measuring or checking the flow, level, pressure 2. Liquid meters

Source: Authors.

4.4.1 Contribution of exports of water and sanitation goods to South Africa's exports

The graph below illustrates that total exports of water and sanitation goods contributed 0.8% or US$195 million to South Africa's total exports in 2001. Exports rose sharply to a peak contribution of 1.2% or US$1.1 billion in 2012. Exports of water and sanitation goods saw a decline from 2013 to 2016. There was a slight peak to 2018, and these exports contributed 0.90 % to total exports in 2020.

Figure 74: South Africa's exports of water and sanitation goods

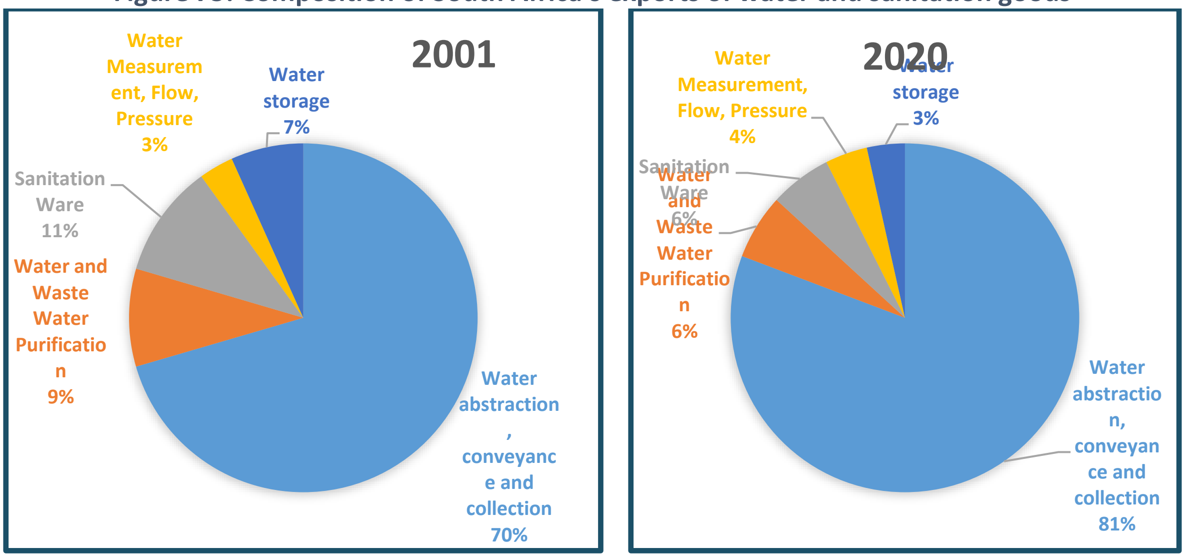


Source: Authors, based on data from Trade Map, 2021.

4.4.2 Composition of water and sanitation exports

The two figures below illustrate that the most exported group of products from 2001 to 2020 were water abstraction, conveyance and collection products (pipes, pumps, valves). An 11% growth in these goods is seen between 2001 and 2020, while all other exports have generally shrunk in the past two decades.

Figure 75: Composition of South Africa's exports of water and sanitation goods

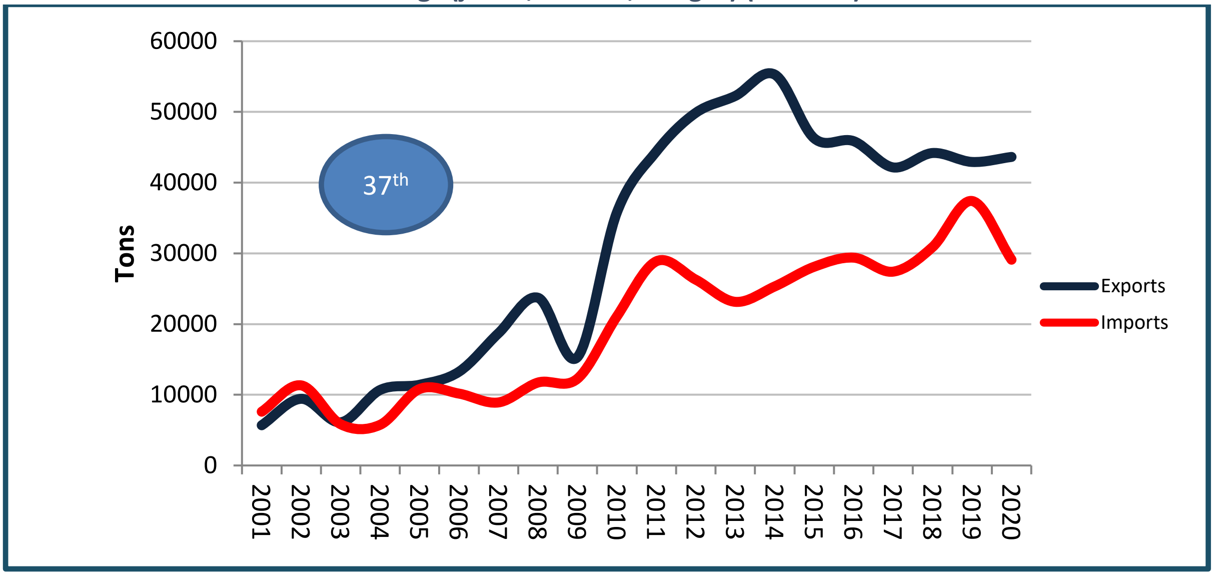


Source: Authors, based on data from Trade Map, 2021.

Exports of water abstraction, conveyance and collection

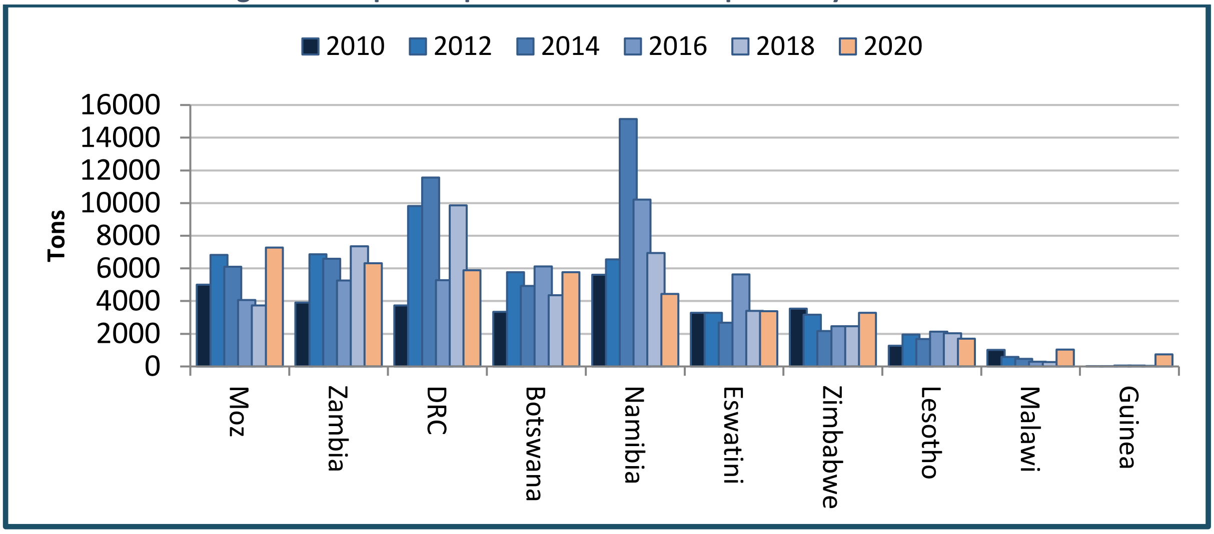
Despite the challenges facing the plastics industry, there is a positive trade a balance in HS 3917 of plastics, tubes, pipes, hoses and fittings. South Africa is the 37th largest exporter globally of the aforementioned goods. Exports rose exponentially from 5 600 tons in 2001 to 55 000 tons in 2011. Since then, exports have been stable with average exports of 44 000 tons. Exports of this product mainly go to the SADC region.

Figure 76: South Africa's Imports and Exports of Plastic Tubes, Pipes, Hoses, Fittings (joints, elbows, flanges) (HS 3917)



Source: Authors, based on data from Trade Map, 2021.

Figure 77: Top 10 Importers of HS 3917 exported by South Africa

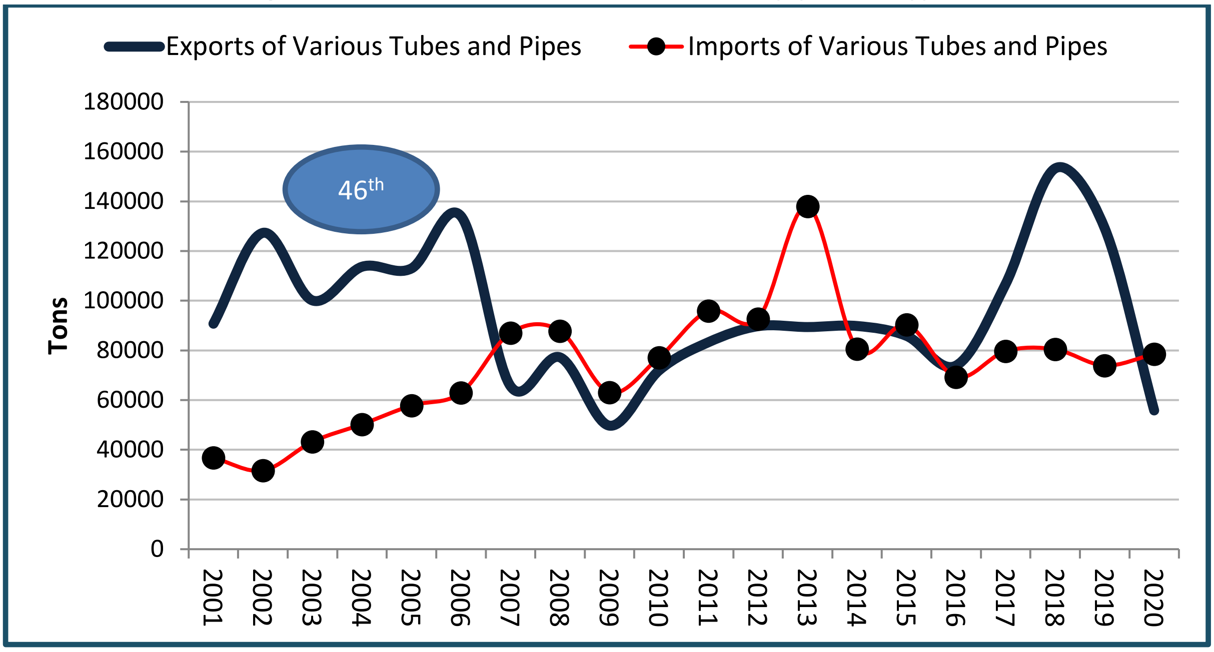


Source: Authors, based on data from Trade Map, 2021.

Trade in iron and steel pipes and tubes

The graph below illustrates that South Africa is the 46th largest exporter globally of iron and steel pipes. These goods fared well between 2001 and 2006 before plunging from 2008 to 2009. Exports remained slightly stable for the next seven years. Exports rose sharply to 129 000 tons (the highest exports in the last two decades). However, with challenges facing the industry in the last couple of years, exports dropped by nearly half to 56 000 tons in 2020. Exports of major categories of pipes mainly go to the SADC region with some deep-sea exports to the US and Australia.

Figure 78: South Africa's trade in tubes and pipes (21 Types)



Source: Authors, based on data from Trade Map, 2021.

Table 26: Main destination of South Africa's exports of tubes and pipes

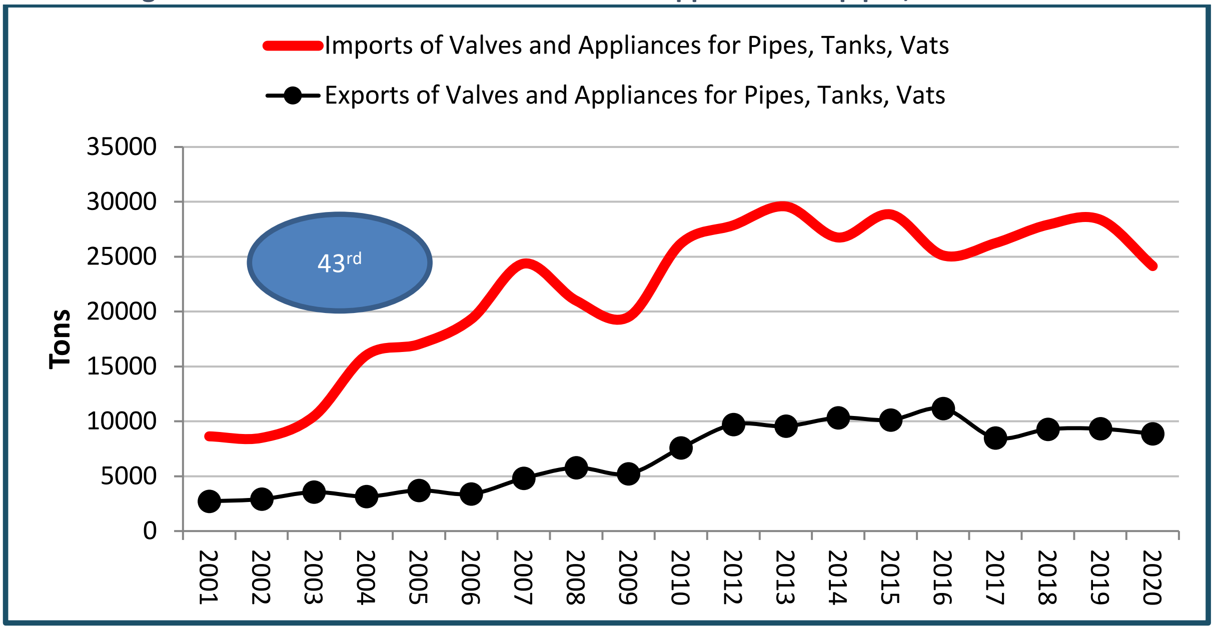
7303 (CAST IRON)	7304 SEAMLESS	7305 (CROSS SECTION)	7306 OPEN SEAM	7307 FITTINGS
Botswana Namibia Eswatini Ship stores and bunkers Lesotho Mauritius Australia Mozambique Madagascar Democratic Republic of the Congo Zimbabwe Sierra Leone	Botswana Namibia Democratic Republic of the Congo United States of America Zambia Mozambique Zimbabwe Eswatini Côte d'Ivoire Netherlands Singapore	Mozambique Zambia Lesotho Eswatini Canada United States of America Guinea Namibia Botswana Democratic Republic of the Congo Zimbabwe	Zimbabwe Botswana Namibia Zambia Democratic Republic of the Congo Mozambique Eswatini Latvia Lesotho Malawi Senegal	Democratic Republic of the Congo Mozambique Namibia Zimbabwe Botswana Zambia Eswatini Qatar Lesotho Angola Ghana

Source: Authors, based on data from Trade Map, 2021.

Trade in various valves and parts

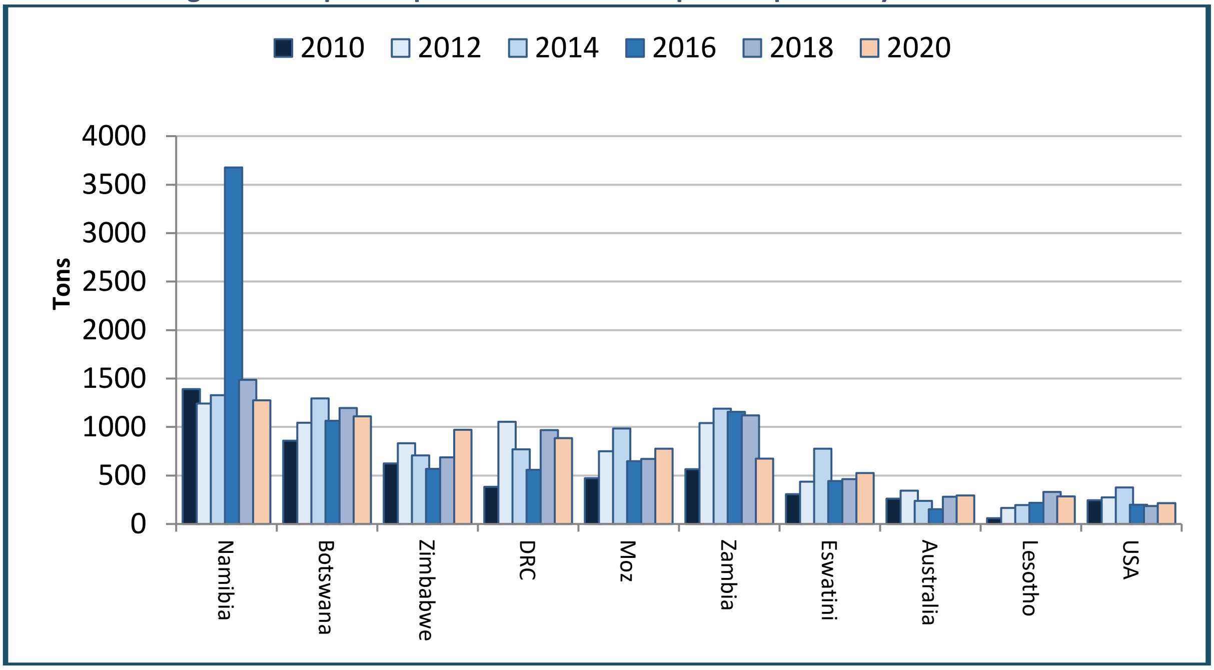
The graph below shows a negative trade balance in the trade of various valves and parts. Despite this, South Africa is the 43rd largest exporter globally of valves and parts. Exports of valves grew from 2 700 tons in 2001 to 11 000 tons in 2016. Since then, exports have declined with only 8 800 tons exported in 2020. The closure of foundries has affected competitiveness of exports valves. Current exports mainly go to the SADC region with other exports going to the US and Australia.

Figure 79: South Africa's trade in valves and appliances for pipes, tanks and vats



Source: Authors, based on data from Trade Map, 2021.

