Trade & Industrial Policy Strategies (TIPS) is a research organisation that facilitates policy development and dialogue across three focus areas: trade and industrial policy, inequality and economic inclusion, and sustainable growth

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GLOBAL WATER AND SANITATION MARKET DYNAMICS: IMPLICATIONS FOR SOUTH AFRICA'S INDUSTRIAL DEVELOPMENT

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Key global trends

1) Water security and access to modern water and sanitation services are intertwined with technology and industrial development, and more broadly, economic development.
2) Key market drivers are: 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.
3) Key systemic responses are: increased focus on demand management, stronger drive towards sustainability, higher interest in technological innovation, sector restructuration towards stronger utility autonomy and private sector participation, and rising water tariffs.
4) The global water and sanitation market was estimated to be US$862 billion in 2016. The utility sector (67%) largely dominates the market, followed by the industrial sector (15%).
5) The global utility and industrial market is expected to reach close to US4$900 billion by 2022, growing by about 3.7% a year over the 2015-2022 period.
6) Operational expenditures are larger than capital expenditures and the spread between the two is expected to further widen as utilities shift from infrastructure projects to the rehabilitation of existing infrastructure, and the implementation of smart, digital solutions.
7) Resources and networks (i.e. civil works) account for 58% of the capital expenditure market, followed by wastewater treatment (25%). Sludge management and unconventional resource development, i.e. desalination and water reuse, are a strong growth area.
8) The global equipment market is estimated to reach more than US$180 billion by 2022, rising by 4.6% a year from 2015. It is heavily dominated by pipes, pumps and valves (44%) and automation and control equipment (14%).
9) The market is quite disaggregated globally, but expertise is fairly concentrated geographically, with developed countries (Europe, US and Japan) being over-represented in the leading firms.
10) Given the weight of civil engineering and localisation policies driven by state-owned entities, supply chains, however, have a strong local flavour in most markets.
11) Global trade in water- and wastewater-related products amounted to about US$282 billion in 2016, more than a third of the market. The provision of products is quite concentrated geographically with China, Germany and the US servicing 41% of the market.

Key implications for South Africa

1) Systemic challenges, notably water supply issues, are making South Africa's water and sanitation systems more vulnerable. In turn, necessary responses, such as rising water tariffs, are forcing a reshuffling of the cards in the sector. Such dynamics are putting at risk industrial and economic development.
2) The nature of water and sanitation markets, both globally and locally, opens room for industrial development opportunities, particularly for import substitution. South Africa's water market, while small on a global scale (about 1%), is significant at the local level and growing strongly.
3) Engaging in the export market by South African firms would appear difficult (due to the domination of civil works and local content policies) but the existing industrial base could provide the capabilities to position local firms as strong suppliers on a number of export markets.
4) The ability of South Africa to align industrial development and water policies and objectives will determine whether new dynamics in the water and sanitation sector hamper or support industrial development in the country.

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ABBREVIATIONS

AMI	Advanced Metering Infrastructure
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
DB	Design-Build
DBO	Design-Build-Operate
dti (the)	Department of Trade and Industry
DWS	Department of Water and Sanitation
EPC	Engineering, Procurement and Construction
GWI	Global Water Intelligence
IPAP	Industrial Policy Action Plan
IWA	International Water Association
L	Litres
MDGs	Millennium Development Goals
O&M	Operations and Maintenance
SDGs	Sustainable Development Goals
TIPS	Trade & Industrial Policy Strategies
UK	United Kingdom
US	United States
WRC	Water Research Commission

1. INTRODUCTION

Water is considered the most precious and – at the same time – the most wasted natural resource. Core to the development of life, water is also central for socio-economic progress, notably by enabling sanitation. Water is, however, an increasingly prominent source of conflicts, both at local and international levels. Indeed, water management is inherently a regional issue, with both supply- and demand-related decisions of a community having repercussions on its neighbours.

Correspondingly, the importance of water and sanitation has been recognised internationally through their inclusion in the Sustainable Development Goals (SDGs) and in their predecessors, the Millennium Development Goals (MDGs). Specifically, SDG 6 aims to "ensure availability and sustainable management of water and sanitation for all" (United Nations, 2017, p. 6). Under the ambit of this goal, a host of targets aim to improve water and sanitation access, water quality, water efficiency, water resource management, the protection of water ecosystems, international support, and the inclusion of local communities.

From a trade and industry perspective, water and sanitation are intertwined with technology, and industrial and economic development. Water security and access to modern water and sanitation services rely on technology and industrial development, while industrial development, and more broadly, economic development, depend 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.

In South Africa, the water and sanitation sector has been identified by the country'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).

To inform the role that South African industries can play in the water and sanitation sector, this report focuses on providing a strategic outlook of global dynamics.

Section 2 analyses the systemic trends and dynamics shaping the water and sanitation sector.

Section 3 reviews the global market, identifying key segments as well as fast-growing areas for the upcoming years.

Section 4 provides an overview of global supply dynamics, identifying leading market players.

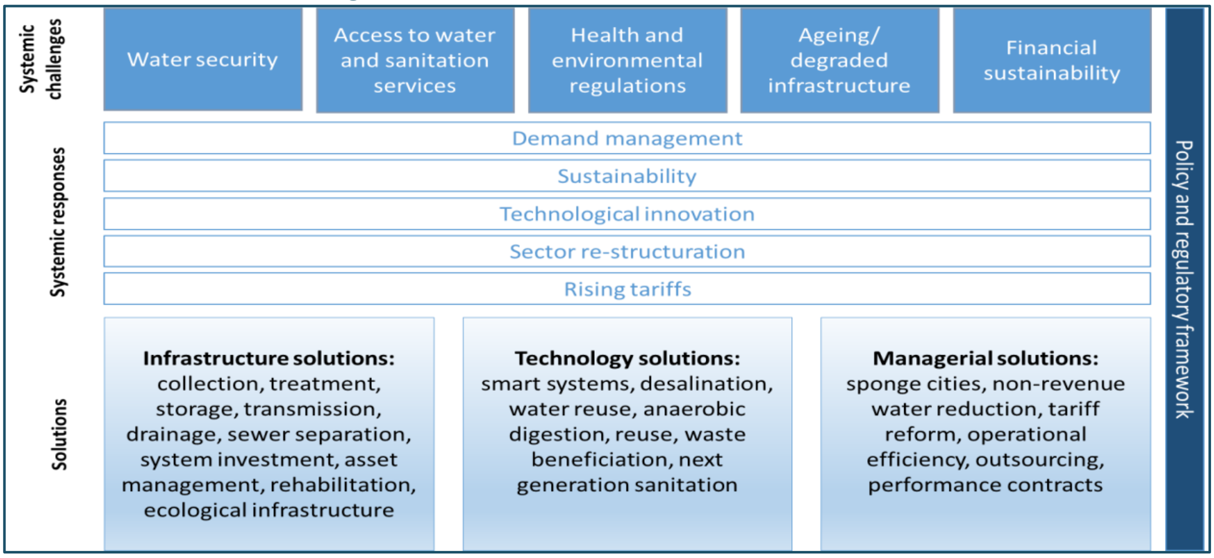
Finally, Section 5 concludes with a discussion on the implications from South Africa's industrial development.

2. SYSTEMIC TRENDS AND DYNAMICS: SHIFTING SANDS IN THE FACE OF STRUCTURAL CHALLENGES

2.1. Systemic challenges: Pressures towards structural change

A number of inter-related, systemic challenges, as illustrated in Figure 1, drive the water and sanitation markets around the world. 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 are the key challenges structuring the market (Deloitte, 2016; GWI, 2017, 2018; IWA, 2016; Montmasson-Clair et al., 2017).

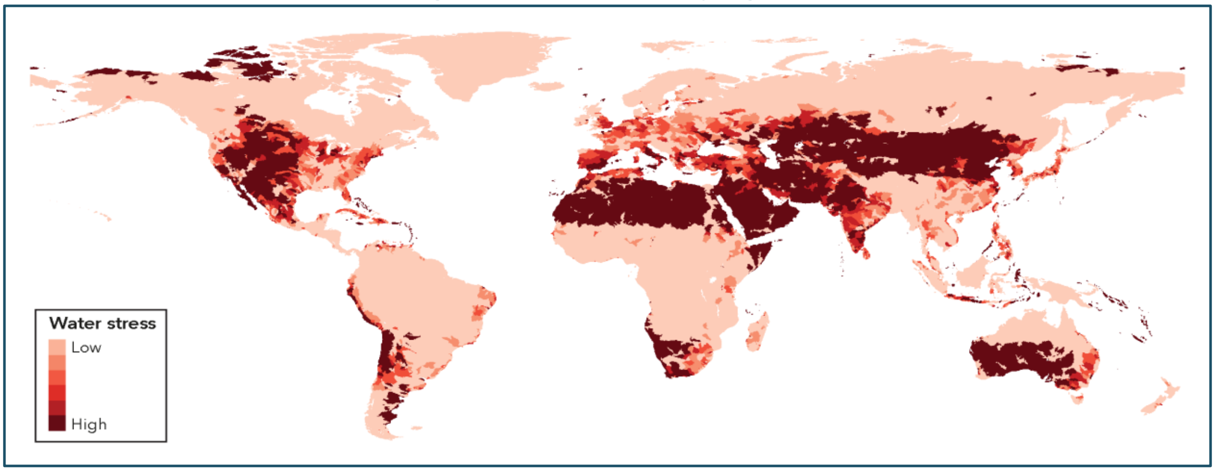
Figure 1: Main market drivers and constraints



Source: Author

First, heightened pressure on water supply security, particularly in the light of climate change impacts, forces the industry to respond to increased water scarcity as well as a rising volume of natural disasters, such as floods and droughts. Large parts of the world are in a situation of permanent water stress (see Figure 2). About 8% of the world's population live in areas where the natural renewable water available annually is below 1 000 m^3 per capita. Global warming is worsening this picture, notably through heightened seasonal variation and increasingly severe droughts.

Figure 2: Water stress by region



Source: GWI, 2017

Second, access to water and sanitation services remains very unequal with large parts of the world still lagging significantly behind. In 2015, respectively 29% and 61% of the world's population did not enjoy safely managed services for water access and sanitation (see Figures 3 and 4).

Despite some improvement over the last few decades, the vast remaining gap drives governments and donor agencies globally to emphasise the increase in access of poor households to modern water and sanitation services. The transition towards a more urbanised society (from about a third of population in 1950 to half today and two-thirds by 2050) is exercising pressure on water supply and wastewater systems, driving the need for more complex, compact and innovative solutions.

Figure 3: Global access to sanitation services from 2000 to 2015

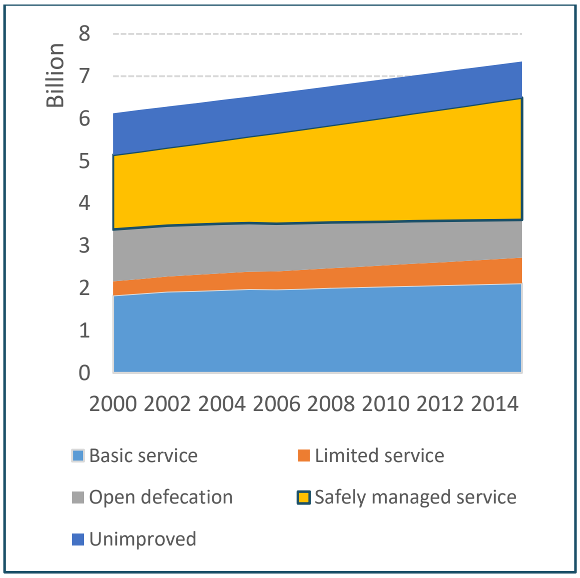
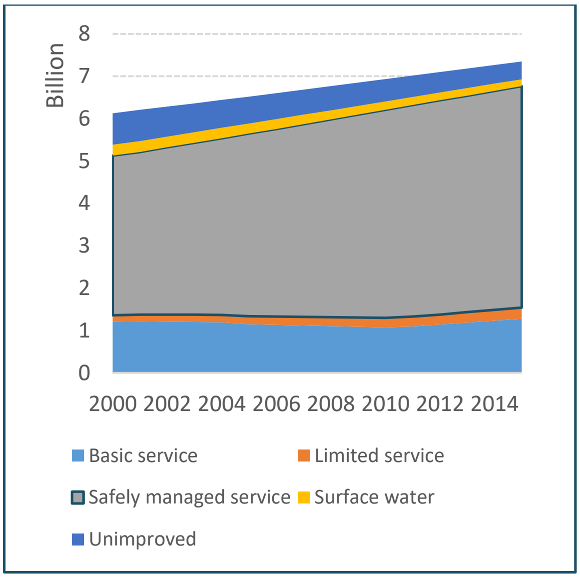


Figure 4: Global access to water services from 2000 to 2015



Source: Author, based on Joint Monitoring Programme (JMP) data (https://washdata.org/)

Notes:

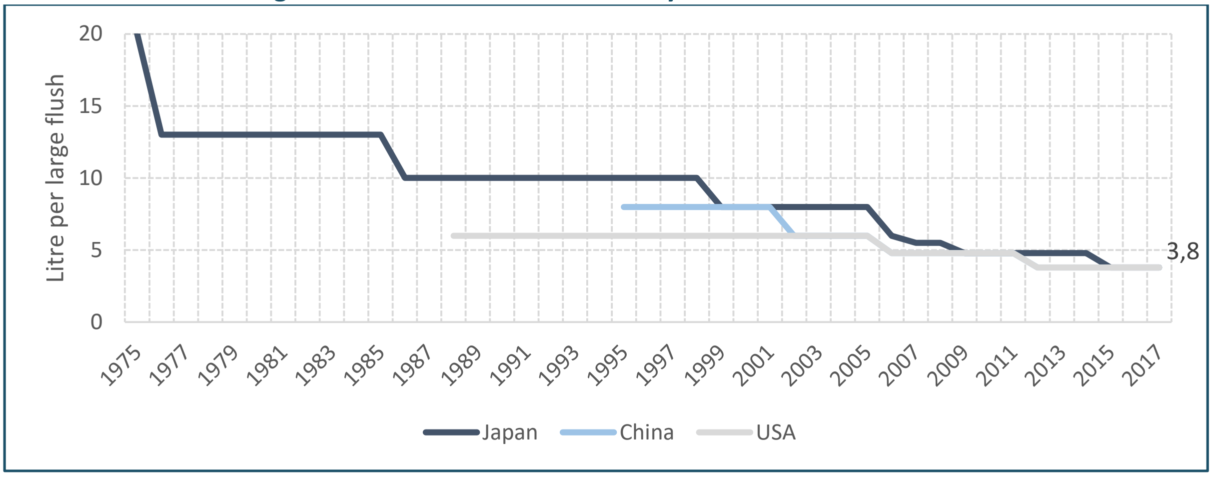
***Safely managed:** use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site; **Basic:** use of improved facilities which are not shared with other households; **Limited service:** use of improved facilities shared between two or more households; **Unimproved:** use of pit latrines without a slab or platform, hanging latrines or bucket latrines; **Open defecation:** disposal of human faeces in fields, forests, bushes, open bodies of water, beaches and other open spaces or with solid waste.*

***Safely managed:** drinking water from an improved water source which is located on premises, available when needed and free from faecal and priority chemical contamination; **Basic service:** drinking water from an improved source, provided collection time is not more than 30 minutes for a roundtrip including queuing; **Limited service:** drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing; **Unimproved:** drinking water from an unprotected dug well or unprotected spring; **Surface water:** drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal.*

Third, increasingly tighter health and environmental regulations on drinking water standards and wastewater treatment are pushing utilities and relevant stakeholders to adopt new technologies and modernise their systems. For example, regulations around the maximum amount of water to be used by flushing toilets are emerging in many parts of the world, capping water use to as low as 4.8 litres (L) in Saudi Arabia and parts of the United States (US). A range of other countries, such as England, China, Mexico, Brazil, and Canada have caps ranging from 6.0 to 7.5L.

Figure 5 illustrates the evolution of water efficiency of conventional toilets over the last four decades in Japan, China and the US.

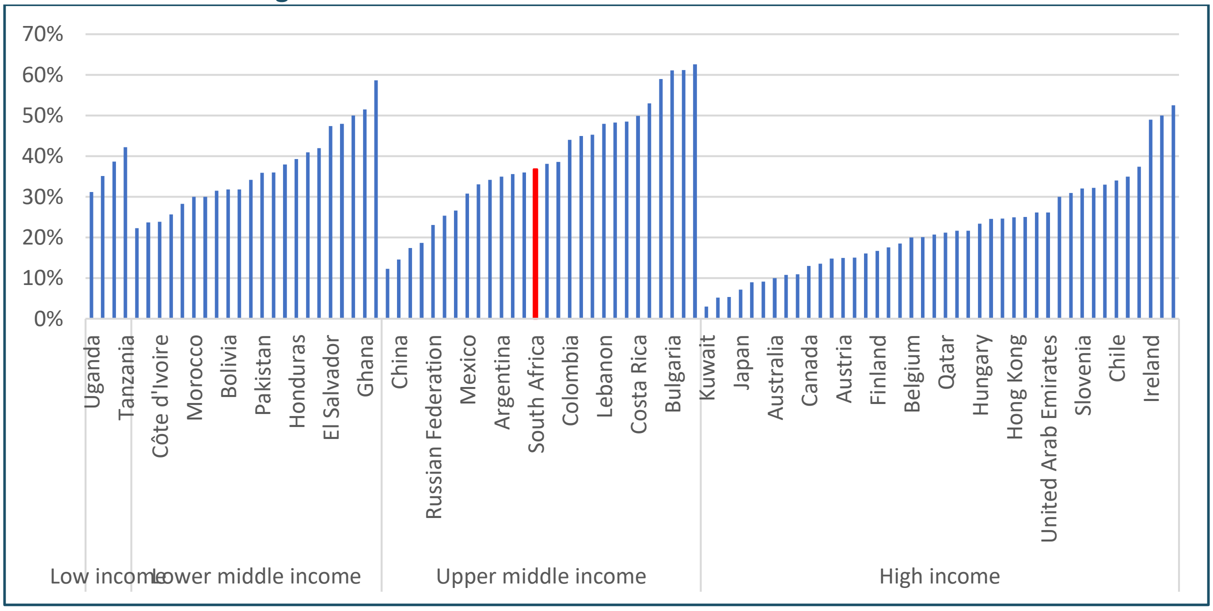
Figure 5: Trends in water efficiency of conventional toilets



Source: Author, based on Toto (https://jp.toto.com/en/company/environment/approach/water/index.htm)

Fourth, ageing infrastructure in mature markets, such as Europe and North America, and degraded infrastructure in many developing markets, such as South Africa, leads to significant failures, leakages and contamination. The extent of non-revenue water, arising from losses, leaks and operating inefficiencies, illustrates the problem faced by utilities worldwide (Figure 6). Although non-revenue water tends to be higher in developing countries than in developed countries, high non-revenue water is a plague impacting countries of all levels of development.

Figure 6: Non-revenue water in selected countries in 2016



Source: Author, based on data from Global Water Intelligence (GWI)

Fifth, financial sustainability is becoming increasingly more difficult to ensure for utilities. Insufficient revenues (as a result of ageing populations and declining tax bases in mature markets, erratic revenue collection in developing markets, and protracted, weak economic growth) and rising input costs, such as energy, squeeze the ability of utilities to operate and leave less and less room to manoeuvre.

In addition, the institutional structure of utilities, which are mostly integrated into existing governmental departments (see Section 2.2), often prevents transparency and accountability, which hinder sustainable management practices.

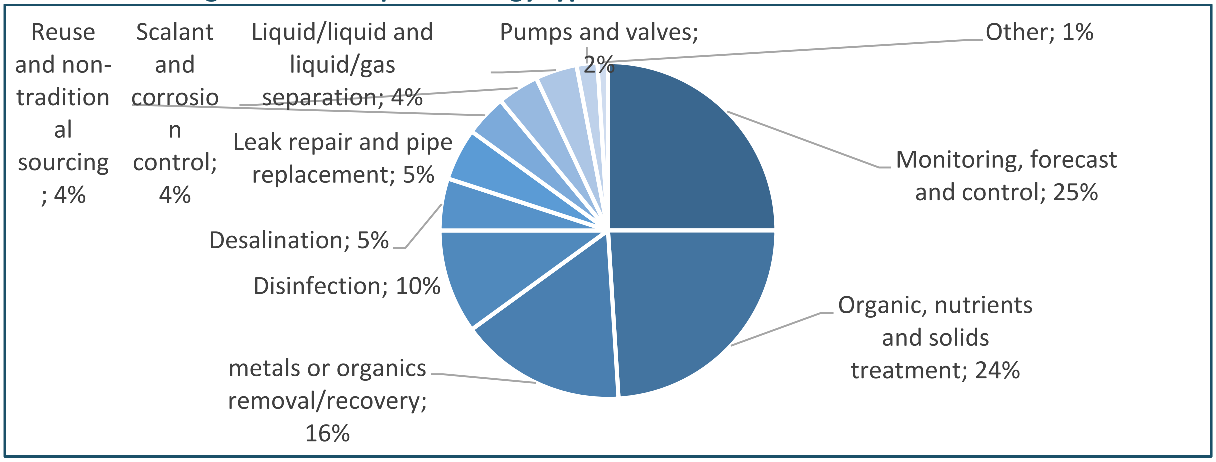
Compounding such challenges, policy and regulatory developments often act as further obstacles by preventing the evolution of the sector. Political economy dynamics around the allocation and pricing of water to different economic sectors and segments of society are particularly pertinent in this respect. The lack of implementation (due to mismanagement, funding gaps and political pressures) also hampers the development of the sector in many countries.