Figure 80: Top 10 importers of valves and parts exported by South Africa

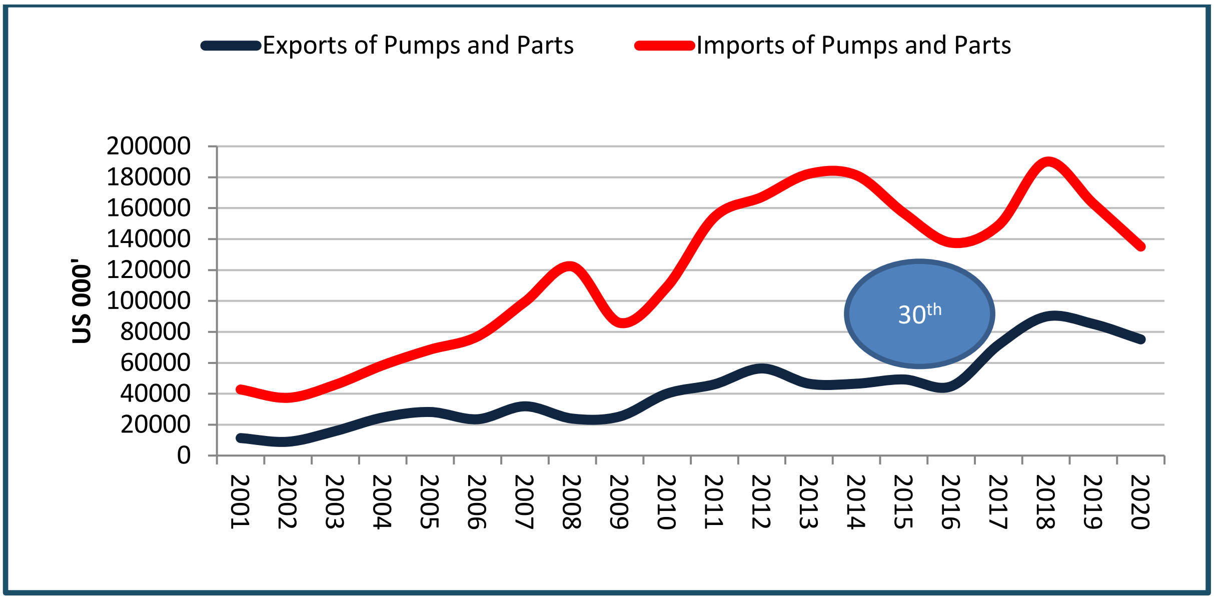


Source: Authors, based on data from Trade Map, 2021.

Trade in various pumps

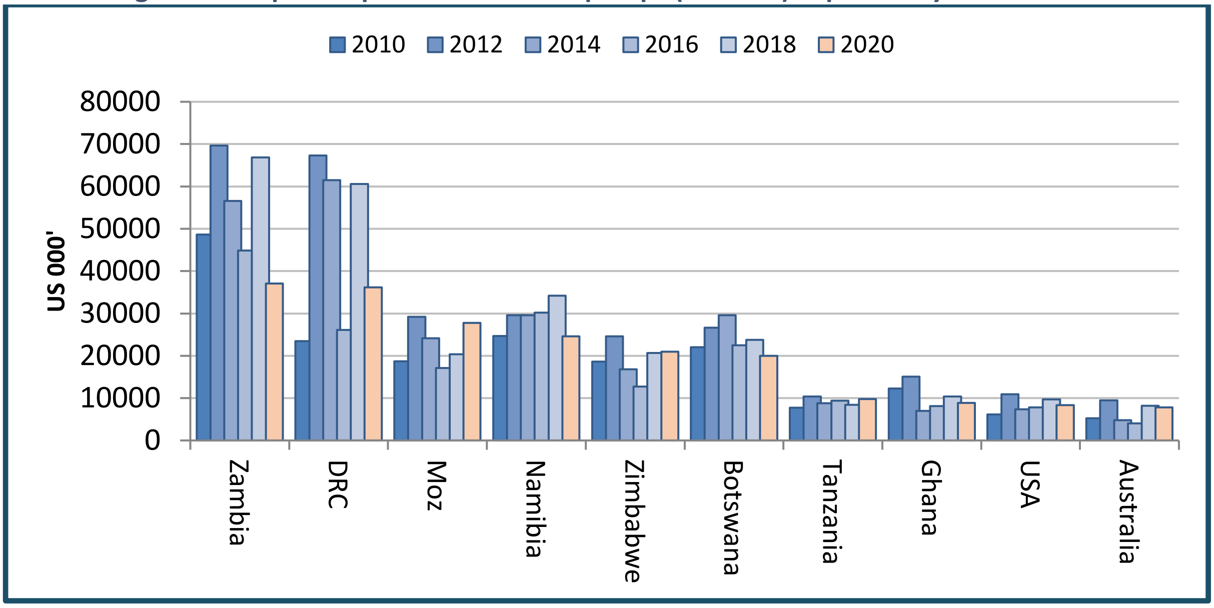
The graph below illustrates a negative trade balance in various pumps (centrifugal pump and the reciprocal and rotary positive displacement pump). South Africa is the 30th largest exporter globally of pumps. In US dollars, exports grew steadily from US$11 million to US$89 million in 2018. Exports then begun to decline with only US$75 million exported in 2020. Similar to other water and sanitation goods, exports are largely destined for SADC with deep-sea exports to the US and Australia.

Figure 81: South Africa's exports of various pumps (HS 8413)



Source: Authors, based on data from Trade Map, 2021.

Figure 82: Top 10 importers of various pumps (HS 8413) exported by South Africa

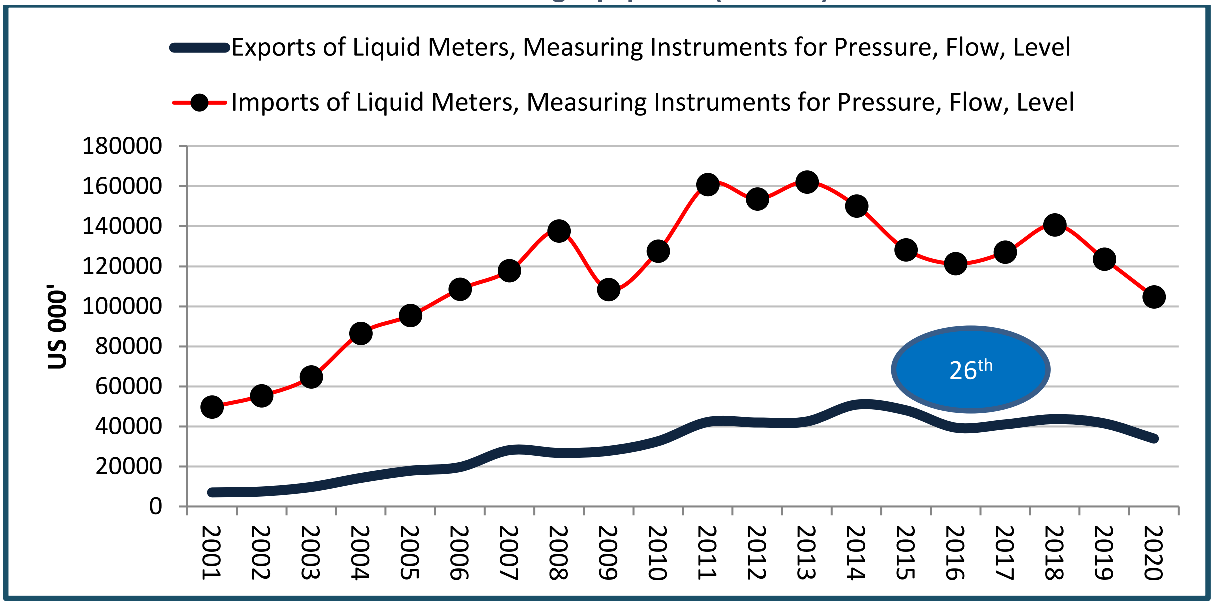


Source: Authors, based on data from Trade Map, 2021.

Exports liquid meters and measuring flow, level, pressure equipment

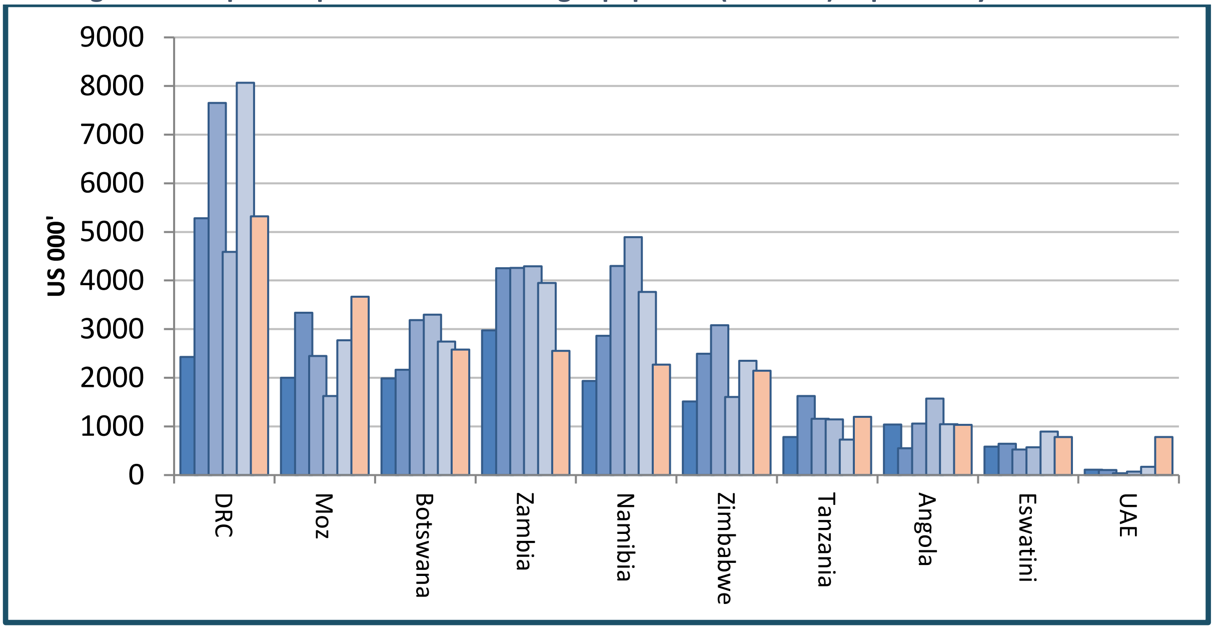
The graph below illustrates a negative trade balance in liquid meters. However, despite that fact, South Africa is the 26th exporter globally of liquid meters. Exports grew from a base of US$7 million in 2001 to US$50 million in 2014. Since then, exports have been showing a declining trend with only US$33 million exported in 2020. Exports are largely geared to SADC with some exports destined for the UAE that could be a potential market in future.

Figure 83: South Africa's exports of liquid meters (HS 902820) and measuring equipment (HS 9026)



Source: Authors, based on data from Trade Map, 2021.

Figure 84: Top 10 importers of measuring equipment (HS 9026) exported by South Africa



Source: Authors, based on data from Trade Map, 2021.

Water and wastewater purification

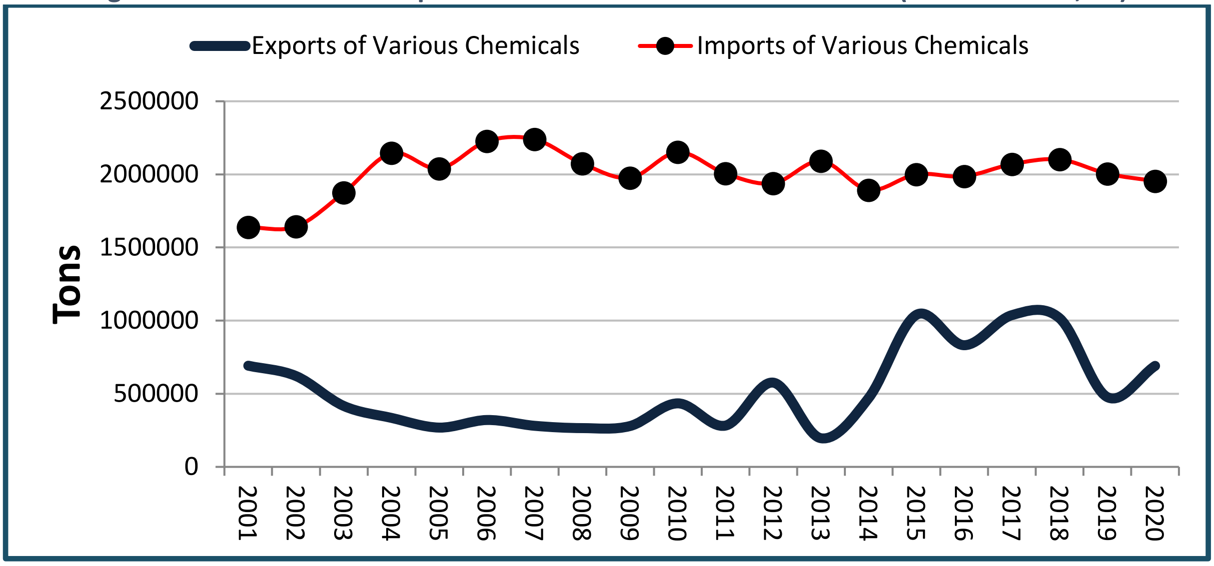
Many chemicals are used for water purification and wastewater treatment. Some of these are:

- Phosphinates, "hypophosphites", phosphonates "phosphites" and phosphates; polyphosphates
- Manganese oxides
- Ammonia, anhydrous or in aqueous solution
- Sodium hydroxide "caustic soda", potassium hydroxide "caustic potash"; peroxides of sodium
- Fluorine, chlorine, bromine and iodine
- Iron oxides and hydroxides
- Sulphites; thiosulphates
- Artificial corundum; aluminium oxide; aluminium hydroxide

- Hydroxide and peroxide of magnesium; oxides, hydroxides and peroxides, of strontium or barium
- Limestone flux; limestone and other calcareous stone
- Quicklime, slaked lime and hydraulic lime (excluding pure calcium oxide and calcium hydroxide)

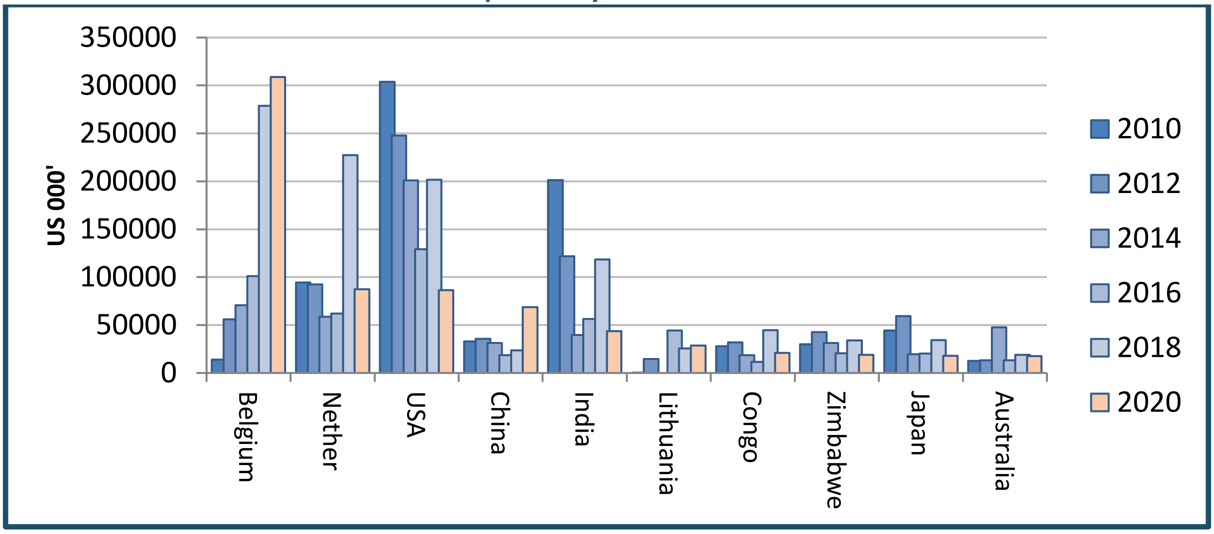
The graph below illustrates a negative trade balance in the aforementioned chemicals. Exports in 2001 ranged at 691 000 tons before declining to 279 000 tons in 2010. Exports recovered from 2014 with the highest recorded exports in the past 20 years. Exports declined from 2018 to 2019 but picked up again in 2020.

Figure 85: South Africa's exports of chemicals for water treatment (HS Various 25, 28)



Source: Authors, based on data from Trade Map, 2021.

Figure 86: Top 10 importers of chemicals for water treatment (HS Various 25, 28) exported by South Africa

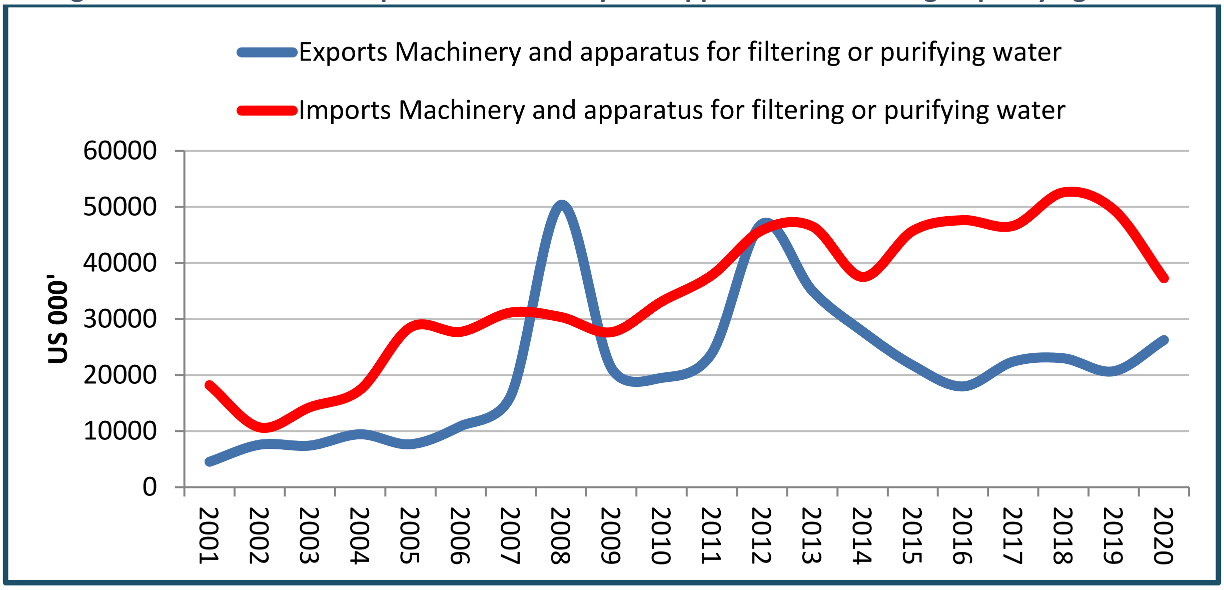


Source: Authors, based on data from Trade Map, 2021.