2.2. Systemic responses: Towards a more sustainable sector

The underlying challenges identified in the previous section have triggered a series of systemic responses shaping the market, as depicted in Figure 1 (page 7). These systemic responses include: increased focus on demand management, stronger drive towards sustainability, higher interest in technological innovation, sector restructuration towards stronger utility autonomy and private sector participation, and rising water tariffs (Deloitte, 2016; GWI, 2017, 2018; IWA, 2016; Montmasson-Clair et al., 2017). The systemic responses are explored in turn.

First, increased focus on demand management is a key trend pushing evolution in the water and sanitation sector. Increased water scarcity, coupled with rising water prices, has driven a global movement to better manage and consume water through a shift to smart water and sanitation systems (i.e. the collection of meaningful and actionable data about the flow, pressure and distribution of an area's water supply and waste).While this trend is less pronounced in the agricultural sector due to historical low prices and subsidisation (despite the existence of technologies, such as drip irrigation, to half irrigation-related water losses), water-intensive industrial activities are increasingly investing in demand management. At the supply level, water utilities have similarly begun to place increasing emphasis on reducing non-revenue water, particularly leakages, as well as harnessing opportunities for water supply arising from wastewater treatment and water reuse. As shown in Figure 7, one-quarter of all the new companies targeting the water space are focused on monitoring, forecast and process controls (through sensors and Internet of Things applications) while roughly the same number is focusing on basic wastewater treatment.

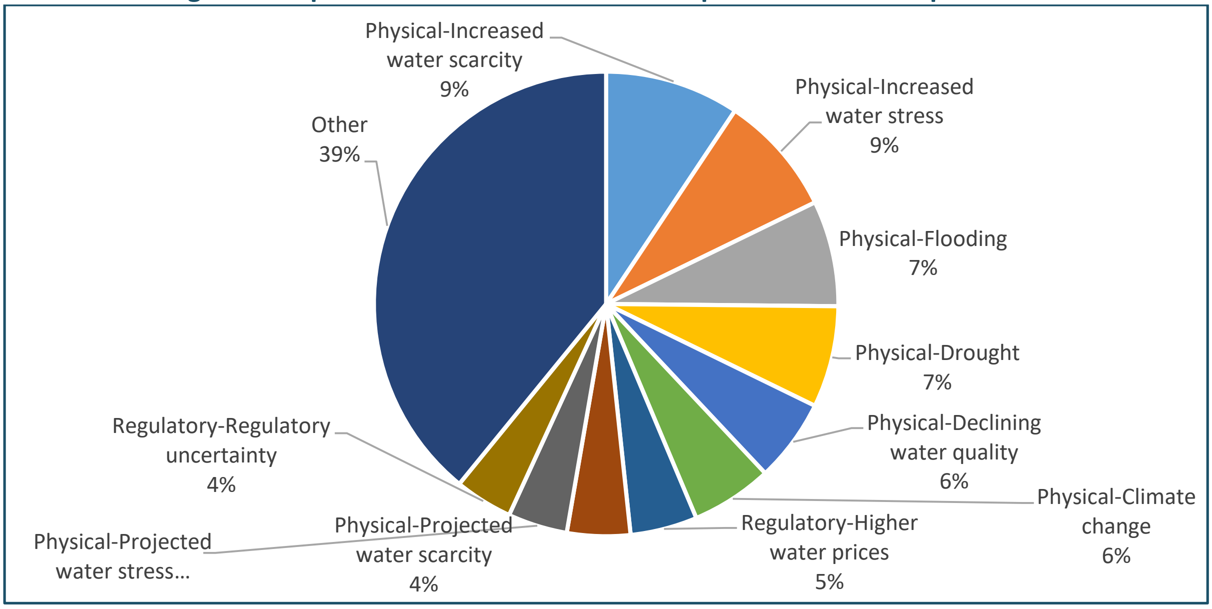
Figure 7: Start-up technology types in the water and sanitation sector



Source: Lux Research, 2013

Second, the global and worsening nature of the water security challenges (both on quantity and quality fronts) has triggered increasing responses from water providers as well as users. Increased water scarcity, stronger regulations and heightened community activism are progressively pushing companies to pay more attention to ensuring water security in conducting their operations. Leading companies worldwide are raising increased water scarcity (i.e. supply concerns) and increased water stress (which includes quality and accessibility in addition to supply) as the main two key water-related risk to their business (Figure 8). Overall, physical risks (66%) dominate the concerns of reporting companies. As a response, firms are putting more emphasis on reducing the water footprint of their economic activities in order to mitigate reputational risks and maintain their licence to operate. The drive towards sustainable development is also supporting investment in demand management and circular economy initiatives, notably to leverage the opportunities associated with wastewater and sludge management.

Figure 8: Reported water risks that could impact firms' direct operations



Source: Author, based on CDP data (https://www.cdp.net/en)
Note: percentage calculated out of 2 703 risks reported in 2016

Third, coupled with the increasing need to do more with less, due to increased financial constraints, these heightened risks have spurred interest in technological innovation, particularly smart/digital systems, waste minimisation and beneficiation and water treatment/reuse. The economics of water and sanitation, a sector which generally values safety over financial gains, is progressively changing to let innovation play a larger role in the future of the sector.

Fourth, increasing financial constraints also push the sector to restructure to some extent. Structural regulations, defining the roles and responsibilities of different players with the water sector, particularly private sector participation, and economic regulation, providing checks and balances on natural monopolies and highly concentrated markets, are progressively changing the rules of the game, introducing more stringent control but also opening the door to new market players.

Indeed, the operating models of utilities, which are primarily unincorporated departments within government (see Table 1), is progressively evolving, with increasing autonomy and accountability (i.e. a move towards incorporated entities) and greater reliance on the private sector to deliver solutions and/or improve operations. Private sector participation takes various forms (see Table 2), with performance and management contracts, which are widely used across the globe, and operations and maintenance (O&M) contracts, leading the way. Utility leases and investor-owned utilities, which transfer significant (if not all) responsibilities to the private sector remain the exception rather than the norm.

Table 1: Corporate structure of utilities worldwide

Utility structure	Key features	Number of utilities	Populated served	Spending
Unincorporated municipal or government departments	Part of government department, direct political control, no separate balance sheets	290 000	44%	33%
Subsidiaries of incorporated public works or multi-utility organisations	Own balance sheet as part of separate municipal or governmental organisation also providing other public works and utility operations.	7 000	15%	24%
Incorporated municipal or government bodies	Separate entity under municipal ownership and control but own balance sheets	9 000	24%	35%
Mixed economy organisations	Majority owned by the local government, with private investors as minority shareholders, direct responsibility for finances, but no direct control over tariff setting.	100	1%	2%
Investor-owned utilities	Privately owned but regulated by a government appointed body.	250	2%	5%
Independent not-for-profit organisations	Independent of government, but not run on a for-profit basis.	20	1%	1%
No utility service	No utility coverage	n/a	14%	n/a

Source: GWI, 2017

Table 2: Private sector involvement at the utility level, based on capital equipment requirement and degree of control

<table>
<tr><th>Contract type</th><th>Key features</th><th>Capital expenditure requirement for private partner</th><th>Degree of control of private partner</th></tr>
<tr><td>Investor-owned utilities</td><td>Private utilities, generally with regulation of prices and service quality): rare and the result of privatisation (UK, Chile) or historical quirks (US)</td><td>High</td><td>High</td></tr>
<tr><td>Utility leases</td><td>Based on releasing equity from public water assets on the basis of long-term utility leases: used as an answer for small-size, cash-strapped municipalities (US, Australia)</td><td>Medium</td><td>High</td></tr>
<tr><td>Concessions and canon contracts</td><td>Equity release similar to utility leasing, as the concessionaire has direct control over capital spending, but with increased focus on performance</td><td>Medium</td><td>High</td></tr>
<tr><td>Affermage-type contracts</td><td rowspan="2">The private contractor concentrates on O&M without taking risk on capital expenditure: used in different countries with varying degrees of responsibilities</td><td>Low</td><td>Medium-high</td></tr>
<tr><td>Operations and maintenance</td><td>Low</td><td>Medium</td></tr>
</table>

contracts	allocated to the private operator (main models originate from the US, France and Spain)		
Management contracts	A private operator takes management responsibility for the utility for a period of time, typically to achieve some transformational objectives	Low	Medium-low
Performance contracts	Address specific issues (from performance improvement to leakage reduction, energy management or smart metering) at the utility, with remuneration dependent on successful delivery: well spread in both developed and developing countries, with support from donor agencies	Low	Low

Source: Author, based on GWI information

At the project level, a shift towards greater private sector involvement can also be witnessed in order to rebalance risk between parties, with an ongoing move from simply commissioning plants from contractors to getting the private sector involved in the O&M of projects.

As illustrated by Figure 9, more extensive contract structures are limiting risks, particularly for the commissioning entity. As a result, client-financed Engineering, Procurement and Construction (EPC) / Design-Build (DB) contracts, which solely focus on construction and handover, are becoming less prominent in the sector. Design-Build-Operate (DBO) contracts, which entail an EPC/DB procurement with an outsourcing operations contract included are increasingly used, particularly when the client has access to capital but is concerned with operational risks. Contracts based on co-financing are moreover witnessing increasing interest. Ideal for new technology, complex operations, and high capital costs, they involve a private developer co-financing an infrastructure project along with the client, building, owning and operating a facility (BOO) and, in some cases, transferring it back to the client (BOT) after a fixed period.

Figure 9: Risk-sharing by contract structure for infrastructure provision

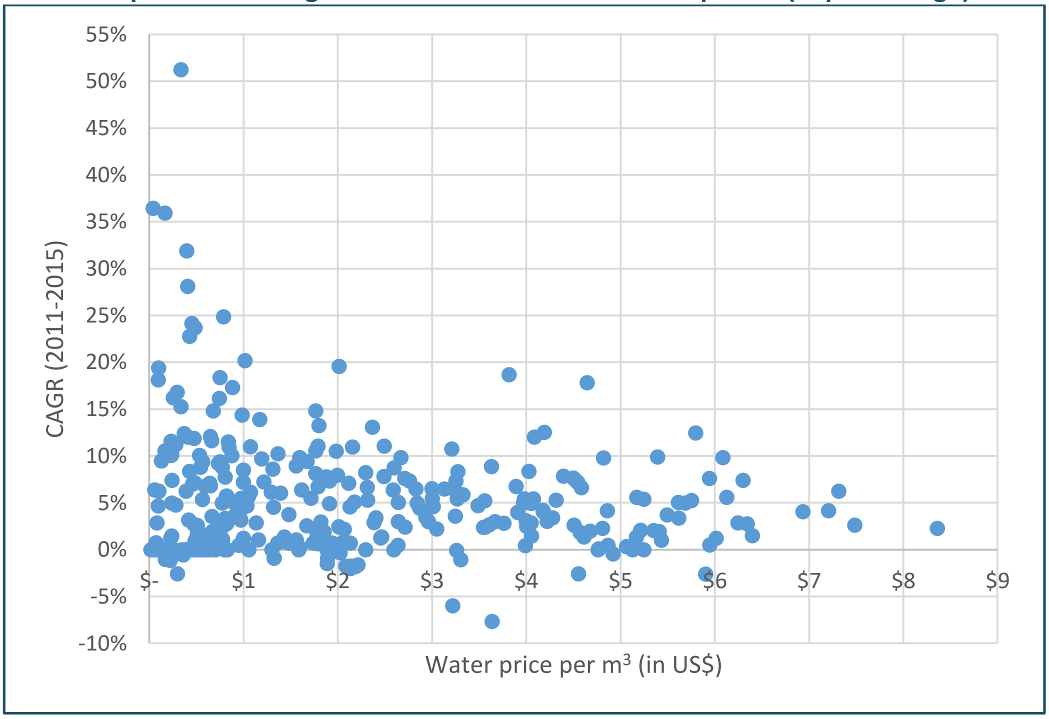
Source: Author, based on GWI, 2017

Along these large trends, other forms of public-private partnerships are emerging. In the US, municipal-industrial partnerships see utilities selling treated wastewater to industrial partners (such as power generation, oil and gas, and refining facilities), as a form of beneficial reuse. Such arrangements allow utilities to monetise otherwise discarded streams while industries secure additional water supply.

In South Africa, reverse transactions have been witnessed with mining companies treating and supply water to municipalities. For example, Anglo American treats water from its and South32's coal mining activities, then selling it directly to the local Emalahleni municipality for use as drinking water. A form of extended vendor credit (dubbed Build-Transfer) is also appearing in China, in which a private contractor builds and finances a facility and then allows the client to operate it for a period of up to five years, before the client pays for the asset and achieves ownership.

Fifth, at the same time, water tariffs are evolving rapidly. Historically, water tariffs have been set below the level required to cover both operating costs and capital investment projects in most parts of the world, largely for political reasons. This is, however, changing with tariffs rising fast in numerous cities around the globe. This is further re-enforcing consumers' focus on demand management, in an attempt by governments to improve efficiencies and extract more value out of each litre of water consumed. In addition, some governments are looking at strategies to direct the allocation of water, either through rationing, restrictions on certain usages or direct water allocation management, specific targets for water reuse for example (like in India), differentiated pricing, and/or the creation of "water rights markets" (US, Australia, Israel).

Figure 10: Water tariffs in selected cities in 2015 (in US$) and compound annual growth rate over the 2011-2015 period (in percentage)



Source: Author, based on GWI data

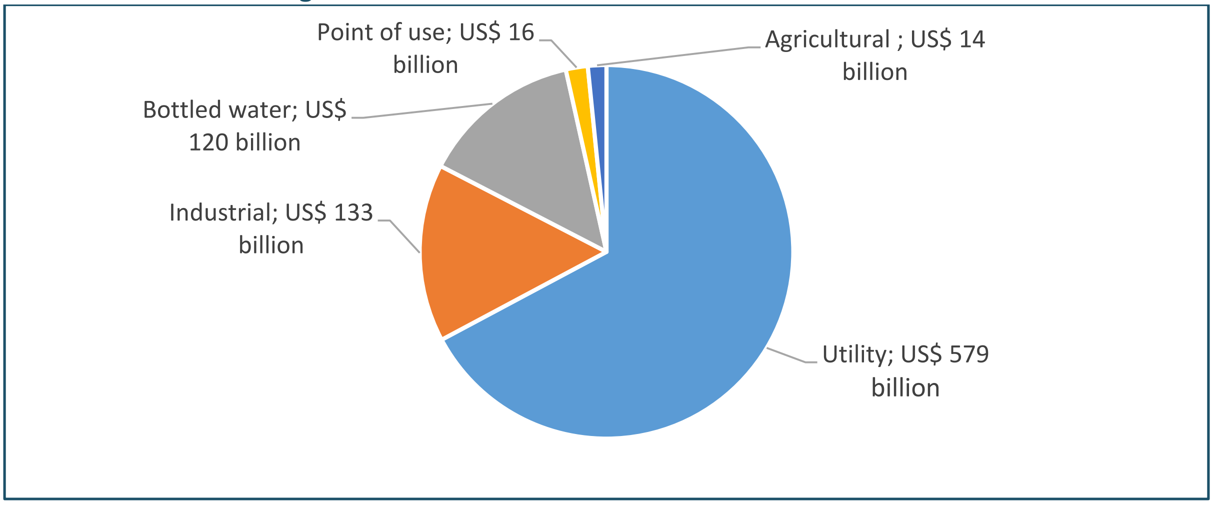
While at times constituting a hindering factor (as already highlighted), the policy and regulatory framework is critical in stimulating the evolution of the sector and facilitating its adaptation to new circumstances. Policy direction is, for example, paramount in driving demand management, through regulations, standards, pricing strategies and support mechanisms. Political leadership is also required to efficiently restructure the sector, improve its accountability and performance and manage the difficult trade-offs between security of supply, affordability, equity and socio-economic development.

3. GLOBAL MARKET DEMAND: A UTILITY-DRIVEN SECTOR

3.1. 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-third of water globally, only accounts for a marginal share of the market (Figure 11).

Figure 11: Global water and sanitation market in 2016

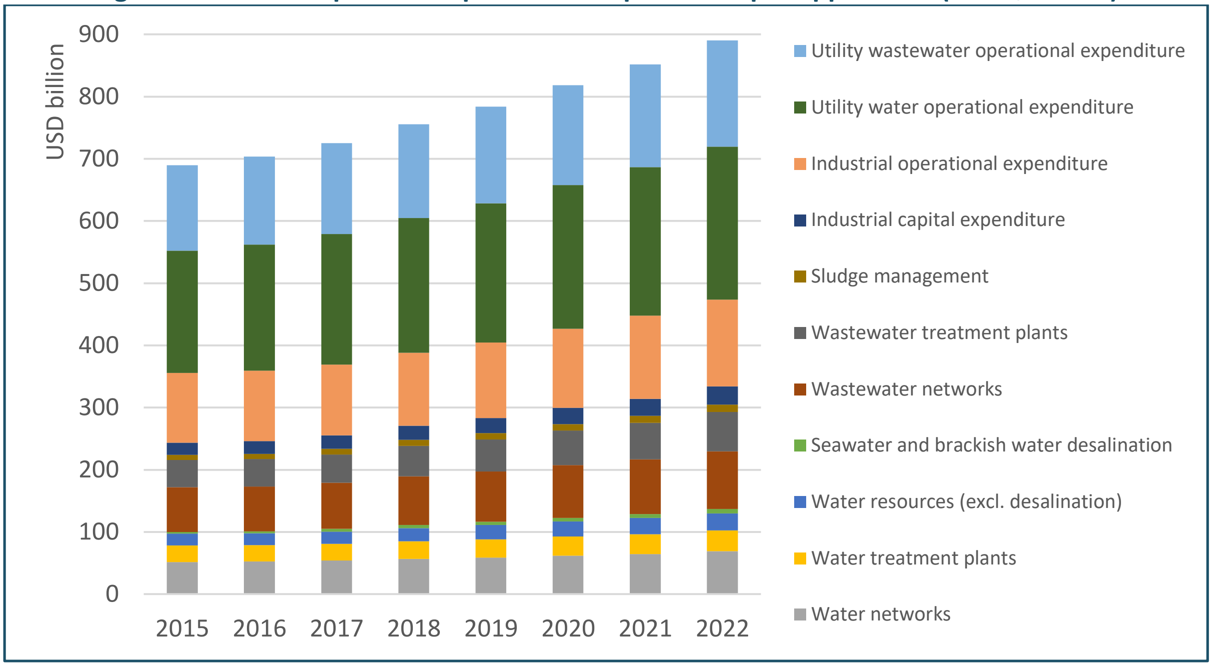


Source: Author, based on data from GWI

As illustrated in Figure 12, focusing on the two largest markets, i.e. 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 from 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 12: Global capital and operational expenditure per application (in US$ billion)



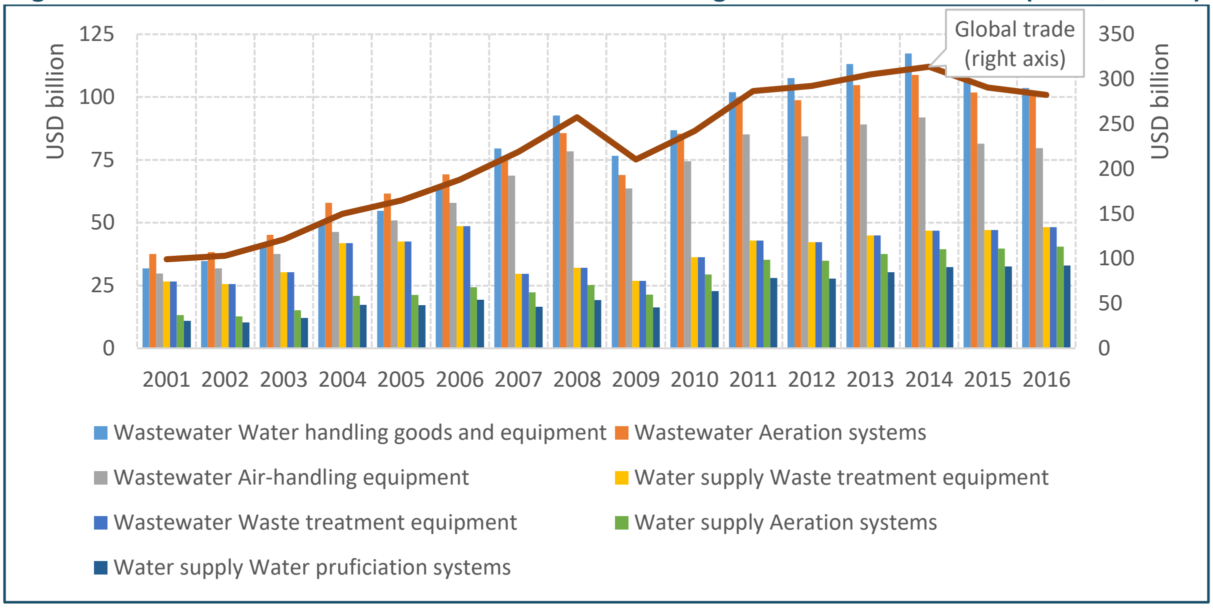
Source: Author, based on data from GWI

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 implementation 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, 2018, 2017; IWA, 2016).