Trade in machinery and apparatus for water purification and filtering

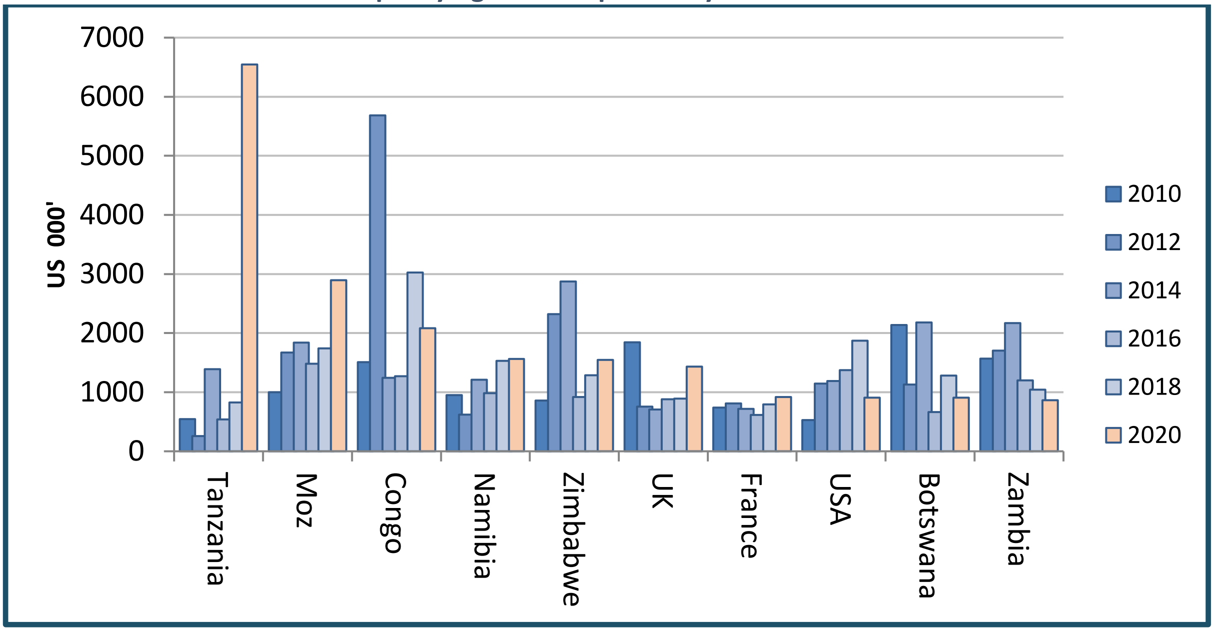
The graph below highlights that exports of apparatus for filtering or purifying water grew from 2001 to 2008, before experiencing a plunge during the global financial crisis. They recovered somewhat from 2011 to 2012. Since 2012, a huge drop in exports was experienced until 2019. From 2020, exports seem to be in the process of recovery. Exports are largely destined for SADC, with the US, UK and France featuring.

Figure 87: South Africa's exports of machinery and apparatus for filtering or purifying water



Source: Authors, based on data from Trade Map, 2021.

Figure 88: Top 10 importers of machinery and apparatus for filtering or purifying water exported by South Africa



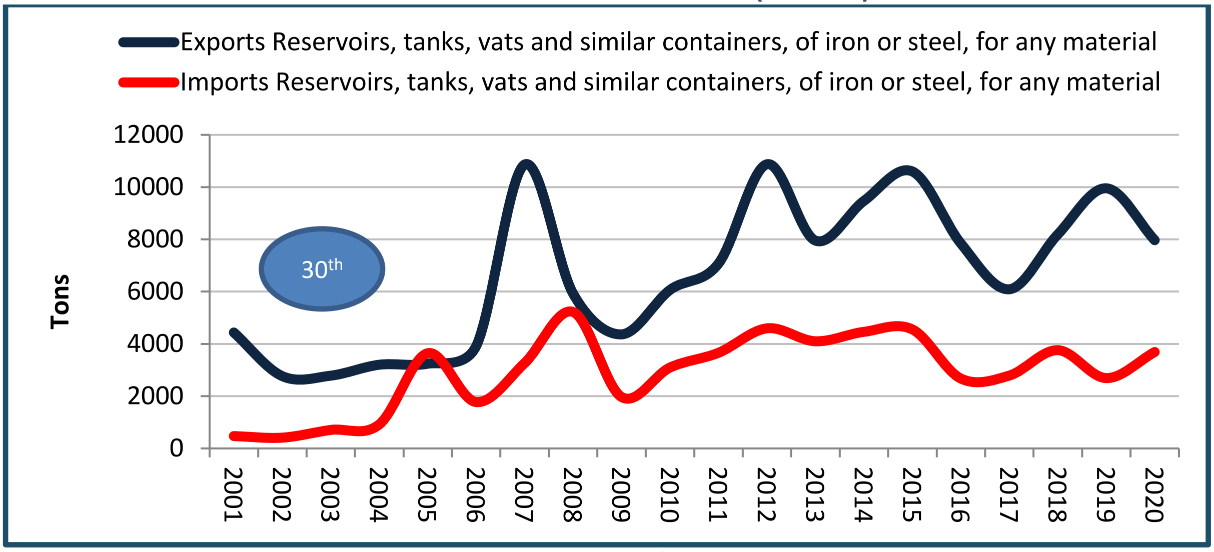
Source: Authors, based on data from Trade Map, 2021.

Water storage equipment

Trade of storage equipment: Iron and steel

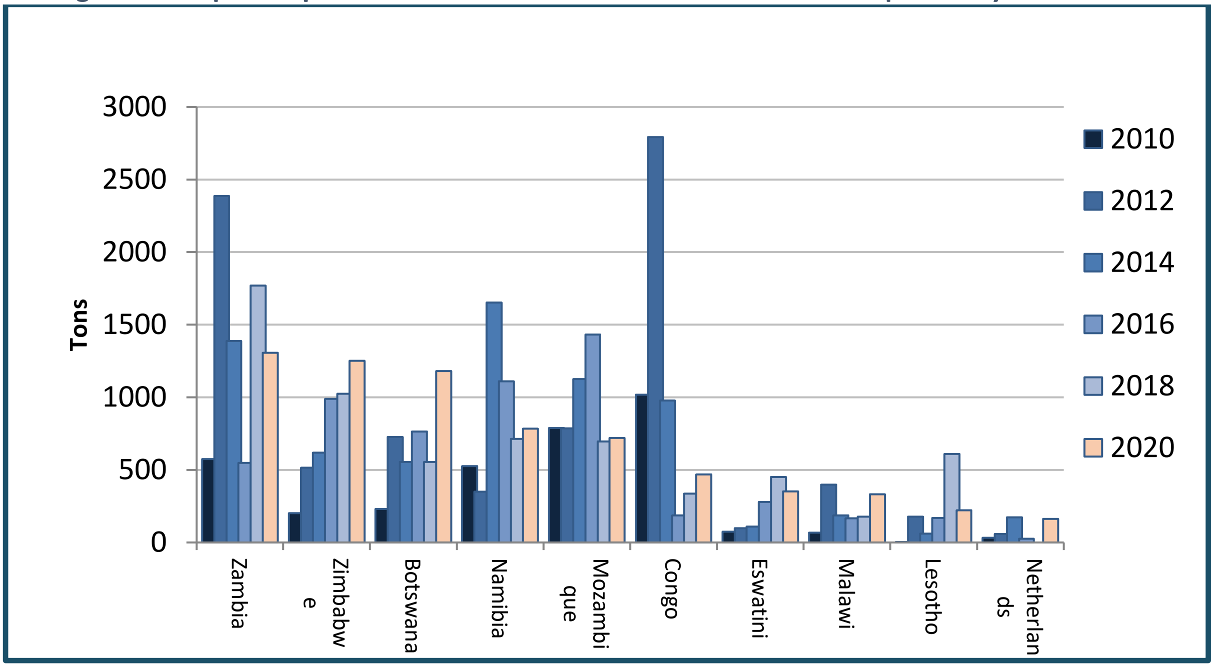
South Africa is the 30th exporter globally of iron and steel storage equipment. There has been a positive trade balance in this code despite volatile exports. There is a concern, however, with exports declining in 2019 to 2020. Exports are mainly destined for the SADC region with the exception of the Netherlands.

Figure 89: South Africa's exports of reservoirs, tanks, vats and similar containers of iron or steel (HS 7309)



Source: Authors, based on data from Trade Map, 2021.

Figure 90: Top 10 importers of iron and steel reservoirs and tanks exported by South Africa

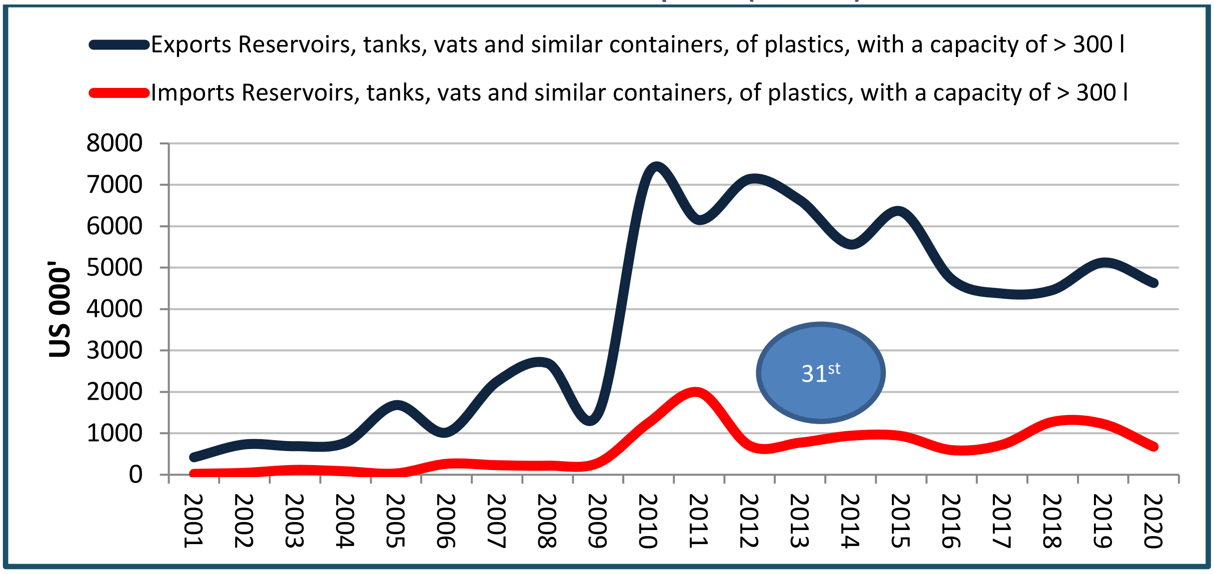


Source: Authors, based on data from Trade Map, 2021.

Trade of water storage equipment: plastic

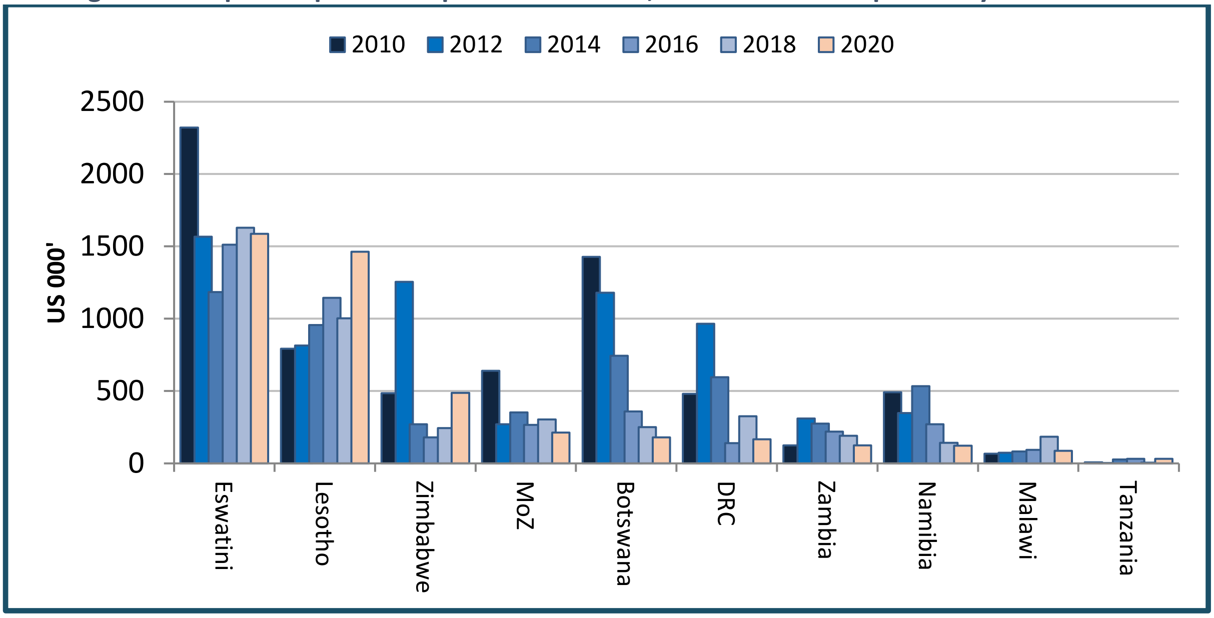
South Africa is the 31st exporter globally of plastic storage goods. The country has reported a positive trade balance in the last 20 years. Exports rose sharply from 2009 to 2010. Since then, exports have been on a decline. However, with the plastic master plan in place, exports are expected to recover in future. Exports are largely destined for the SADC region.

Figure 91: South Africa's exports of reservoirs, tanks, vats and similar containers of plastic (HS 7309)



Source: Authors, based on data from Trade Map, 2021.

Figure 92: Top 10 importers of plastic reservoirs, tanks and vats exported by South Africa



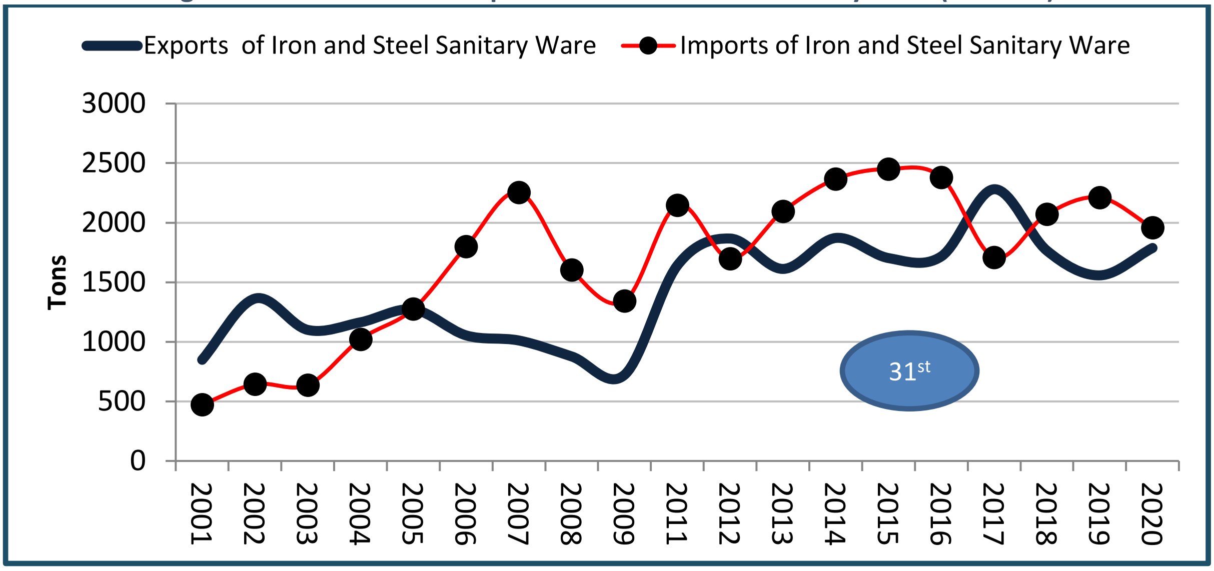
Source: Authors, based on data from Trade Map, 2021.

Sanitation ware

Trade of sanitation ware – iron and steel

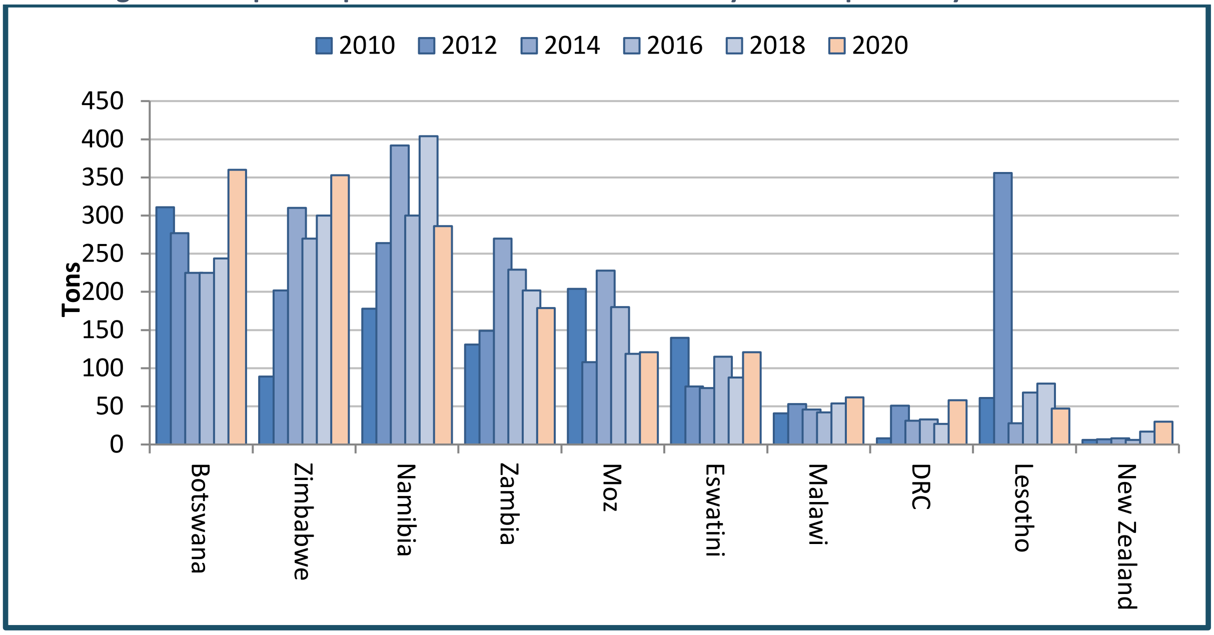
South Africa is the 31st exporter globally of iron and steel sanitary ware of sinks and washbasins, of stainless steel, sanitary ware, baths of steel sheet and baths of cast iron. Exports took a decline between 2002 and 2008. This was followed by a rise in exports until 2017. Although 2018 to 2019 saw a slight depression, exports are beginning to recover. Exports are mainly destined for the SADC region.