In addition, decentralised solutions for both water supply and wastewater treatment are increasingly attractive and rapidly spreading out. 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 13), 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 (see Figure 19 and discussion further on), trade is dominated by pumps, valves and compressors. As listed in Table 3, a limited set of 10 products accounts from about two-thirds of the trade.

Figure 13: Global trade in water- and wastewater-related goods from 2001 to 2016 (in US$ billion)



Source: Author, based on data from Trade Map

Note: the sum of individual categories is larger than global trade due to some products figuring in more than one category

Table 3: 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%

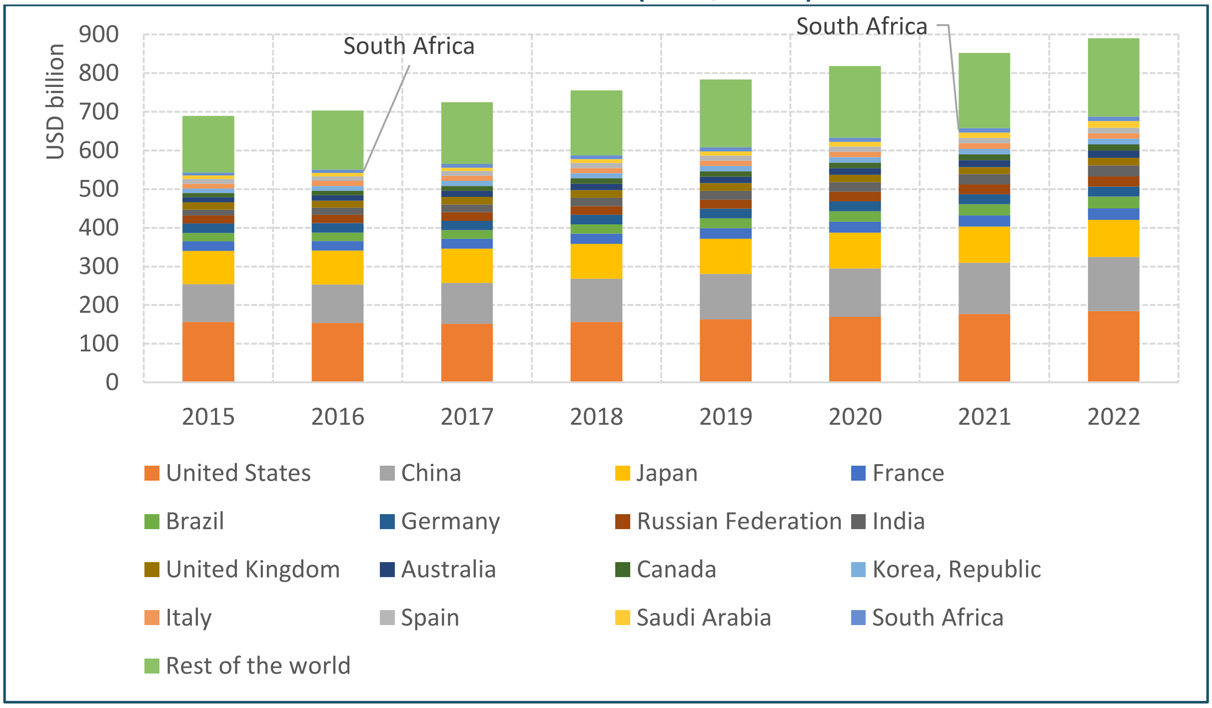
Source: Author, based on data from Trade Map

3.2. 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 US (21%), China (15%) and Japan (12%) lead the pack, concentrating about half the market (48%), as depicted in Figure 14. 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 14: Global capital and operational expenditure per country from 2015 to 2022 (in US$ billion)

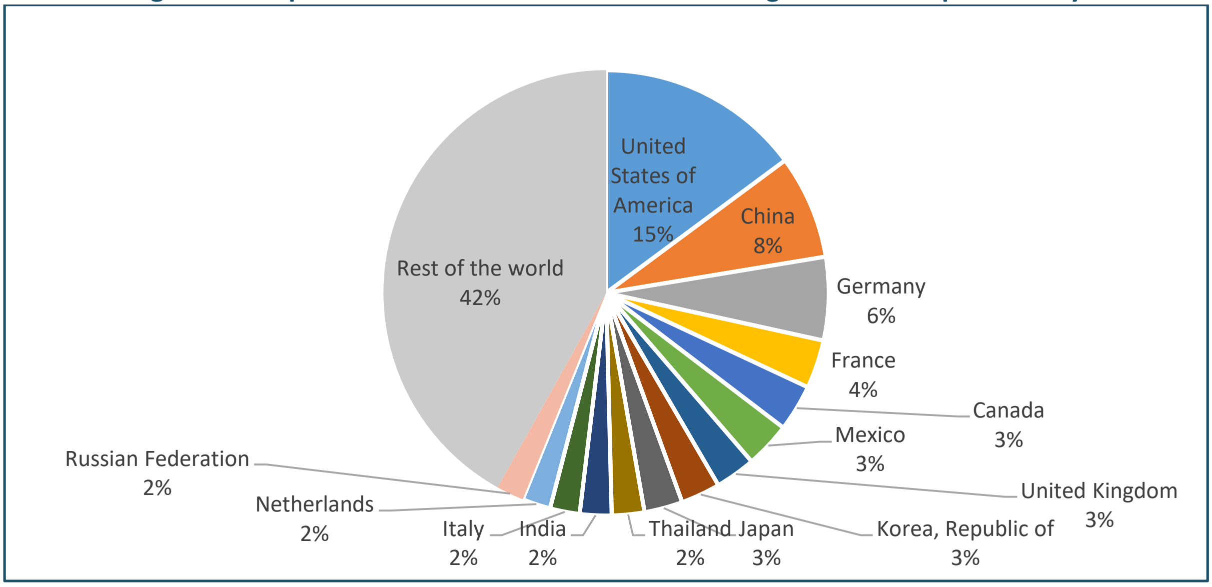


Source: Author, based on data from GWI

Correspondingly, imports of water- and wastewater-related products are dominated by few countries (see Figure 15). 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, probably due to its role in bringing products into the North American Free Trade Area.

Figure 15: Import of water- and wastewater-related goods in 2016 per country

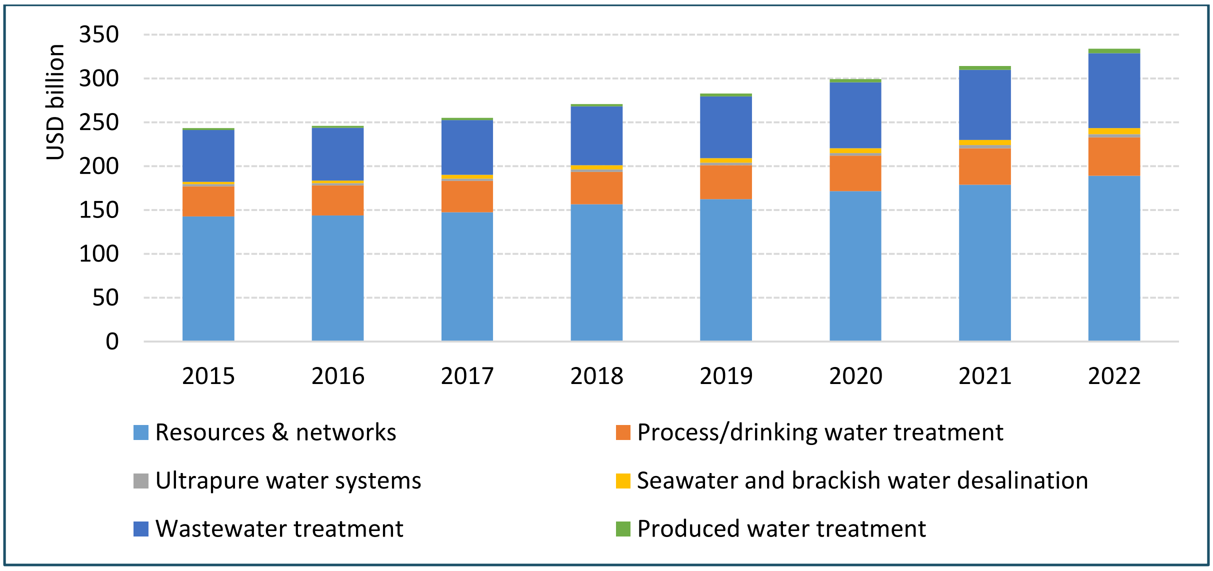


Source: Author, based on Trade Map data

3.3. 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 16), 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 16: Global capital expenditure per segment from 2015 to 2022 (in US$ billion)



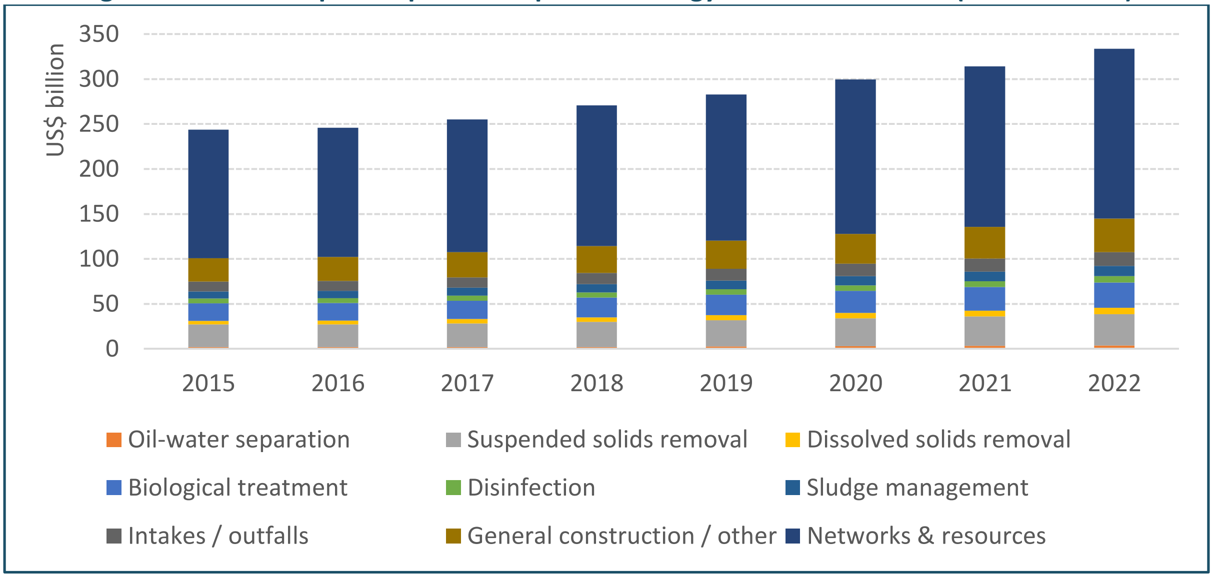
Source: Author, based on data from GWI

From a technology perspective (Figure 17), 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 17: Global capital expenditure per technology from 2015 to 2022 (in US$ billion)

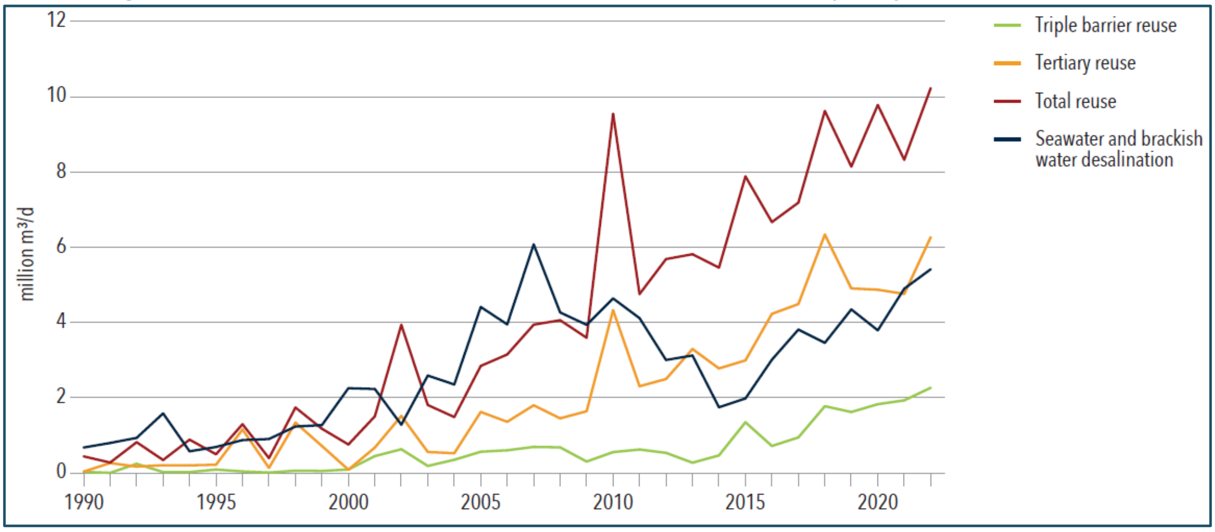


Source: Author, based on data from GWI

Unconventional resource development, i.e. desalination and water reuse, is also experiencing strong growth on the back of rising water security concerns (Figure 18).

The market for desalination is forecasted to reach US$4.8 billion in 2022, rapidly increasing at 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.

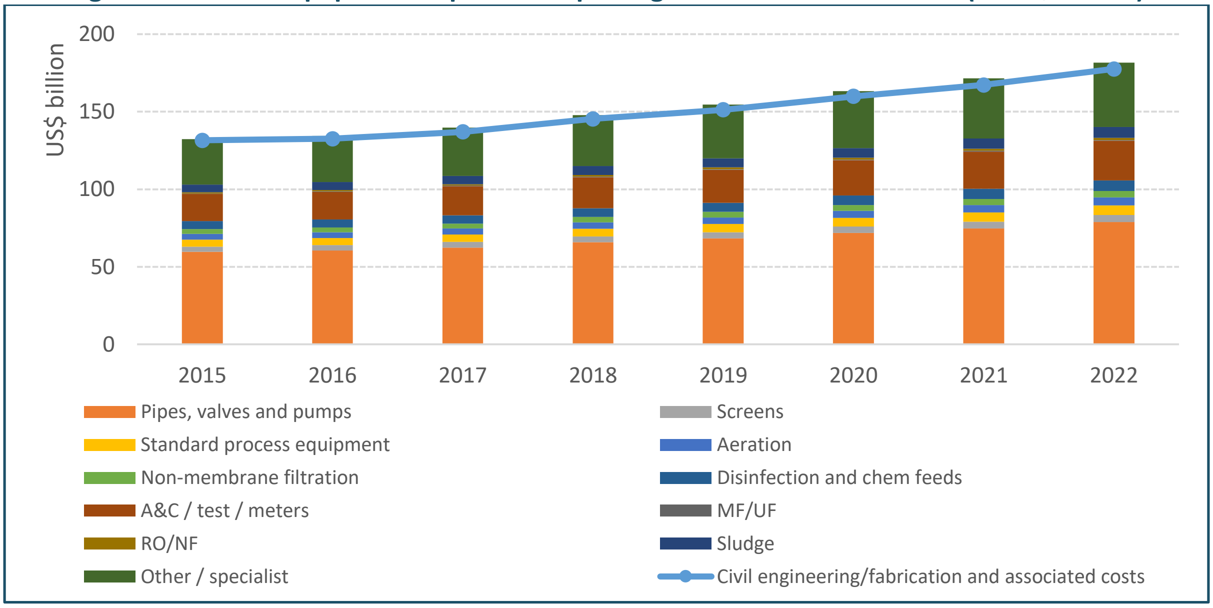
Figure 18: Incremental contracted desalination and reuse capacity from 1990-2022



Source: GWI, 2018

Beyond the 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 19), 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 4.0% per 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.

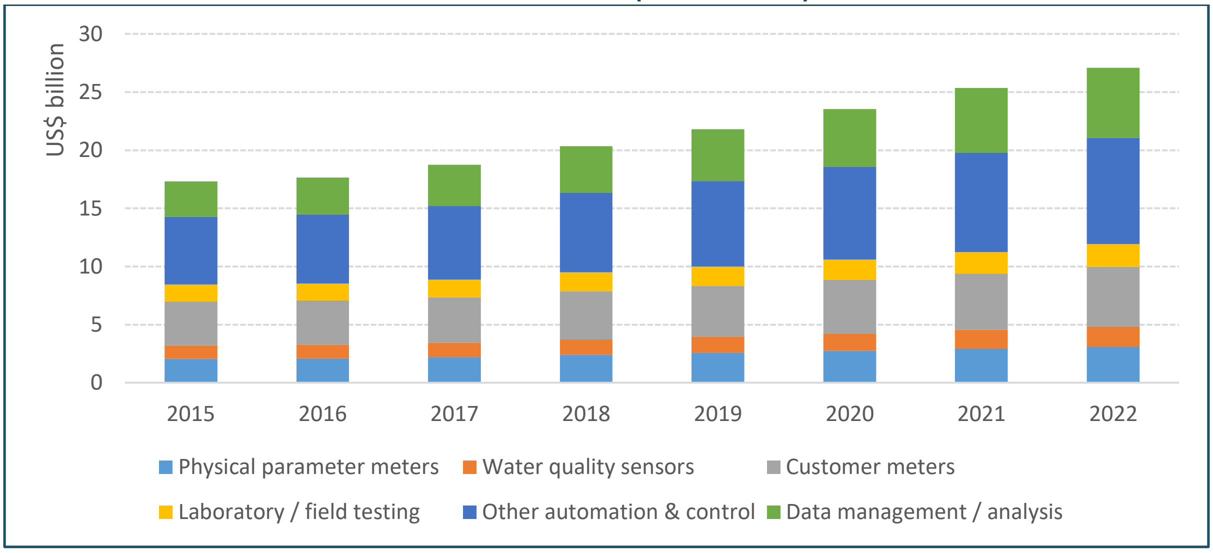
Figure 19: Global equipment expenditure per segment from 2015 to 2022 (in US$ billion)



Source: Author, 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 20: Global spending on digital solutions in the utility sector from 2015 to 2022 (in US$ billion)



Source: Author, based on data from GWI

At a sectoral level, the utility sector drives the bulk of the 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.

4. 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) 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.

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. 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.[1] In addition, there are about 1 300 privately-owned businesses active in the industry with revenues in excess of US50 million.