Figure 93: South Africa's exports of iron and steel sanitary ware (HS 7324)



Source: Authors, based on data from Trade Map, 2021.

Figure 94: Top 10 importers of iron and steel sanitary ware exported by South Africa



Source: Authors, based on data from Trade Map, 2021.

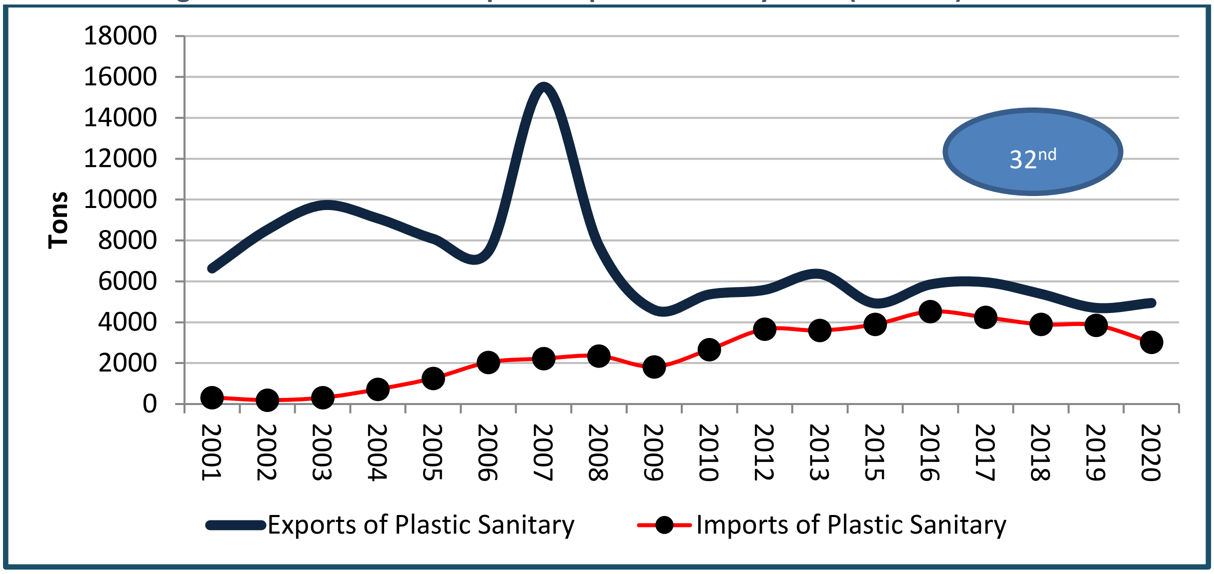
Trade of sanitation ware – plastic

Exports of plastics sanitary ware include:

- Baths, shower-baths, sinks and washbasins, of plastics
- Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics
- Lavatory seats and covers of plastics

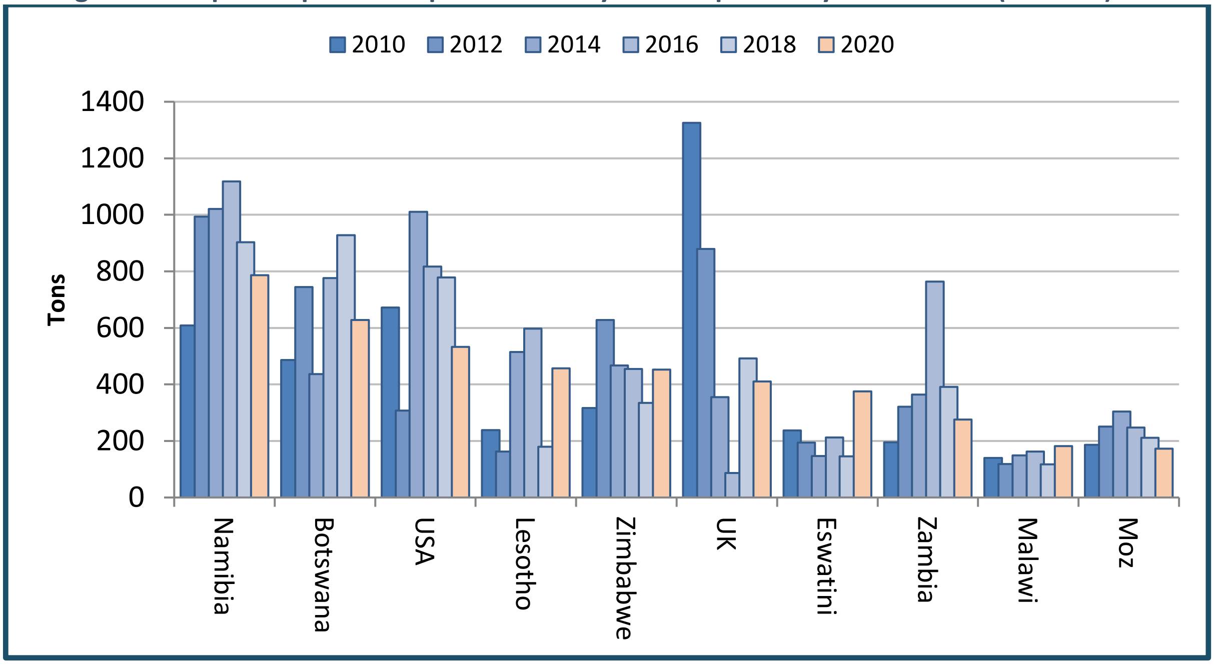
South Africa is the 32nd largest exporter globally of plastic sanitary ware. The graph below illustrates that exports of plastic sanitary ware have been on a decline since 2007. Exports ranged at 15 000 tons in 2007 and these dropped to 5 000 tons in 2020. Exports are destined for the SADC region with exports also going to the US and the UK.

Figure 95: South Africa's exports of plastic sanitary ware (HS 3922)



Source: Authors, based on data from Trade Map, 2021.

Figure 96: Top 10 importers of plastic sanitary ware exported by South Africa (HS 3922)

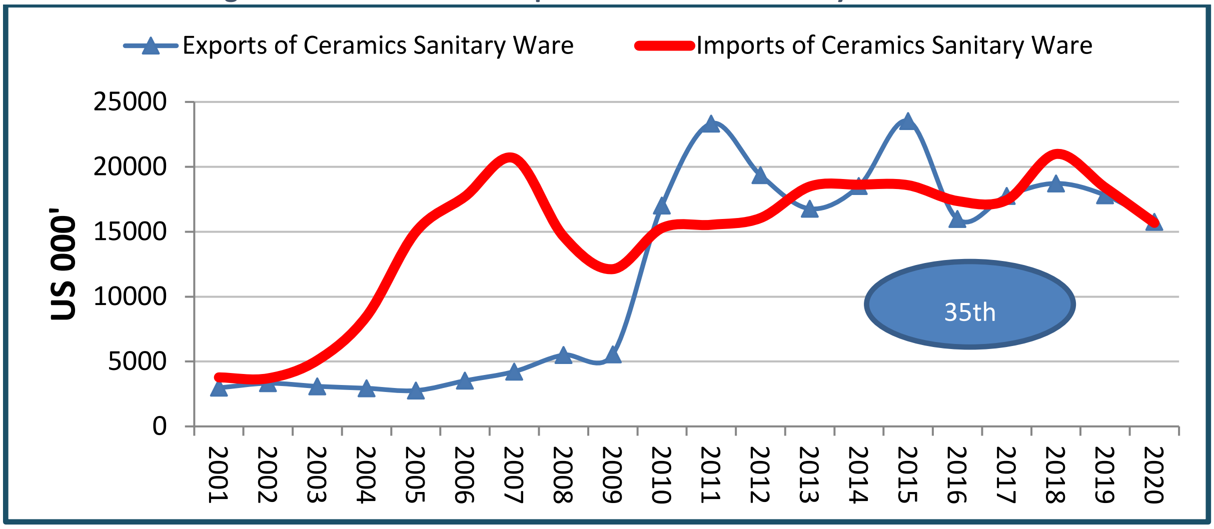


Source: Authors, based on data from Trade Map, 2021.

Trade of sanitation ware – ceramics

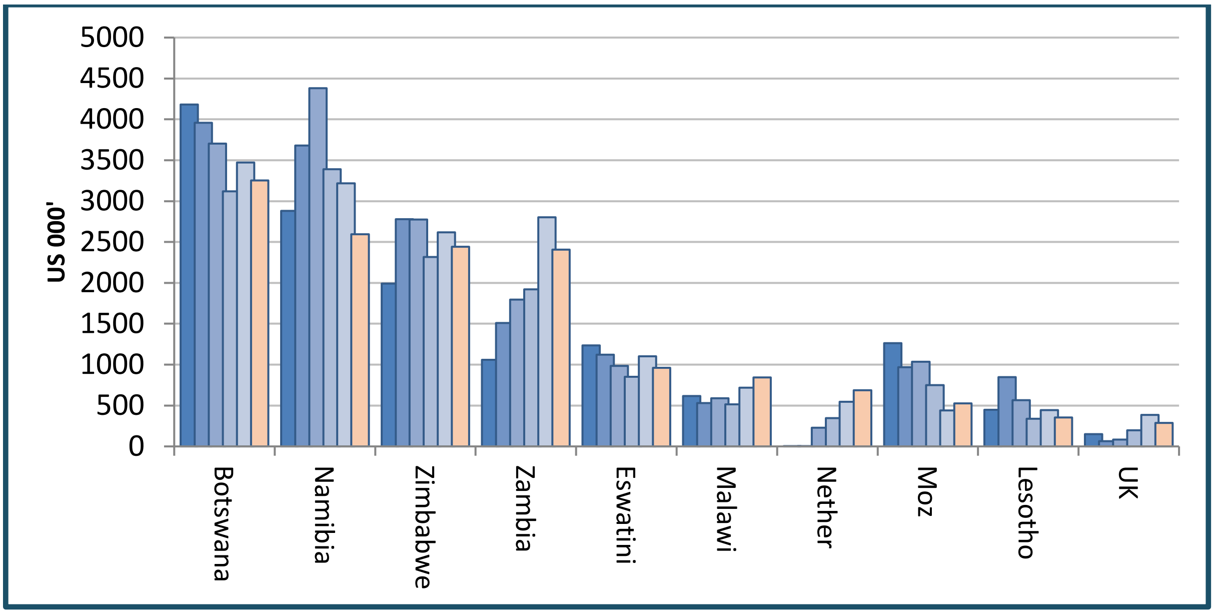
South Africa is the 35th largest exporter of ceramic sinks, washbasins, washbasin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures. Exports remained constant from 2001 to 2007, below US$5 million. Exports climbed from 2009 to 2011 (US$23 million) before declining until 2016. Exports then recovered slightly in 2018 before declining again to US$15 million in 2020. Exports largely go to the SADC region with some exceptions to the EU (Netherlands and the UK).

Figure 97: South Africa's exports of ceramics sanitary ware



Source: Authors, based on data from Trade Map, 2021.

Figure 98: Top 10 importers of ceramics sanitary ware exported by South Africa (HS 6910)



Source: Authors, based on data from Trade Map, 2021.

Exports of water and sanitation innovations and technology

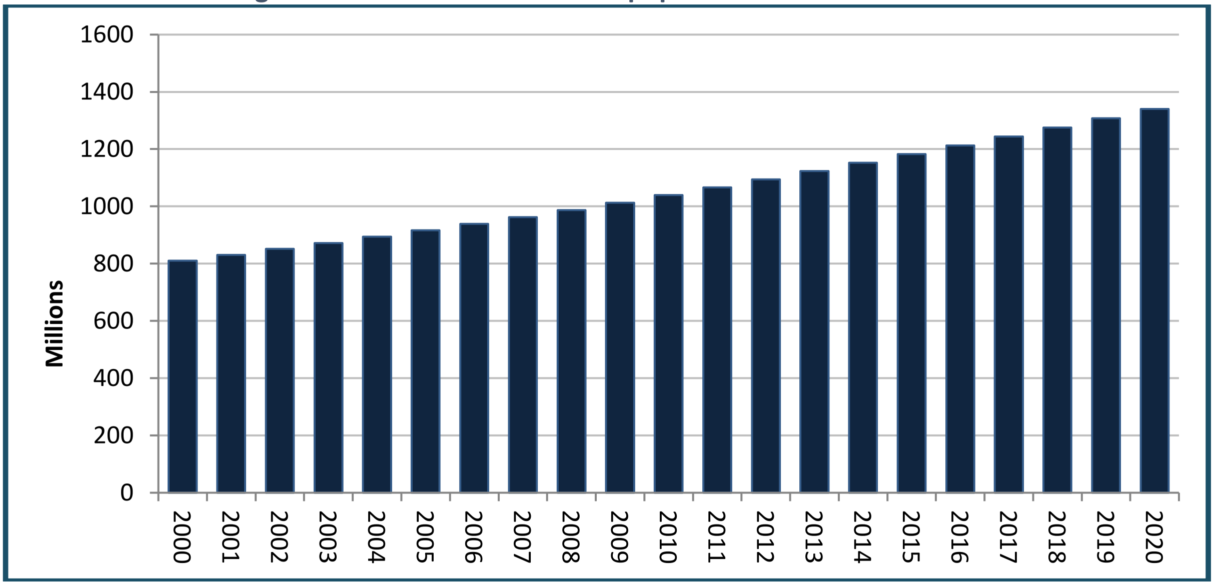
South Africa has developed many innovations and technologies in water and sanitation. Innovations still use plastics, iron and steel, and ceramics but are built differently from previous designs. For chemicals, a combination of biological and chemical treatment steps is used to produce desalinated water. Unfortunately, trade data does not describe if a product is an innovation or technology. Qualitative data suggests there are manufacturers exporting water and sanitation innovations and technologies. However, it has been reported that substantial investment is needed to take new products from design through testing, recodification, patenting, certification and production to market.

Figure 99: Illustrative pictures of water and sanitation innovations

4.4.3 Drivers for exports of water and sanitation goods

As Africa's population increases, growth in water and sanitation infrastructure will be fundamental. According to the United Nations, 42% of people in Sub-Saharan are without a basic water supply, and 72% without basic sanitation. Globally, three in 10 people lack access to safely managed drinking water services and six in 10 people lack access to safely managed sanitation facilities – 2.4 billion people lack access to basic sanitation services, such as toilets or latrines. As such, there should be growth in spend on infrastructure from governments, World Health Organization, UNICEF (WASH programme), World Bank (WSP) and other international organisations. This points to potential for South Africa to increase regional and continental exports of water and sanitation products, equipment and systems to help achieve the SDGs.

Figure 100: Evolution of Africa's population over time



Source: Authors, based on data from the World Bank.

Africa's imports of water and sanitation goods

The graph below illustrates Africa imported over US$8 billion of water abstraction, conveyance and collection equipment (pipes, pumps, valves) in 2020. In terms of chemicals imports, these were over

US$2 billion. Imports of sanitary ware have been growing exponentially from US$100 million to US$ 700 million in 2020. This indicates that there is still a market for South Africa to supply to meet the needs of Africa's water and sanitation infrastructure.

Figure 101: Africa's imports of water goods

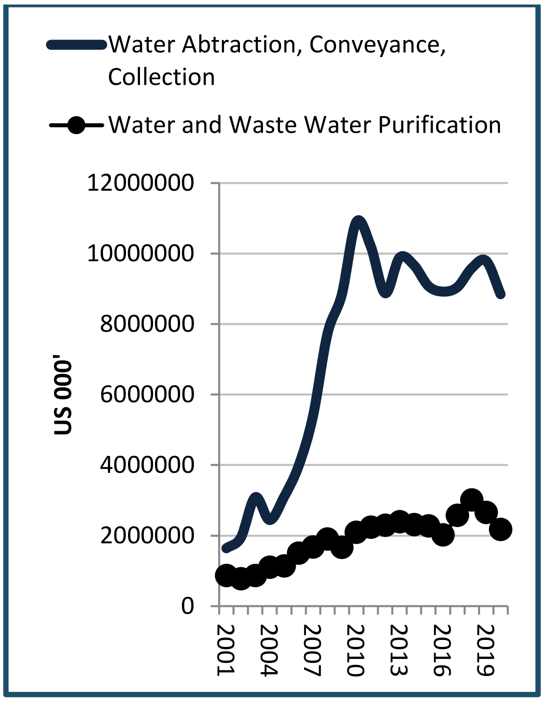
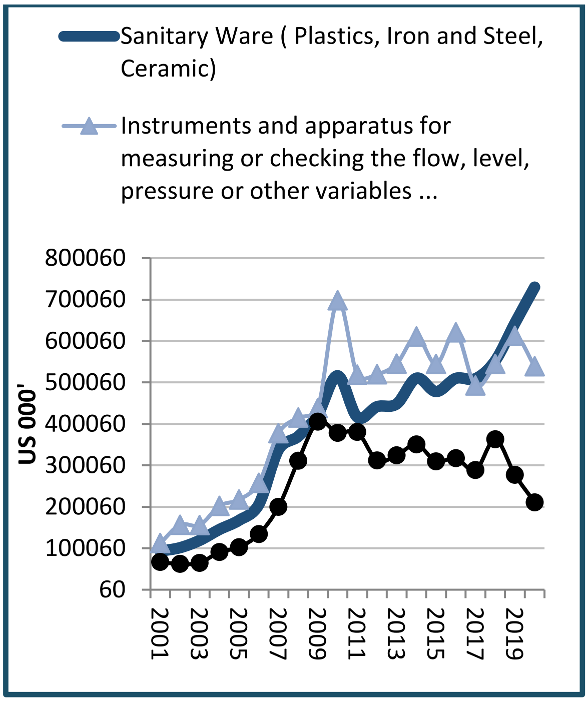


Figure 102: Africa's imports of water and sanitation goods



Source: Authors, based on data from Trade Map, 2021.

4.4.4 Factors affecting exports

Many factors affect exports. A summary of these illustrate internal constrains in South Africa, such as:

- The difficult macroeconomic environment in South Africa
- The competitiveness of firms
- The availability and rising costs of utilities (water and electricity)
- Inputs or raw material costs and availability
- Low rates of investment in new plant and equipment or upgrading their technologies
- Insufficient testing and certification capacity
- Costs of certifications
- Lack of a good rail transport system
- Imports (firm closures, erodes market share)

In addition, external constraints encompass:

- Challenges at border crossings and delays at the ports
- Access to foreign markets and information costs
- Non-tariff measures/barriers
- Curbing trade of high carbon goods
- Cost of foreign certification

4.4.5 Current Master Plan actions to support exports of plastics, steel, chemicals

It is important to note steps taking place in current Master Plans that aim to promote exports. These include:

1. Negotiations in prices of raw materials and inputs across steel and plastics.
2. Drive to capacitate SABS to ensure manufacturers meet standards and get certification on time.
3. The dtic and IDC are considering the creation of new finance models and targeted finance for plastics and steel manufacturers for capital expenditure and working capital.
4. Drive for provision of tax rebates on exports to assist in rescuing cost of export to international customers.
5. Current discussions between the IDC and the dtic on export credit insurance and persuading financiers like banks to restore export insurance.
6. Drive for government negotiators for the African Continental Free Trade Area (AfCFTA) to ensure priority duty-free access for South African manufactured goods.
7. Drive for the dtic, through its Foreign Economic Representatives, to compile a database of the HSE regulations in countries targeted for exports.
8. Drive for Africa-wide market intelligence on products manufactured and gaps.
9. Engagement with the Public Private Growth Initiative on how to foster mutually beneficial dynamics across the three masterplans.

4.5 Strengthening R&D, standards and certification

4.5.1 Research and development in South Africa

South Africa's research, development and innovation in water and sanitation space is mainly overseen by the DWS, the WRC and the Department of Science and Innovation (DSI). Table 27 shows the different players that collectively contribute to the country's research and development (R&D) in the field.

Table 27: Organisations and companies in research and development

Government and Stakeholders	DWS, NPC, DSI, Department of Health (DoH), Department of Agriculture, Fisheries and Forestry, DHS, South African Local Government Association (SALGA), Water Boards, Water Services Authorities, Water Services Providers, SABS, NRCS, Agrément, CIDB, Council for the Built Environment.
Private Sector	Private sector engineering companies.
Research Agencies	National Research Foundation, WRC, Technology Innovation Agency – these agencies are largely responsible for enablement, such as funding, providing partnerships, or other support mechanisms.
Science Councils and Universities	Broad range of partnerships at Higher Education Institutes, Agricultural Research Centre, Mintek, CSIR, Council for Geoscience, with specific partners depending on RFA, discipline, and scale of technology. These organisations have roles and mandates relating to fundamental research, applied research, industrial development, and scale-up of innovative products and processes.
Other partnerships	Strategic Water Partners Network South Africa, NBI, NEPAD. These "other" partners are involved in diverse activities, for example dissemination of new knowledge, assistance with finding and securing sites and/or partners for piloting/demonstration, co-funding, promotion of the research, development and innovation outputs to their networks.

Source: WRC, 2020.

Drawing on work from TIPS (2020) and Nyakabawo et al. (2021), a country's technological capabilities and advancements can be measured by looking at a series of indicators (see Table 28), including Gross Fixed Capital Formation (GFCF), Gross Expenditure on Research and Development (GERD), research output, number of researchers and number of patent registration. This analysis makes use of some of these metrics, in as far as the data is available.

Table 28: Economy-wide indicators (and their availability at the level of the sector)

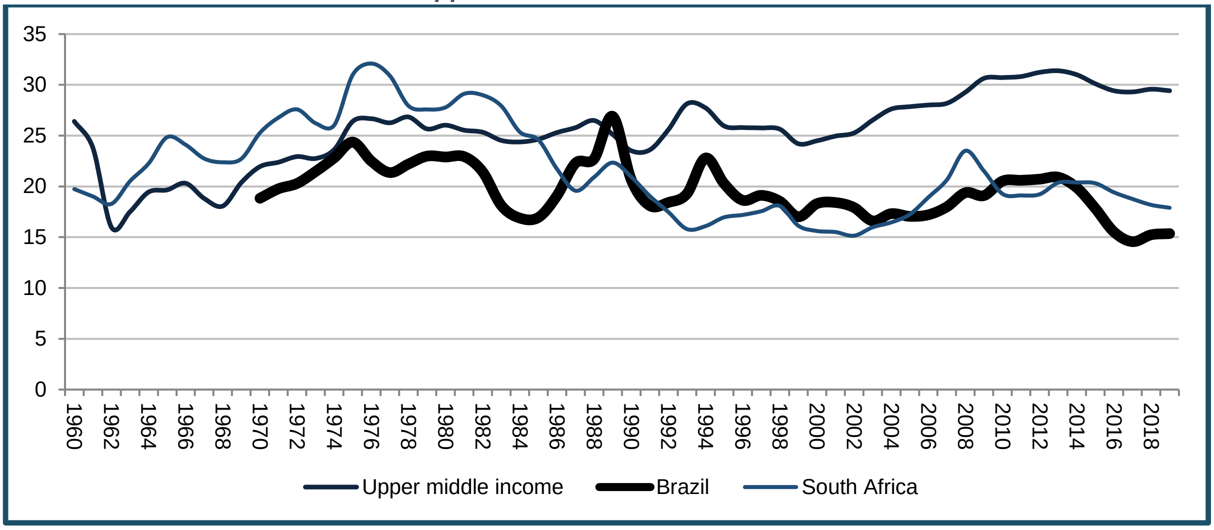
	MAIN INDICATOR	FURTHER APPLICATION	SECTORAL LEVEL AVAILABILITY
INPUTS			
Investment	GFCF		Yes
		GFCF/Gross Domestic Product (GDP)	Sectoral GFCF/Sectoral Production or Turnover
		GFCF Machinery and Other Equipment	Yes
R&D	GERD		Yes
		GERD/GDP	Sectoral GERD/Sectoral Production or Turnover
	Business Expenditure on Research and Development (BERD)		Yes
		BERD/GDP	BERD/Sector Production or Turnover
	No. of Researchers		Yes
	Total Employment in R&D		Yes
Inputs from Abroad	Payments for Technology		No
	Foreign Direct Investment (FDI)		Yes
	Greenfield FDI		Yes
OUTPUTS	Receipts for Technology		No
	Domestic Patents		Yes
	Foreign Patents		Yes
	High Tech Exports		Yes
	Unit value of exports		Yes
	Export Sophistication		Yes

Source: TIPS, 2020.

4.5.2 Measuring innovation in South Africa through inputs

GFCF is widely used as a measure of technological advance in a country through investment. This is because innovation requires investments to secure inputs that are specifically designed to enhance technological capacities.

Figure 103: Gross Fixed Capital Formation as a % of GDP: South Africa, Brazil, upper middle income countries

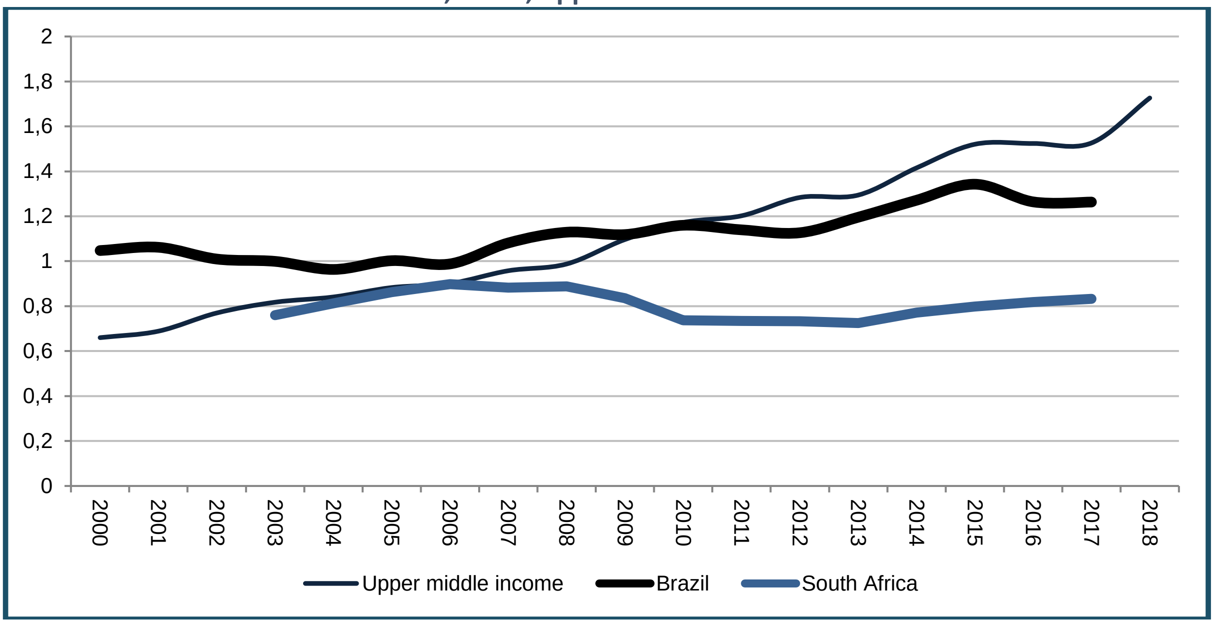


Source: Nyakabawo et al, 2021.

Since Brazil is similar to South Africa in terms of resource dependency and income inequality, this analysis uses it for comparison. Expressed as a percentage of GDP, South Africa's GFCF has averaged 19% since 2010, declining from 19.2% in 2010 to 17.8% in 2019, showing the general declining trend as a result of subdued economic performance. Other upper middle income countries recorded a GFCF as percentage of GDP of 29% in 2020, and Brazil recorded below South Africa at 15% in 2020.

In terms of expenditure on R&D, the GERD shows that South Africa has consistently been below that of Brazil and upper middle income countries.

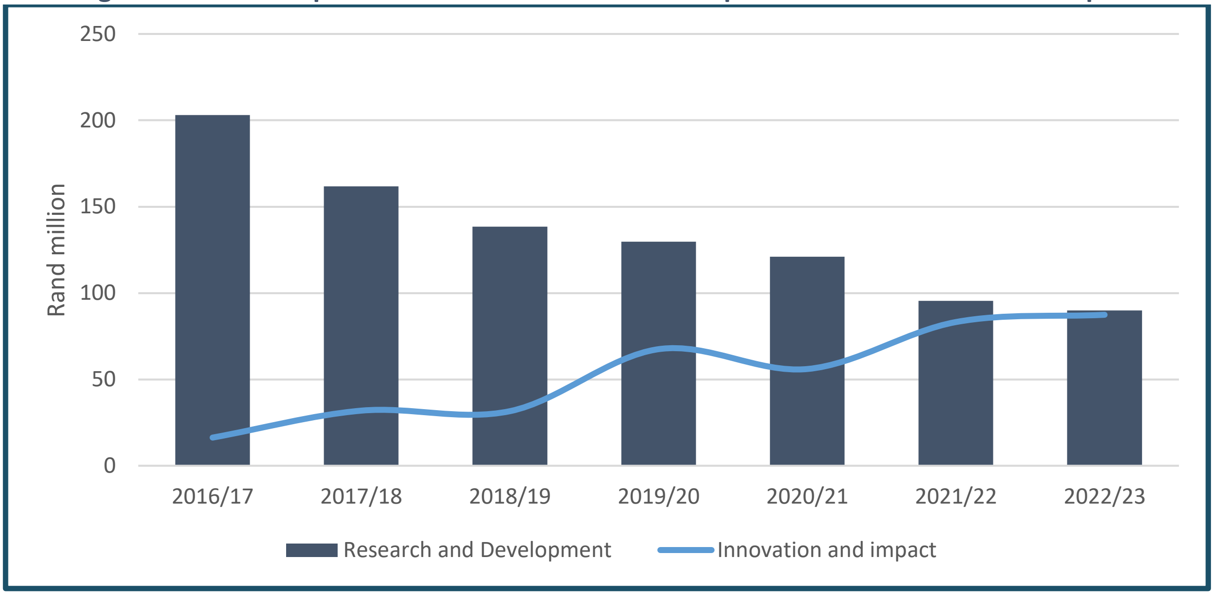
Figure 104: Gross expenditure on research and development as a % of GDP: South Africa, Brazil, upper middle income countries



Source: Nyakabawo et al, 2021.

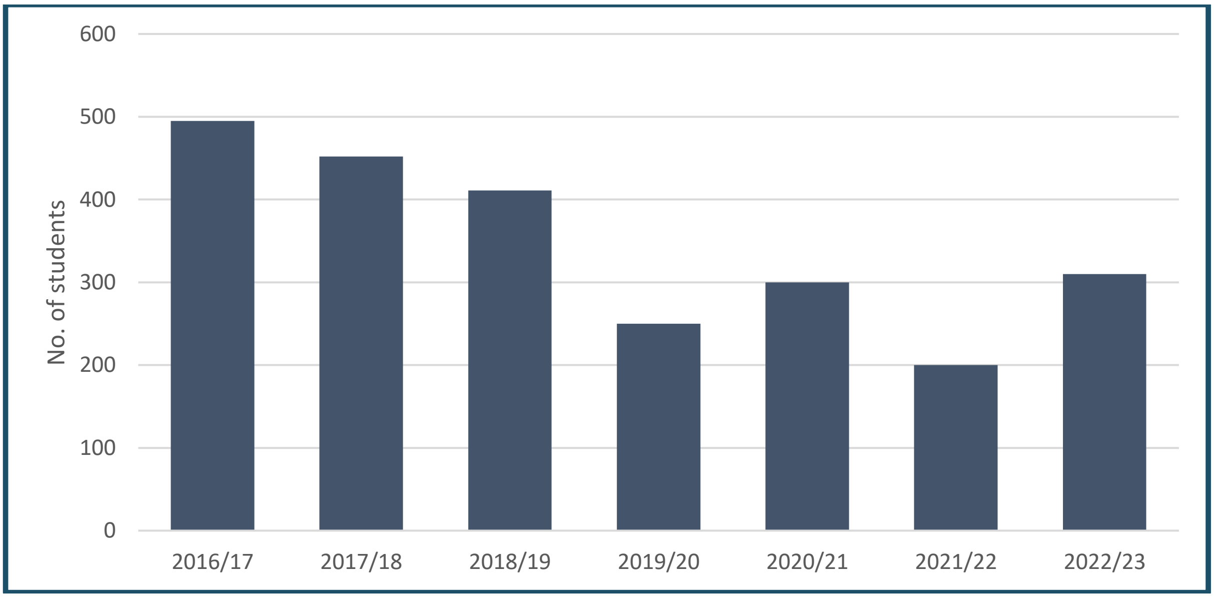
Considering WRC's expenditure (which funds 65% of the country's water-related research) (WRC, 2020), a decreasing trend in expenditure is evident since 2016 and into the medium term.

Figure 105: WRC expenditure on research and development and innovation and impact



Source: National Treasury Annual Budget Reviews 2017-2020.

Figure 106: WRC students financially and technically supported



Source: National Treasury Annual Budget Reviews 2017-2020

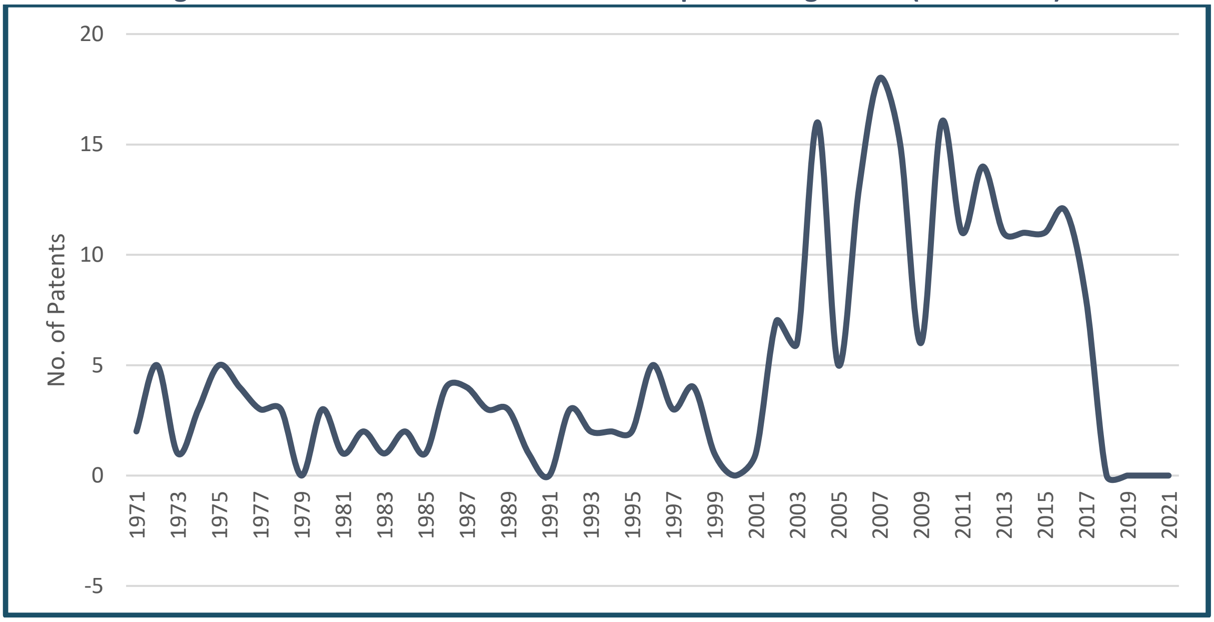
In terms of research output, a 2018 research study analysed countries according to the most influential publication of sanitation research in the world (Zhou et al, 2018). Results showed that the top 20 countries included three Asian countries/regions, 10 European countries, five American countries, one Oceanic country, and South Africa. These 20 most productive countries generated the vast majority of published articles (94.5%). The US was first, followed by Brazil, India was seventh, China was ranked tenth, and South Africa was in 13th position.

Importantly, although South Africa spends less money compared to other upper middle income countries, the country boasts world-class scientific and technical capabilities, and good networks across the world that all contribute to the potential for increased technological advancement.

4.5.3 Measuring innovation in South Africa through outputs

To get an idea of how South Africa is evolving in the water and sanitation innovation space, this analysis considers the number of patents that are registered at the patent office from South Africa (Figure 107), the top innovators of water treatment according to country (Figure 108) and the top current assignee companies owning the patents in South Africa (Figure 109).