Table 4: 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, & wastewater technology supplier	3,7	Eq Sy
Grundfos	Denmark	Pump supplier with strength in residential services	3,2	Eq
American Water	US	Regulated utility & 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: Author, based on GWI data

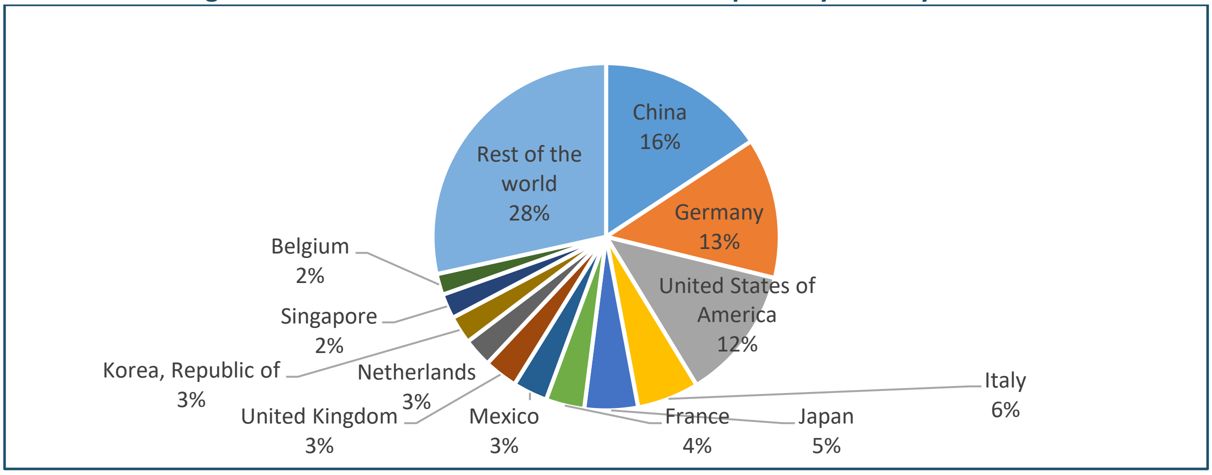
Note: Eq = Equipment; Sy = Systems; En = Engineering;
C = Chemicals; Op = Operations; Ow = Ownership

Despite this high degree of disaggregation, expertise is fairly concentrated geographically. As listed in Table 4, 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).

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

As with the firm level, the provision of tradable water- and wastewater-related products (see Figure 21) 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.

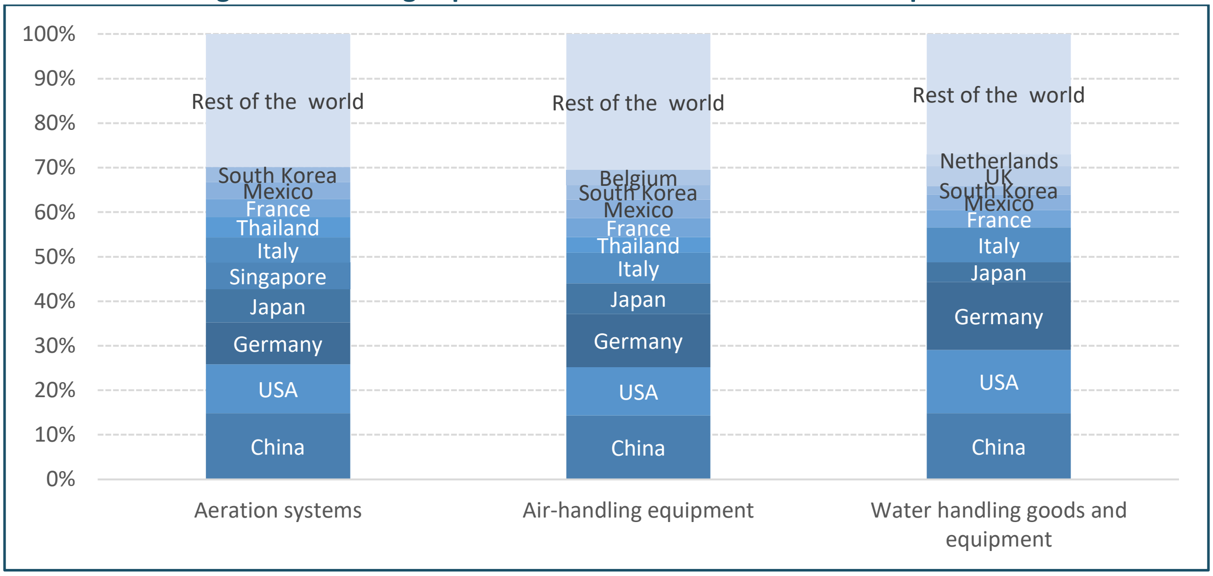
Figure 21: Water- and wastewater-related exports by country in 2016



Source: Author, based on Trade Map data

Leading exporters remain relatively unchanged across top segments (Figure 22), 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 22: Leading exporters of main water-related traded products



Source: Author, based on Trade Map data

5. IMPLICATIONS FOR SOUTH AFRICA'S INDUSTRIAL DEVELOPMENT

From the perspective of South Africa's industrial development, global dynamics, as they shape and permeate the local market, constitute a both a challenge and an opportunity.

On the one hand, South Africa faces similar challenges as the rest of the world in terms of water security, access to water and sanitation services, water quality, infrastructure development and financial sustainability. This puts significant pressure on the country's water and sanitation systems, in turn jeopardising the country's industrial development. South Africa is indeed a water-stressed country and climate change impacts are set to further compromise water supply (DWS, 2015).

In addition, water quality is increasingly problematic, as exemplified by the challenges associated with acid mine drainage and algal blooms in dams (i.e. a quick increase in the algae population). Coupled with water supply challenges, a steep increase in water demand has been witnessed over the last couple of decades, spurred by growing population and economic activity. Projections show that South Africa will approach physical water scarcity by 2025 and would require 17% more water than what would currently available by 2030, as illustrated by Figures 23 and 24. Severe shortages are expected in core industrial areas, including Gauteng, Mpumalanga, KwaZulu-Natal and the Western Cape.

Figure 23: Projected water demand in South Africa

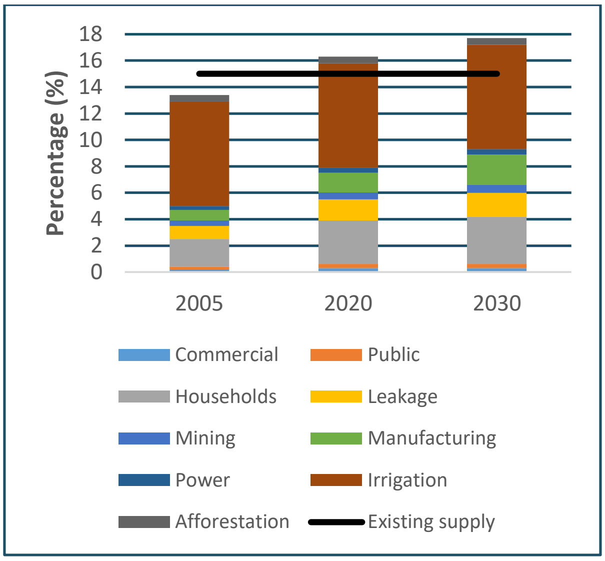
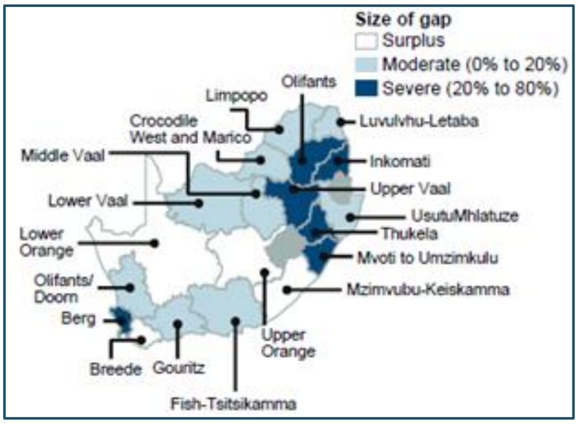


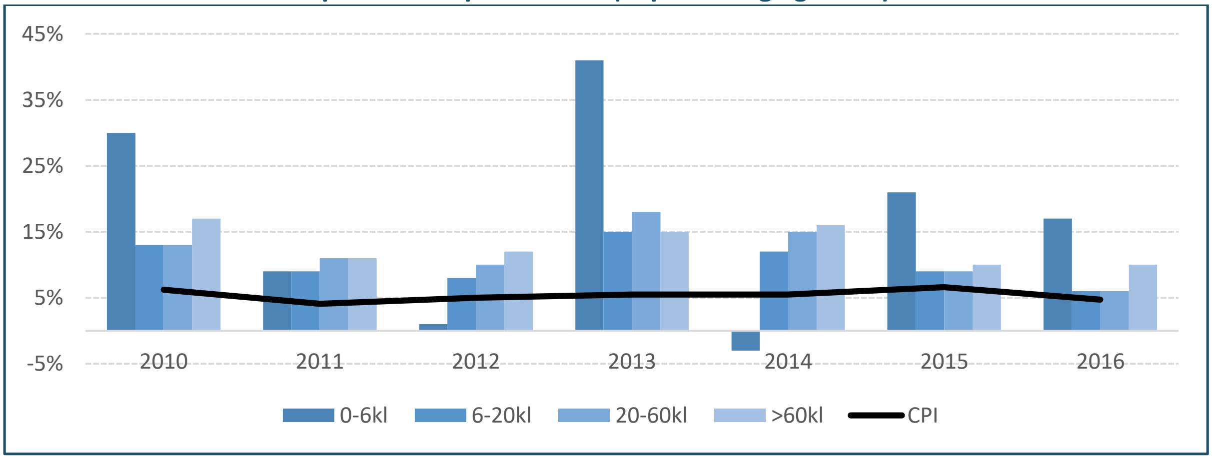
Figure 24: Project gap between water supply and demand in 2030 (in percentage of 2030 demand)



Source: Addams et al, 2009

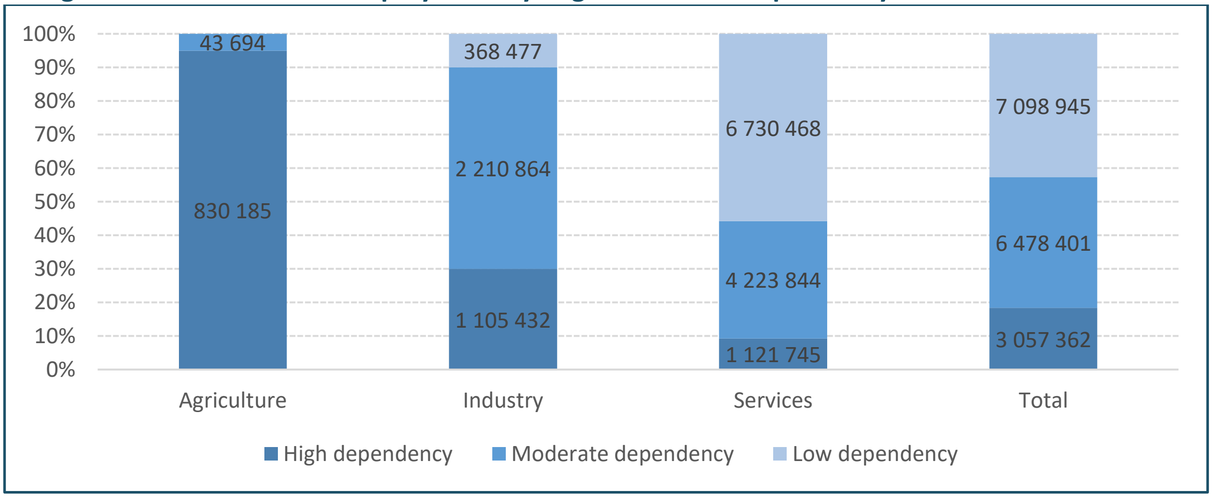
Along with global trends, South Africa's water prices, while still low by international standards, have been rising materially over the past few years (Figure 25), putting additional pressure on all consumers, notably in municipal areas. Furthermore, the state of the water infrastructure, with dams, treatment plants and piping in dire straits, is set to push prices higher in the coming years. Capital replacement costs for water infrastructure in South Africa are estimated to be R855 billion over the 2015-2025 period (in real terms) (DWS, 2017). These trends are extremely worrying from the perspective of industrial development, with large parts of the economy being directly dependent on water supply. About 9.5 million jobs are significantly dependent on water in South Africa (Figure 26), raising serious questions about the management of the country's water supply and consumption.