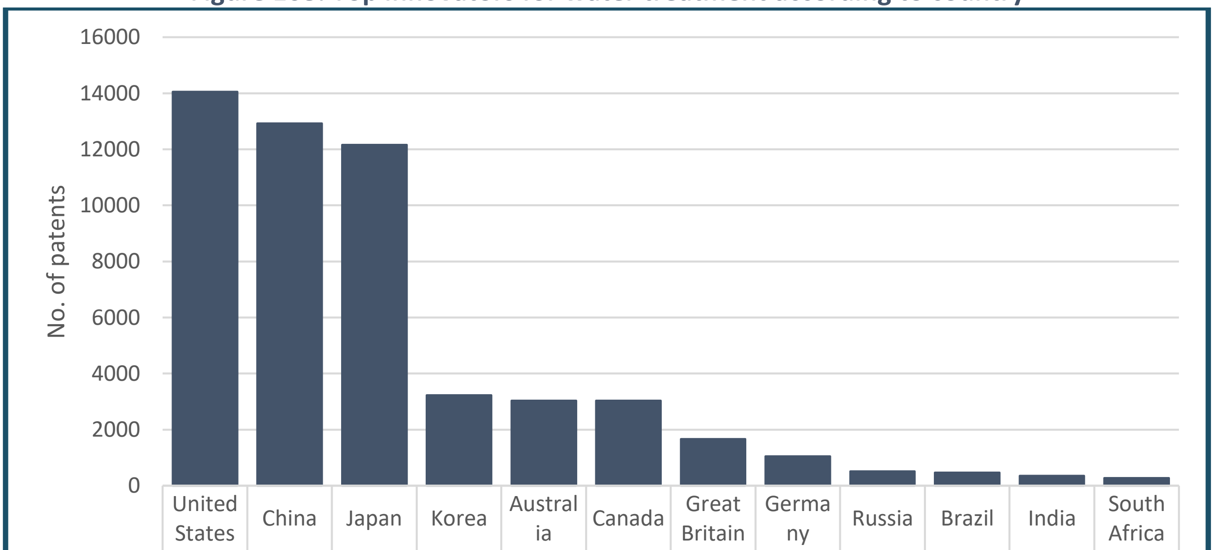
Figure 107: South Africa's water treatment patents registered (1971–2021)



Source: PatSnap Patent Database, 2021.

The top innovators in water treatment are the United States, China and Japan. Among the BRICS (Brazil, Russia, India, China and South Africa) countries, South Africa has the least number of innovations with 273 to date.

Figure 108: Top innovators for water treatment according to country



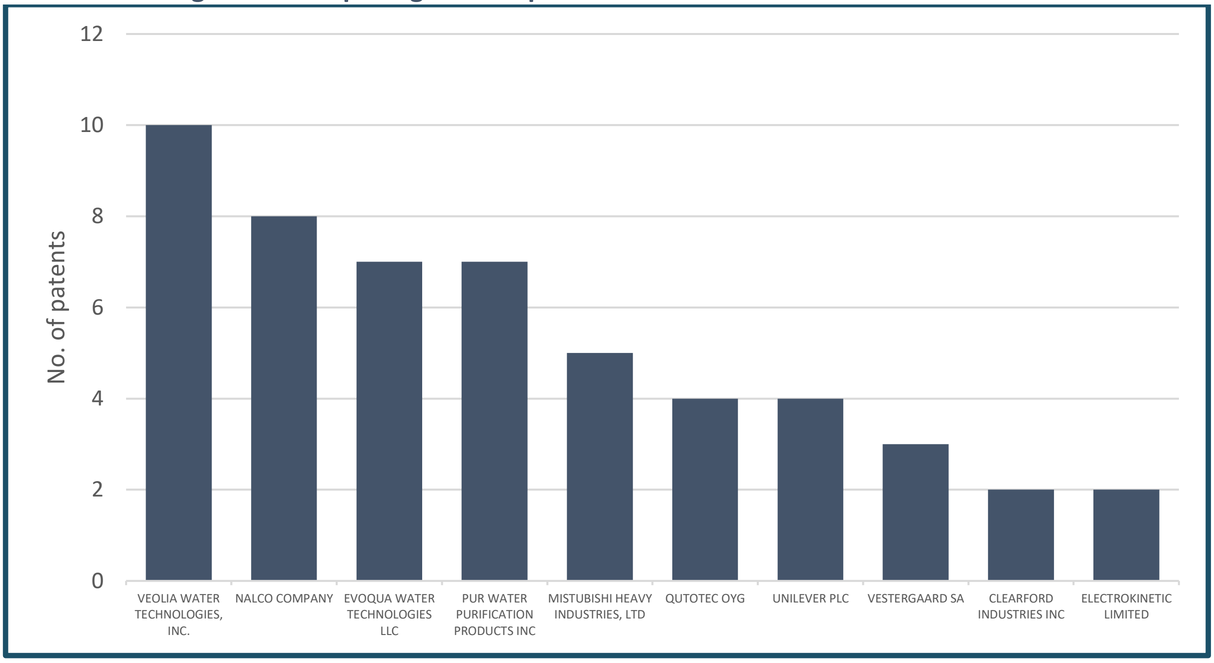
	United States	China	Japan	Korea	Australia	Canada	Great Britain	Germany	Russia	Brazil	India	South Africa
Series1	14053	12928	12157	3227	3037	3030	1665	1050	509	464	352	273

Source: PatSnap Patent Database, 2021.

Assignee companies are firms that have an ownership interest in the legal rights of patents or companies that employ the inventor of the technology. For water treatment in South Africa, Veolia

Water Technologies is the top assignee company with the most patent technologies, followed by Nalco Company, Evoqua Water Technologies and Pure Water Purification Products.

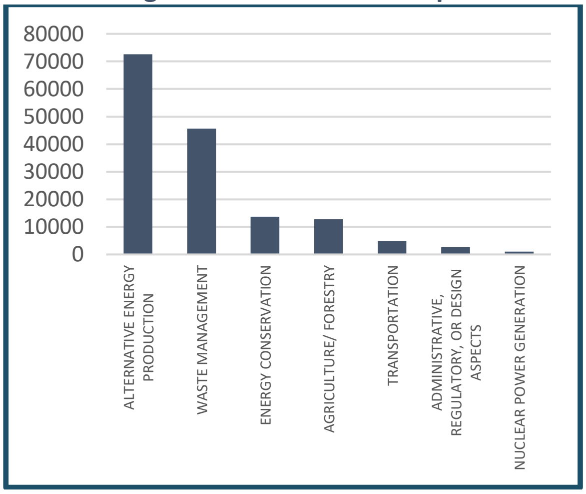
Figure 109: Top assignee companies for water treatment in South Africa

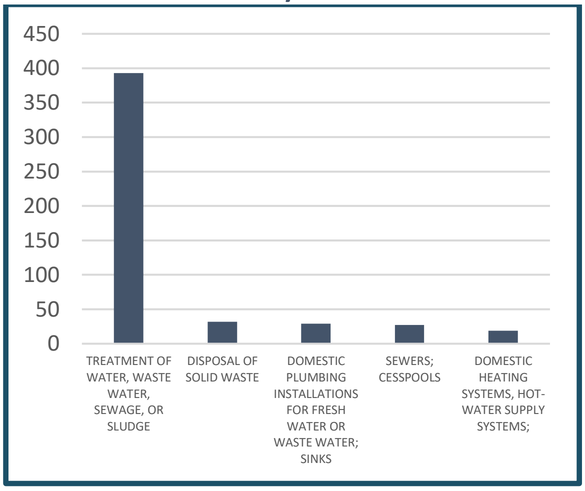


Source: PatSnap Patent Database, 202.)

To show innovation from South Africa in environmentally-sound technologies, the graph below shows South African patents registered locally, according to the IPC Green inventory classification. South Africa is making a significant contribution in alternative energy production and waste management technologies. In terms of waste management, most of the innovation is in water, waste and sewage treatment technologies.

Figure 110: South African patents based on IPC Green Inventory classification





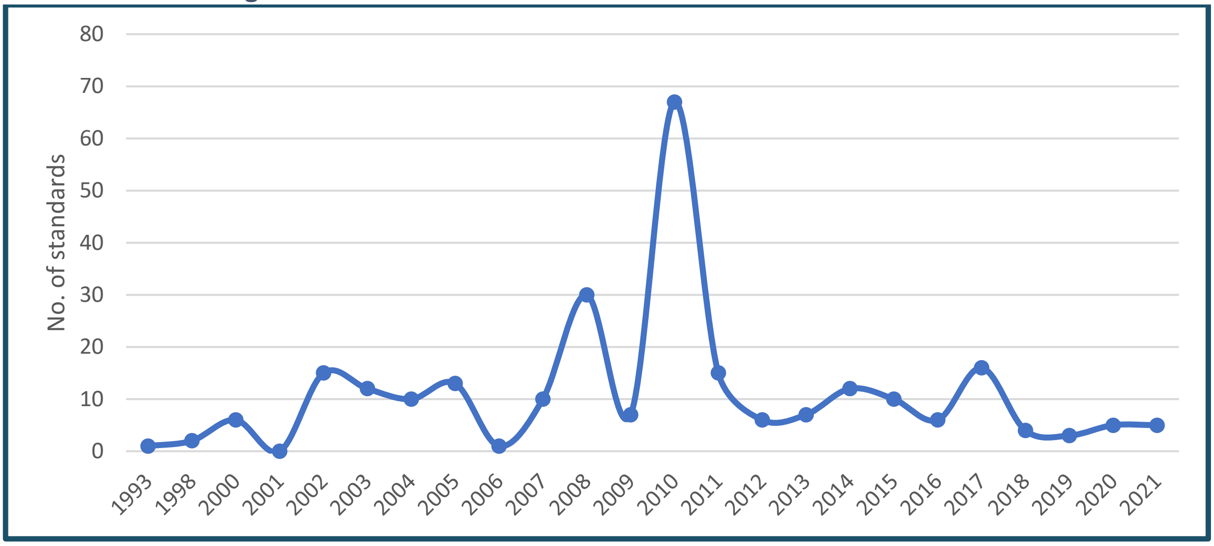
Source: Montmasson-Clair et al, 2017.

4.5.4 Standards and certification in water and sanitation

Standards and certification are a central mechanism in international trade. Accreditation against standards provides access to markets. SANAS is the national accrediting body that approves and appoints institutions such as Agrément that have the skill, capacity, and competence to perform a standards test for certification purposes. Certification qualifies that the product is fit for purpose and meets the criteria. Validation is a database where anyone can confirm that they are certificated, when they received the certification and the validity of the certification.

SABS has 263 standards for water and sanitation that are published, spanning from 1993 to 2021. Figure 111 illustrates the trend of the development of these standards since 1993, and this includes newly established standards as well as amended standards.

Figure 111: SABS standards for water and sanitation 1993-2021



Source: SABS, 2021.

4.5.4.1 Voluntary standards versus mandatory standards

Standards in this space are either voluntary or mandatory. Mandatory standards are called up in legislation, and they are compulsory for manufacturers, whereas those that are voluntary serve as a guideline for manufacturers and they can choose to comply with them or not. Regulators make a standard mandatory when its non-compliance would affect public health and safety. The process can either be:

1. Through NRCS, by embedding the standard into the regulatory framework, so that it becomes become mandatory; or
2. Through reference, where prescripts refer to the national standards and it becomes a legal requirement to comply with the standards.

The main concern with mandatory standards is that enforcement and adoption of the standards is very low. SABS primarily develops voluntary standards. The ISO also develops voluntary standards, which represent an international consensus of experts and countries on design, performance level and operation. Certification to an ISO standard is a mark of quality and robust procedures regardless of a facility's industry or country of origin.

As part of the World Trade Organization’s agreements, countries have signed and agreed to remove technical barriers to trade that come from regulatory standards. However, not all countries have the same standards, or adopt ISO standards. To export, manufacturers have to adhere to export destination standards, and South African plumbing standards as a whole are not necessarily the same as international standards. Therefore, local manufacturers generally have to obtain foreign certification of their products for the export market. This leads to loss of economies of scale, especially for small and medium enterprises (SMEs), conformity assessment costs and information costs. The exception is plastics pipes and fittings who have similar standards as the ISO standards.

4.5.4.2 Standards from SABS versus standards from Agrément

The main regulating body for standards and certification in South Africa is the SABS. Its main purpose is to give a guidance on the minimum criteria for products and services produced and procured to enhance the competitiveness of South African products, as well as provide for consumer protection, health, safety and environmental issues.

Agrément caters for non-standardised construction products and systems that are still in the innovation space. Most standards developed through Agrément aim to support this niche. Agrément is a third-party certification body that advises manufacturers on which test laboratories to approach, then assesses the test reports, assesses compliance and consults a group of experts for advice on whether to certificate. Once the technology is widely adopted, Agrément passes on the standards to SABS.

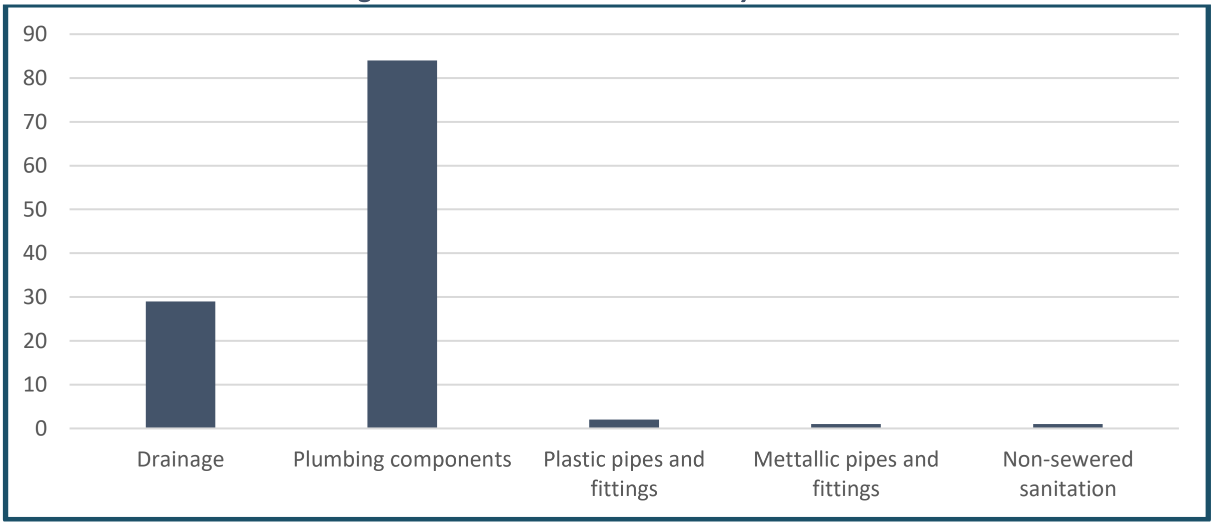
The general benefits of adopting standards are:

- Regulators can rely on global expert opinion to ensure safety of the product for its citizens without spending its own time and money. They can access the constantly updated source of information and experiences from around the world.
- Manufacturers have a blueprint to create a product that meets international guidelines, making market entry easier.
- Users have increased confidence in the product, reflecting a consensus of regulators, manufacturers, and users from across the world. The users can have a dignified, reliable, safe, hygienic, odour-free experience that may even produce by-products that can be re-used by the community.

4.5.4.3 Key standards in water and sanitation

Key standards in water and sanitation are categorised according to the following sub-committees: drainage, plumbing and equipment, metallic pipes and fittings, plastic pipes and fitting and non-sewer sanitation. In terms of mandatory standards, Figure 112 shows the distribution of the 117 mandatory standards in water and sanitation, according to the sub-committee.

Figure 112: Number of mandatory standards



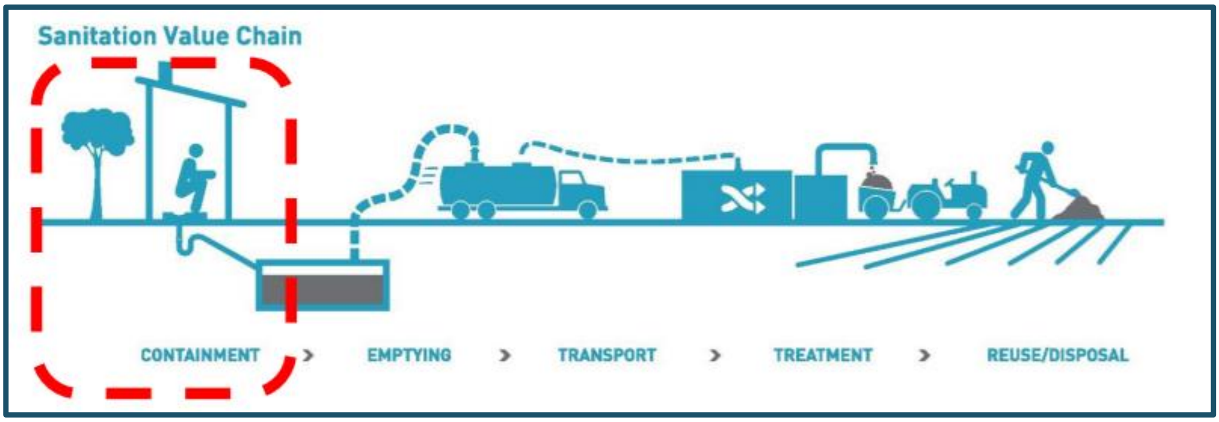
Source: SABS, 2021.

Some of the key standards include the following:

1. SANS 10257 (mandatory standard) for the reconditioning of valves for use with pipelines.
2. SANS 30500:2019/ ISO 30500:2018 (voluntary international product standard), developed in 2018 by ISO for a non-sewered sanitation system, which is a prefabricated integrated treatment unit, comprising of frontend (toilet facility) and backend (treatment facility). This

standard defines general safety and performance requirements for design and testing as well as sustainability considerations. SANS/ISO 30500 also focuses on cutting the sanitation chain value chain at the containment stage therefore eliminating the emptying and transportation stages and with treatment performed onsite. See the figure below for a demonstration of SANS/ISO 30500 in the sanitation value chain.

Figure 113: SANS/ISO 30500 in the sanitation value chain

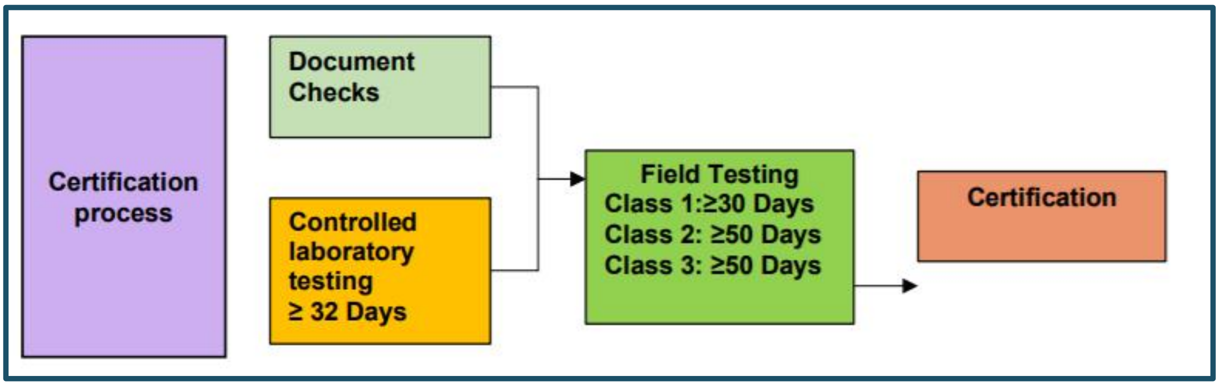


Source: WRC, 2020.

A gap in standardisation was identified in rural and remote areas. A few manufacturers together with the University of KwaZulu-Natal (UKZN), SALGA, Rand Water and WRC set up a technical committee to improve service delivery, especially to remote areas. Through this, experts represented South Africa at ISO to look at standards to adopt in South Africa to close this gap. This was published internationally by ISO in 2018, and adopted by South Africa in 2019. It is not clear who should test and certify against these standards. SABS is mandated to do this but indicated structural issues as the main challenge, though there is a business case to test and certify these technologies. Agrément is in discussion with UKZN for possible collaboration, where UKZN would do the testing and Agrément would do the certification.

According to WRC (2020), certification for SANS/ISO 30500:2018 is as illustrated in the figure below.

Figure 114: Certification process for SANS/ISO 30500



Source: WRC, 2020.

3. ISO 31800 (voluntary standard) – this standard deals with faecal sludge treatment units that are energy independent, prefabricated, community-scale resource recovery units that serve approximately 1 000 to 100 000 people.
4. SANS 10252 (mandatory standard) – this is a standard for water supply and drainage for buildings. Plumbing installations are extremely dangerous if not installed correctly which can

lead to public health risk, damage to property and the environment and huge cost implications.

4.5.4.4 Infrastructure uniformity standards

The Construction Industry Development Board (CIBD) sets out standards and training for engineering and construction contracts. This is to provide standardisation and uniformity in infrastructure contracts documentation, practices and procedures. The standards are issued in terms of sections 4(f), 5(3)(c) and 5(4)(b) of the Construction Industry Development Board Act 38 of 2000, read with Regulation 24 of the Construction Industry Development Regulations (as amended) issued in terms of section 33. These standards apply to all infrastructure procurement contracts and are not disaggregated according to sector. In addition, Guidelines for Human Settlement Planning and Design in water and sanitation are found in CSIR (2019), also called the Red Book.

It is a requirement that all public sector bidders comply with CIDB standard prescripts. The main challenge is that some public sector bidders do not comply either because they are not aware of the prescript or because they just choose not to comply. The CIBD offers this prescript and training for free as such that compliance should not be a problem.

4.5.4.5 Stakeholder concerns with regards to standard and certification in water and sanitation

Main stakeholder concerns are listed below.

Manufacturers:

- There is clear guidance on what parameters are considered during the certification process for innovation standards ISO 30500 (innovation in non-sewage systems that are a substitute to onsite sanitation) and ISO 31800. As such, manufacturers know what their product needs to meet the standards. However, manufacturers struggle with the complexity of the standards, in terms of environmental, performance, structural design and public health considerations.
- The cost of certification is high if the manufacturers absorb the total cost of the certification. There is also no full understanding of the total cost of certification because sanitation needs vary depending on whether it is a household, community or university installation. In addition, it involves many steps, for instance checking documents, installation in laboratories and in the fields, tests and analysis. As a result, WRC and SABS, working jointly, aim to reduce costs in South African contexts.
- It takes time to test the products.
- Cheap sub-standard imports are finding their way into the local market. A suggestion for industry is for the dtic and DWS to specify the requirements, either through designation or testing and certification of this standard.
- There is insufficient testing capacity. For instance, there are not enough laboratories to conduct these tests in South Africa, yet some standards are mandatory. Some SABS laboratories have been closed due to staff shortages and the costs to reopen them are deemed very high. NRCS also has little capacity (staff) to deal with compulsory specifications. It reports that there are no specialists available to deal with the intricacies of the plumbing industry.
- Local manufacturers can be pushed out of business if the local standards are amended to match international standards but there is no capacity to test the new standards.

Regulators:

- The ISO standards are voluntary and only a guideline. This presents a challenge for the regulators because they cannot be enforced as a certification.

- It takes time to raise awareness about new standards. Therefore, regulators have embarked on awareness campaigns with different stakeholder groups, such as DWS, SABS and municipalities.
- It is difficult and expensive for regulators to certify new innovative products. However, new products often require new certification to attract investors and grow. Discussions have been underway to increase the public budget towards certification processes.
- The COVID-19 pandemic stalled the infrastructure preparation for the testing to be done.

Users:

- Studies on the social acceptance of innovation systems in water and sanitation have found that the systems are generally accepted as long as they offer dignified solutions and are appropriate to the culture and needs of the community. This can be solved by introducing appropriate systems and educating the community that these systems are certified so they are up to standard.

4.5.5 Policy implications

South Africa has world-class R&D capabilities, customs authorities, testing bodies and accreditation services. Policy recommendations include investing in targeted pockets of excellence in R&D. With a constrained fiscus, funding from the government needs to be managed to do more with less and identify the right mix of instruments and incentives to implement to stimulate high-tech development.

This includes expanding South Africa's certification capabilities, notably through targeted investment and strategic collaboration with universities and agencies that have testing capacity. In addition, mandatory standards need to be enforced. This requires the relevant regulatory authorities to have stricter enforcement procedures.

South Africa could consider developing Mutual Recognition Agreements (MRAs) with targeted export markets. An MRA is an agreement in which one government recognises another country's testing and certification requirements as acceptable, without undertaking its own testing or customs inspections. This requires credibility in signatory countries' inspection procedures, and this could lead to cost savings in the medium and long term for manufacturers.

As a solution to unlocking some of these challenges, the Water Sanitation and Hygiene Research and Development Centre at the UKZN has engaged SABS for the centre to offer some of the testing at its laboratories. However, a university might not be allowed to do certification. In addition to state capacity, the private sector has some testing capacity which could be used as a complement.

4.6 Improving infrastructure spend and procurement processes

Key issues in relation to expenditure and procurement are summarised in this subsection, based on the following set of questions:

- How much is allocated and spent on water and sanitation infrastructure in South Africa?
- How much does this (actually and potentially) contribute to industrial development?
- What are the factors (including procurement) behind underspend/efficiency and effectiveness of spend?
- What policy issues were identified during stakeholder dialogues?
- What interventions are proposed?

Some of these issues are highly contested. Policy dialogues were constrained by a pending court case. The policy options and interventions proposed may not have the same level of consensus as those in relation to other sections.

4.6.1 How much is allocated to water and sanitation infrastructure?

Expenditure on water and sanitation infrastructure in South Africa includes both public and private sector expenditure.

In relation to infrastructure generally, the National Development Plan (NDP) set a target for public infrastructure investment at 10% of GDP, financed through tariffs, public/private partnerships, taxes and loans, focusing on transport, energy and water. National Treasury's 2022 Budget Review reports that public sector capital investment averaged 5.8% of GDP from 2010 and 2020. Private capital investment averaged 11.2%. Total investment is therefore well below the NDP target of 30% and has been declining since 2015. To reach the target, public sector investment would need to grow from 3.9% of GDP in 2020 to 10% of GDP by 2030. Private sector investment would need to grow from 9.8% of GDP to 20% in the same period (National Treasury, 2022).

In relation to water and sanitation infrastructure specifically, the National Business Initiative (2019) reported a R330 billion gap in funding over the next decade, and a R13 billion municipal water debt. GreenCape's Water Market Intelligence Report 2022 estimates that an investment of R90 billion a year is needed in water and sanitation infrastructure over the next decade. This includes refurbishing and upgrading existing infrastructure, as well as new infrastructure required. The required, budgeted and projected allocations are reported in the table below.

Table 29: Required, budgeted and projected public sector funding for water and sanitation services and infrastructure

Funding (R billion)	Revised estimate 2021/2022	Medium term estimates 2022/2023	Medium term estimates 2023/2024	Medium term	Average year-on-year increase (%)
Community development:	**11.6**	**12.7**	**13.8**	**13.9**	**6.3%**
Regional and local water and sanitation services (subsidies for basic services)	11.6	12.7	13.8	13.9	6.3%
Water and sanitation infrastructure:	**33.3**	**42.6**	**46.9**	**54.2**	**1.6%**
Water resource and bulk infrastructure	27.5	36.4	40.1	47.4	19.9%
Regional Bulk Infrastructure Grant (RBIG)	2.2	2.5	2.9	2.8	7.3%
Water Services Infrastructure Grant (WSIG)	3.6	3.7	3.9	4.0	3.4%
Total planned public sector funding for water and sanitation	**44.9**	**55.3**	**60.7**	**68.1**	**12.9%**
Total estimated annual capital requirements (DWS 2019):	**90.0**	**90.0**	**90.0**	**90.0**	**-**
Water supply infrastructure	70.0	70.0	70.0	70.0	-
Wastewater infrastructure	20.0	20.0	20.0	20.0	-
Funding shortfall	**-45.1**	**-34.7**	**-29.3**	**-21.9**	**-21.3%**

Source: Greencape, 2022.

The 2022 Budget Review points to major investments in infrastructure, including:

- Total public infrastructure spend until 2024 is estimated at R812.5 billion.
- Government is prioritising 11 strategic infrastructure projects in the water sector, estimated at R115 billion. These are designed to "crowd in" private sector investments. For example, the Trans-Caledon Tunnel Authority has raised R15 billion from the Development Bank of Southern Africa, the African Development Bank and the New Development Bank.

- The framework for public-private partnerships (PPPs) has been reviewed to increase private sector investment.

4.6.2 Employment potential of water and sanitation infrastructure expenditure

Procuring local goods and services for these projects aims to grow domestic manufacturing capabilities to deliver to regional and global markets. In relation to sanitation, TIPS (2020) summarises upside and baseline scenarios to illustrate the potential. Globally, on the upside scenario, the global estimated potential revenue for 2030 is US$5.2 billion. On the baseline scenario, the estimated global potential revenue to 2030 is US$1.9 billion. Regionally, Africa's estimated total revenue for 2030 is US$447 million. On the baseline scenario, the estimated total revenue for 2030 is US$201 million.

The 11 strategic water infrastructure projects with an estimated value of R115 billion are expected to create about 20 000 temporary jobs during construction and 14 000 during the operational phases (National Treasury, 2022).

In relation to sanitation, it is estimated that 32 871 jobs could be supported through delivering improved sanitation to about 3.3 million people across the 10 most water-stressed municipal districts. The total cost would be around R16 billion.

Interviews suggested that retrofitting smarter and more sustainable technologies in existing private sector infrastructure (households and businesses) has the potential to create 2.4 million short-term contracts, translating to 25 000 new direct long-term jobs. These are likely to be financed by alternative risk insurance instruments, linked partly to carbon trading but with a win-win-win for financial institutions, the state and citizens. Preferential procurement strategies – linked to Broad-Based Black Economic Empowerment (BBBEE) scorecards – are likely to drive transformation of the built environment industries.

The employment impact of water and sanitation infrastructure is not limited to direct job creation. Ward and Mudombi (2018) also demonstrated that millions of jobs in South Africa are moderately or heavily dependent on water. These jobs are heavily concentrated in areas where there are existing or projected water shortages. Investing in water and sanitation infrastructure is as much about protecting existing jobs as it is about creating new jobs.

4.6.3 How much is being spent on water and sanitation infrastructure?

While there are (increased albeit inadequate) budget allocations, an analysis of public sector expenditure demonstrates significant underspend across all categories of water and sanitation infrastructure.

Department of Water and Sanitation

At national level, the DWS has consistently underspent across programmes from 2015 to 2020. All data below is drawn from DWS's Annual Reports:

- Water planning provides a national strategy for the planning of water services and supports municipalities to plan for the provision of sustainable water services. Water planning affects the procurement of water goods. Water planning has underspent by R280 million across the five-year period.
- Sanitation planning provides a national strategy for the planning of sanitation services and supports municipalities to plan for the provision of sustainable sanitation services. Sanitation planning affects the procurement of sanitation goods. Budget allocations for sanitation planning are only recorded from 2016. In the 2016/17 financial year, the department spent R11 million. Expenditure went up in the 2017/18 year before declining sharply to R9 million in the 2019/20

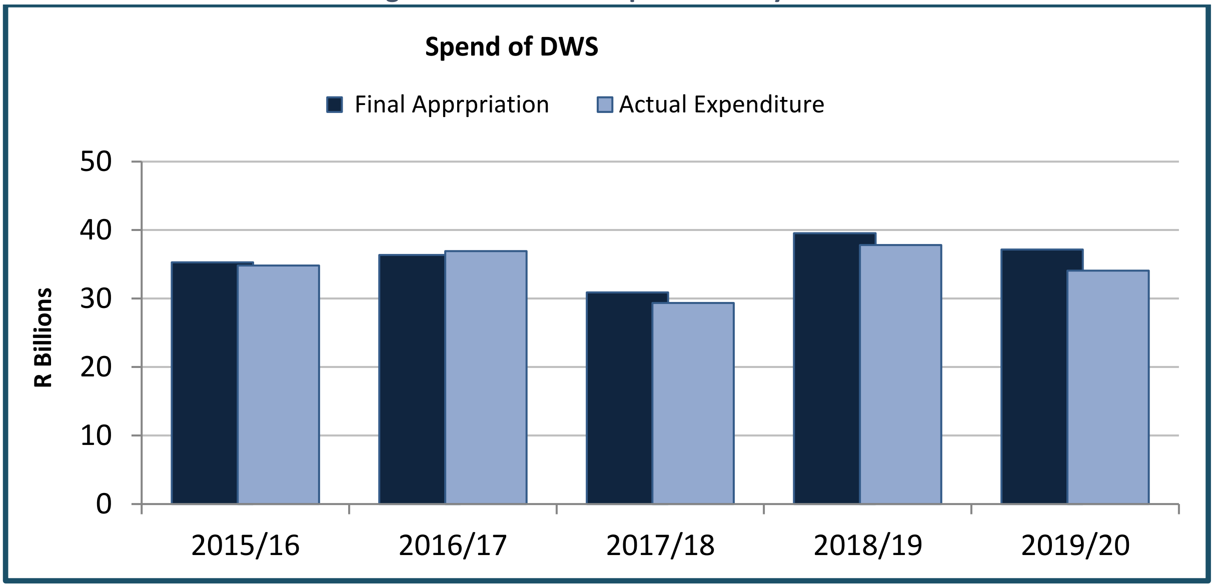
year. In 2019/20, there was an underspend of R3 million. Auditors reported that the underspend related to "implementation".

- The policy and strategy sub-programme was initiated in 2017. It develops, monitors and reviews the implementation of the water and sanitation sector policies and strategies. For all three years, there has been underspend of R2.3 million.
- Programme 3 provides for the design, construction, commissioning and management of new and existing water resource infrastructure. This programme affects the procurement of goods such as pipes and pumps. Actual spend in 2019/2020 stood at R12 billion, lower than the previous year of R14 billion. Over the past five years, underspend has totalled R2 billion.
- The regional bulk infrastructure grant provides for the development of new infrastructure, and the refurbishment, upgrading and replacing of ageing infrastructure servicing extensive areas across municipal boundaries. This programme budget allocation began in 2016. In the last four years, average spend was R5.5 billion. The years 2017-2020 saw an underspend of R1.8 billion.
- The sub-programme for water services infrastructure provides for the construction of new infrastructure and the rehabilitation of existing water and sanitation infrastructure through the grant transfer of water services schemes to water service institutions. The allocation prioritises the 27 poorest district municipalities. This programme does not reflect significant underspend.
- Capital investment, maintenance and asset management includes new and replacement assets; upgrades and additions; rehabilitation, renovations and refurbishments; maintenance and repairs. Capital investment and maintenance expenditure illustrates that, from 2015 to 2018, the DWS used all its final appropriation. Between 2019 and 2020. There was an underspend of R1.9 billion.

The graph below reflects consolidated spend of the DWS on:

- Capital investment, maintenance and asset management
- Water Services Infrastructure Grant
- Regional Bulk Infrastructure Grant
- Water infrastructure
- Policy and Strategy
- Sanitation Planning
- Water Planning

Figure 115: Annual expenditure by DWS



Source: DWS Annual Reports, 2015-2020.

Other National Departments

Other national departments that include major capital budgets for water and sanitation include DHS, DoH, DHET and Department of Basic Education.

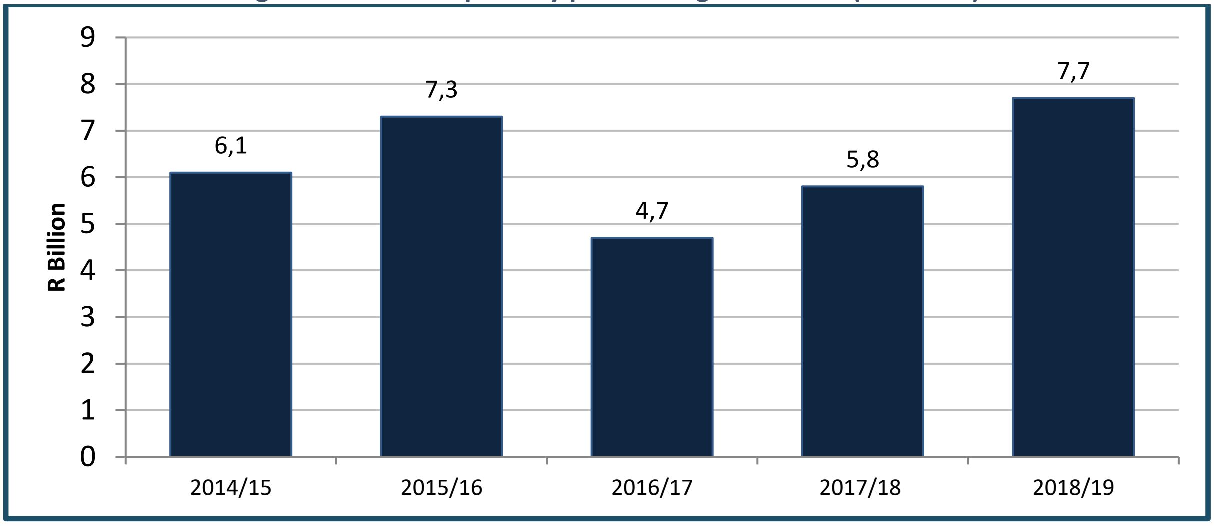
- DHS facilitates the creation of sustainable human settlements. It has underspent on it housing development financing by roughly R400 million per annum over the period.
- DHET provides norms and standards for infrastructure development and maintenance, as well as funding for TVET colleges and Higher Education Institutions. DHET Annual Reports for the period suggest these institutions have seldom underspent, but the efficiency of spend needs to be improved.
- DBE provides infrastructure development and maintenance budgets for schools. Budget allocations for water and sanitation infrastructure to 4 500 schools without adequate infrastructure have consistently underspent.

Municipal expenditure

Provinces and municipalities account for the bulk of public spending in South Africa. National Treasury in its various budget reviews highlights provinces underspend in budgets from 2014 to 2019.

Provincial government underspent by a total of R31.6 billion. Water and sanitation spend is obviously only one component of this budget.

Figure 116: Underspend by provincial government (R billions)

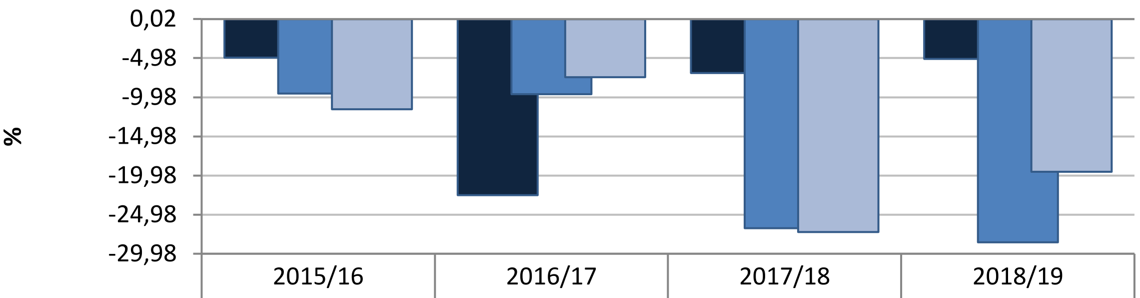


Source: Authors, based on National Treasury Annual Budget Reviews 2017-2020.

In terms of municipalities, spending outcomes for 2018/19 varied across the 257 municipalities. A total of 211 municipalities underspent their operating budgets and 214 municipalities underspent their capital budgets. In the 2017/2018 year, 217 municipalities underspent their operating budgets and 220 municipalities underspent their capital budgets.

The figure below illustrates underspent of three major municipalities. National Treasury measures anything above -15% as bad. In the 2018/2019 financial year, eThekwini municipality underspent its budget by -28.5% and Cape Town underspent by -19.5%.

Figure 117: Underspend in major municipalities



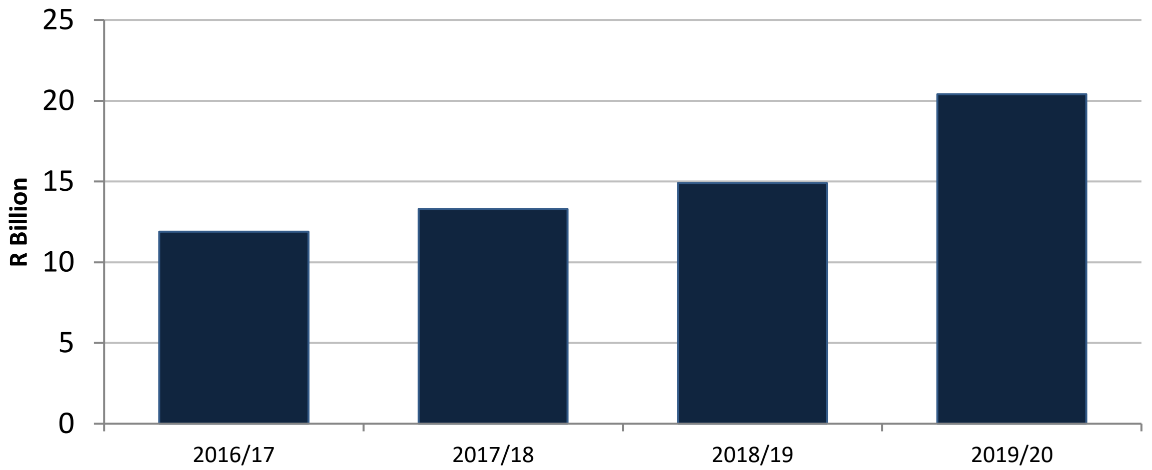
	2015/16	2016/17	2017/18	2018/19
Johannesburg	-4,9	-22,5	-6,9	-5,1
Ethekwini	-9,5	-9,6	-26,7	-28,5
Capetown	-11,5	-7,4	-27,2	-19,5

Source: Municipal Money, 2021.

Water boards

The focus of the water boards is the extraction and purification of raw water into potable bulk water that will be supplied to their various clients, which include municipalities, industries and mines. In addition to providing bulk treated water to municipalities, in some cases, the boards also provide retail water and sanitation services on behalf of municipalities. The figure below highlights consolidated spend of water boards on core activities (extraction and purification), i.e. mainly spend on pipes, pumps, valves and chemicals. The efficiency of water boards has been under review, with the goal of expanding their role in municipal service delivery.

Figure 118: Consolidated water board spend on core activities (extraction and purification)



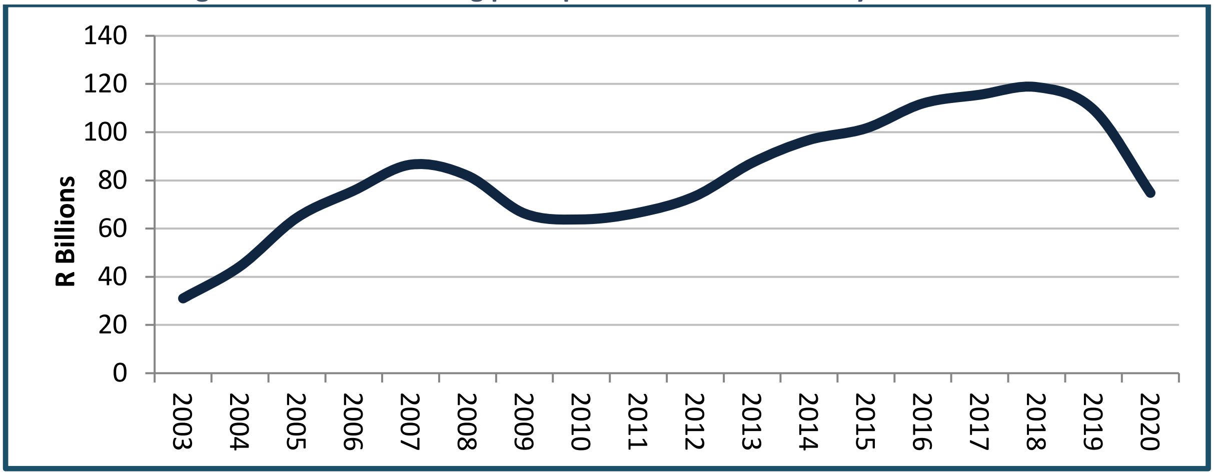
Source: Authors, based on DWS Budget Vote 2017, 2018, 2019, 2020.

Private sector expenditure

There are no consolidated statistics on private sector expenditure on water and sanitation infrastructure. A proxy on spend was developed, using building plans approved.

All buildings have some form of water piping and sanitation products. These differ across different types of buildings, but standard Bills of Quantity suggest water and sanitation forms roughly 15% of total construction costs. Statistics South Africa conducts an annual survey of municipalities regarding buildings completed (see Statistics South Africa Report-50-11-01) as well as a monthly survey representing approximately 86% of the total value of buildings completed (see Statistics South Africa Report P5041.1 & P5041.3). The graph below illustrates that the private sector building plans showed an upward growth from 2003 to 2008 before being negatively affected by the global financial crisis in 2009. From 2010, building plans showed a healthy steady rise until 2018. Since then, building plan approvals have been declining. This may affect the demand for water and sanitation goods.

Figure 121: Total building plans passed in South Africa by value in Rand

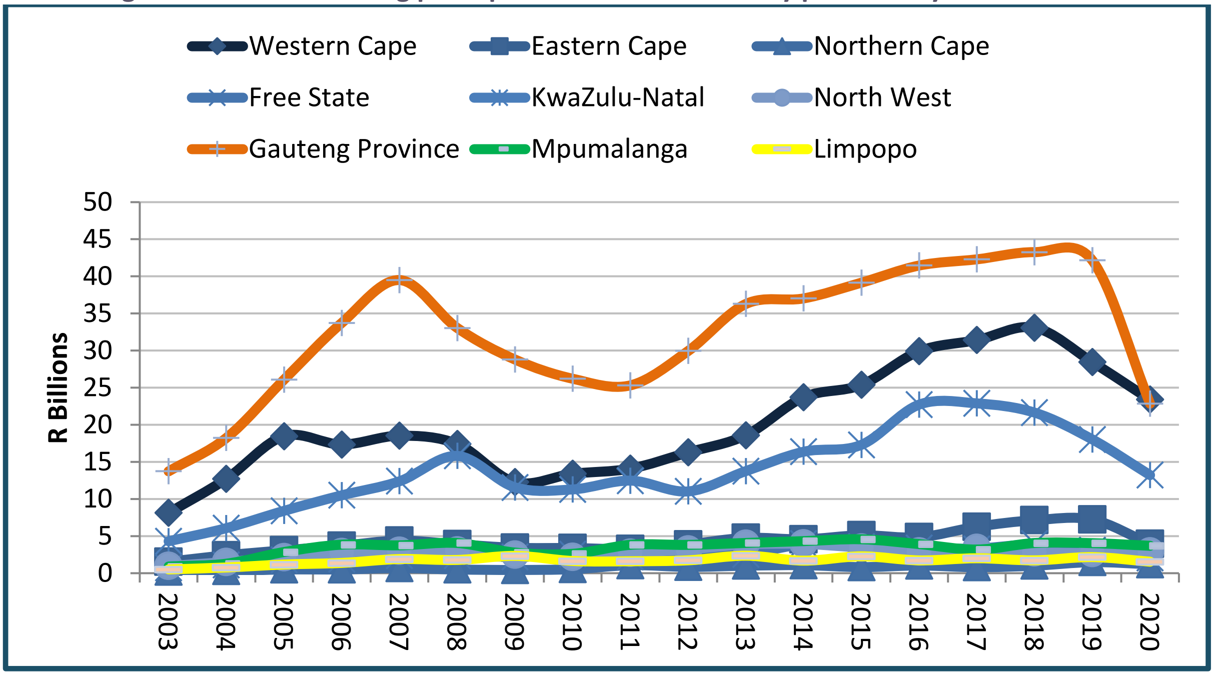


Source: Authors, based on data from Statistics South Africa's building statistics.

By province, Statistics South Africa shows that more building plans have been approved for the three major provinces of Gauteng, Western Cape and KwaZulu-Natal. The aggregate results support National Treasury's analysis that private sector expenditure has declined over the past five years.

Interviews suggest that private sector procurement challenges relate to the efficiency and stability of supply chains. Poor regulation of compliant goods results in cheap, sub-standard imports.

Figure 122: Total building plans passed in South Africa by province by value in Rand



Source: Authors, based on data from Statistics South Africa's building statistics.

4.6.4 Reasons for underspend

The summary of water and sanitation infrastructure budget allocations and expenditure echoes key themes from other studies. Water and sanitation infrastructure budget allocations are not yet in line with projected needs. However, much of the funding allocated is not spent. Funds which are spent are inefficiently spent. Spend is inadequately aligned to support domestic industrial development and transformation (through "strategic sourcing").

McKinsey (2020) argues that there are substantial resources available for financing infrastructure in Africa. However, 80% of projects fail at feasibility and stakeholder engagement stage; and only 10% of projects are ultimately implemented. The high failure rate is due to "low technical capabilities, as well as limited financial resources being dedicated to feasibility studies and business plans".

A similar situation applies to the financing of water and sanitation infrastructure in South Africa. Dithebe et al. (2019) report that "challenges affecting the success of the financing of water infrastructure projects in South Africa are corruption, hostility towards private participation, cost recovery constraints, high fiscal deficits by state government, unreliable planning and procurement processes, and a rapid increasing number of municipalities that lack technical and administrative capacity to plan implement, operate and maintain water assets".

Reasons for underspend at municipal level are summarised in the table below.

Table 29: Main reasons for underspending by municipalities

Lack of capacity Poor project and budget management High technical staff turnover of municipalities Failure of municipalities to identify projects in water and sanitation Late appointments and payment of service providers	**Lengthy processes** Council decisions take too long (approval of projects, budgets and appointments) Prolonged processes in identifying Professional Service Providers for projects Poor procurement practices, slow resolving of disciplinary cases on expenditure Prolonged and lengthy decision-making with other departments on building infrastructure (e.g. environmental assessments)
Supplier issues Delays in implementing projects, mainly caused by slow supply chain management (SCM) processes and litigation due to SCM processes. Termination of contracts of firms which are liquidated	**External factors** Restrictions due to COVID-19 (office closures) Community unrest also delays progress on site

Source: Authors.

4.6.5 Localisation through designation

Designations are a procurement policy lever intended to:

- Enhance and smooth out certainty of demand over the years or increase demand;
- Promote competitive industrial capabilities with high employment and growth multipliers;
- Diversify the economy towards more employment-intensive and value-adding activities;
- Ensure value for money for the fiscus and society;
- Leverage public expenditure;
- Reduce South Africa's trade deficit;
- Generate savings due to lower impact of currency fluctuation (owing to high local content) and faster response time to varying demand;
- Promote skills development and training (strengthen engineering sector);
- Stimulate export opportunities and foreign earnings;
- Induce competition (local supplier should be as price and quality competitive as any other supplier); and
- Foster availability and security of supply.

Under the Public Preferential Procurement Framework Act, the dtic and National Treasury designated 23 products as of 2017. The following impact on the water and sanitation industry are listed in the table below.

Table 30: Local content requirement in the water and sanitation sector

Revised Pipe fittings	100%	Steel Pipe Fittings and Specials 100% Galvanized 100% Lined and Coated 80% Galvanized, Lined and Coated 80% Forged 100%
Valve Products and Actuators	70%	All components 80% Includes valves (check, butterfly, ball, gate, diaphragm, knife, air, pinch, disc, sleeve), safety or release valves, taps, cocks, pneumatic actuators, spring, manual actuator, fire hydraulics, PRV, plugs valves, control valves
Residential electric water meters	50 to 70 %	n/a
Pumps and MV Motors	70 %	Pumps (end suction centrifugal, multistage centrifugal, horizontal split casing pumps, vertical turbine pumps, slurry pumps, positive displacement, self-priming centrifugal, centrifugal process) 70% MV Motors (Medium voltage electric motor) 70% – 100 %
Plastics pipes		Request to designate proposed in 2021

Source: the dti, 2017.

The table below highlights bids reported from March 2015 to February 2020 by the dtic. According to the dtic, designations have boosted local production of some products such as valves and actuators, which totalled R299 million.

Table 31: Value of bids associated with designated products

DESIGNATED PRODUCTS	SIGNED STANDARD BIDDING DOCUMENTS SUBMITTED TO THE DTIC	TOTAL VALUE PER SECTOR (IN RAND)
Valves and Actuators	25	299 882 000 000
Steel Products (including pipes)	16	423 047 000 000
Textiles and Clothing Products	549	2 946 365 000
Electrical and Telecom Cables	96	1 984 753 000
Canned and Processed Veg	23	697 950 000
Rail Rolling Stock	4	49 547 227 000
Power Pylons	11	2 253 000 000
Solar Water Heaters	14	456 922 000
Busses	3	806 600 000
Working Boats and Vessels	3	4 299 195 000
Transformers	42	4 490 126 000

Source: the dti, 2017.

The designation process offers crucial opportunities for local suppliers, but fundamental weaknesses remain. Smaller suppliers find it difficult to track tenders. There is no single channel or standard specifications for many products (multiplicity of organisations and media involved; fragmentation of procurement). Tenders are not always linked to supplier development programmes, and state contracts cannot provide up-front payments. As a result, a company can get a tender but be unable to obtain bridging finance or funding for new investment if required. Due to fragmentation, it is difficult to achieve economies of scale or predict demand in the medium term, deterring investment in new production.

Agencies often do not respond to complaints about excessively narrow specifications, and neither unions nor companies can be sure that the oversight departments will back them up consistently. In some cases, designations effectively require that local suppliers reduce their own dependence on imports, with a risk of stifling local production rather than furthering it. In some cases, notably with solar water heaters, suppliers argue that they cannot effectively comply.

4.6.6 Policy implications

Policy implications arising from the above include:

- There is a sizeable gap between the funding required and public sector funding available. Finalisation of the raw water pricing strategy would go some way toward addressing this. Revising the framework for PPPs is, however, seen as crucial to "crowding in" private sector investments.
- Availability of funding is one issue. Reducing underspend is another. The analysis is that many projects are inadequately planned and poorly managed. National Treasury's efforts to coordinate infrastructure funding and build a viable pipeline of projects has coalesced institutional capabilities to support a higher percentage of projects moving from feasibility to bankability.
- Ensuring the water and sanitation infrastructure funding benefits local industries requires fuller product designations; strategic sourcing during bid specification processes; pre-surveillance of cheap and non-standard imports; and policing compliance at point of installation, through Building Control Officers and other professional bodies.

5 CONCLUSION

This research report provides the available evidence related to the development of the Water and Sanitation Industry Master Plan. It underpins the associated Policy Report (TIPS, 2022).

It provides a detailed analysis of the water and sanitation industrial value chains to suggest that South Africa is well-positioned to leverage the expenditure to grow a domestic manufacturing base which will simultaneously address domestic priorities; sustain and grow existing businesses and jobs; develop export potential; and transform and transition local industries.

Economic data reported reflects a bumpy, uneven but mostly upward trajectory in the production and sales of raw materials and equipment used in water and sanitation. Related Master Plans have initiated policy interventions to take these industries forward. It is proposed that the Water and Sanitation Industry Master Plan builds on these through a set of six key pillars:

- Developing and retaining skills
- Improving industry competitiveness and capacity utilisation
- Reducing cheap and sub-standard imports
- Promoting export of local products;
- Strengthening R&D, standards and certification
- Improving expenditure and procurement

The report analyses key issues (based on these six pillars) and provides a line of sight towards addressing these more coherently by highlighting key policy implications. Together with the Policy Report, this Research Report summarises an 18-month process, including desktop research, interviews, a set of national stakeholder dialogues, and a series of sub-dialogues.

A vision and associated interventions are developed in the Policy Report, forming the foundation of a Water and Sanitation Industry Master Plan for South Africa.

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