Figure 25: South African municipal tariffs from 2010 to 2016 per consumption levels (in percentage growth)



Source: Author, based on DWS, 2016

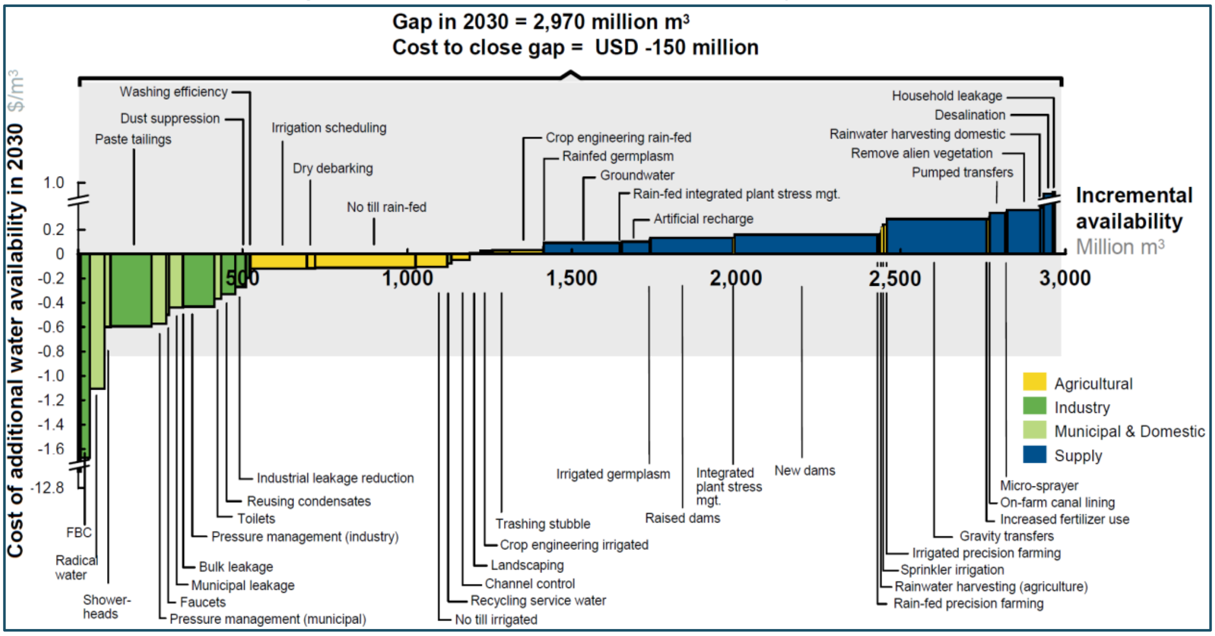
Figure 26: South Africa's employment by degree of water dependency in South Africa in 2016



Source: TIPS, based on data from Statistics South Africa

In the agricultural sector, which utilises around two-thirds of South Africa's water resources, uncertainty in water supply would directly threaten domestic food security. Particularly vulnerable groups, like small-scale farmers, would face increased business risks from supply constraints. At the same time, the sector is particularly water-inefficient, largely as a result of historically low water supply. Mining, power generation and industry account for about 11% and also rely heavily on water for their business activities. Coal-based power generation, the predominant form of generation in South Africa, is a water-intensive process. The addition of the coal-fired Kusile and Medupi power plants will further increase the vulnerability of South Africa's electricity supply to water scarcity. Similarly, the mining industry is reliant on water for extraction, processing and beneficiation. Numerous manufacturing industries also depend directly on water supply, such as agro-processing, mineral beneficiation, pulp and paper and textile. In addition to jeopardising current operations, the lack of water availability could severely hinder future developments in such water-dependent, hampering economic growth and job creation.

Figure 27: South Africa's water availability cost curve



Source: Addams et al, 2009

Water supply considerations (i.e. quantity, quality and price) will, going forward, increasingly permeate industrial policy decisions. Water policy choices will inform, if not constrain, industrial development in the future triggering critical trade-offs between economic activities. As illustrated in Figure 27, water supply solutions vary greatly in cost and impact, with efficiency and leak repair measures bringing significant co-benefits. Competition between uses and users will become an increasing reality with social needs, the requirements of strategic industries (such as power generation), mining, manufacturing, agriculture and a range of other economic sectors, the preservation of the ecological reserve coming in opposition. Allocation decisions in the context of scarcity, cost and competing demands will be at the core of industrial policy in the future.

Figure 28: Water use in South Africa by sector

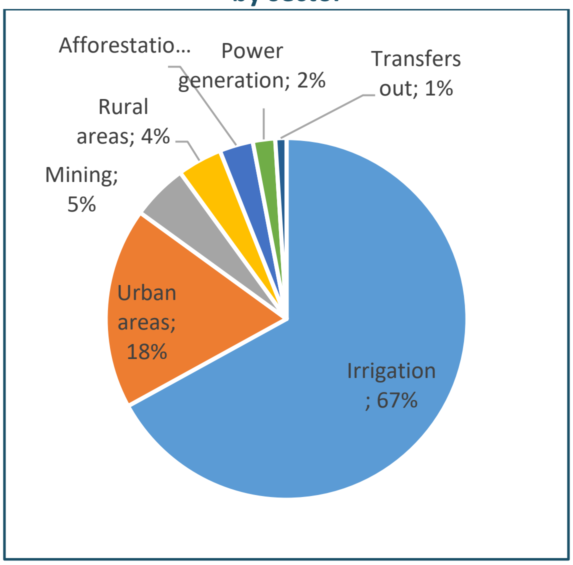
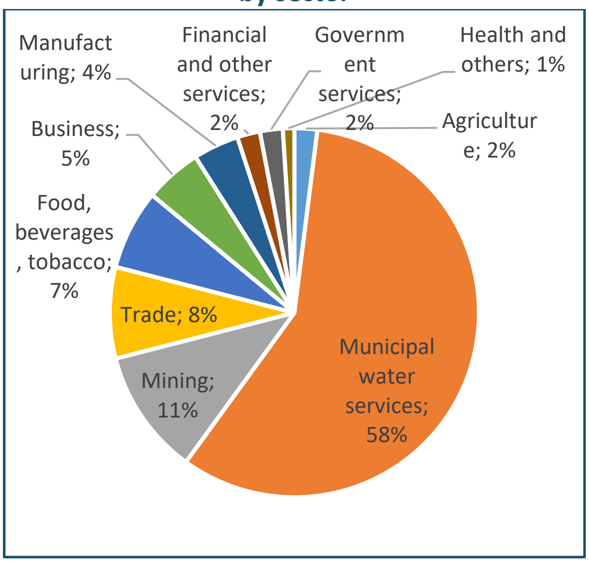


Figure 29: Financial value of water sales by sector

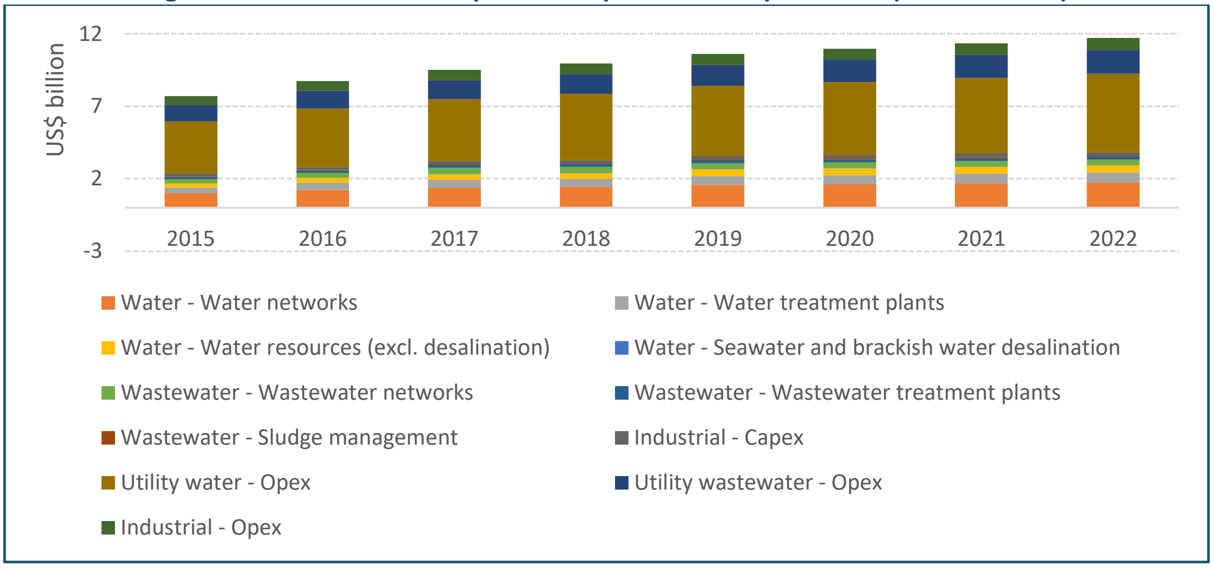


Source: TIPS, based on data from GreenCape

The case of agriculture exemplifies the complexity of the problem. While agriculture consumes more than two-thirds of the country's water, it only accounts for 2% of the value of water sales, at the favour of rain water harnessing and low prices (see Figures 28 and 29). At the same time, the sector generates low value add and employment per unit of water compared to other sectors of the economy. However, agriculture is paramount for food security, the development of rural areas and the preservation of water resources (notably through water stewardship).

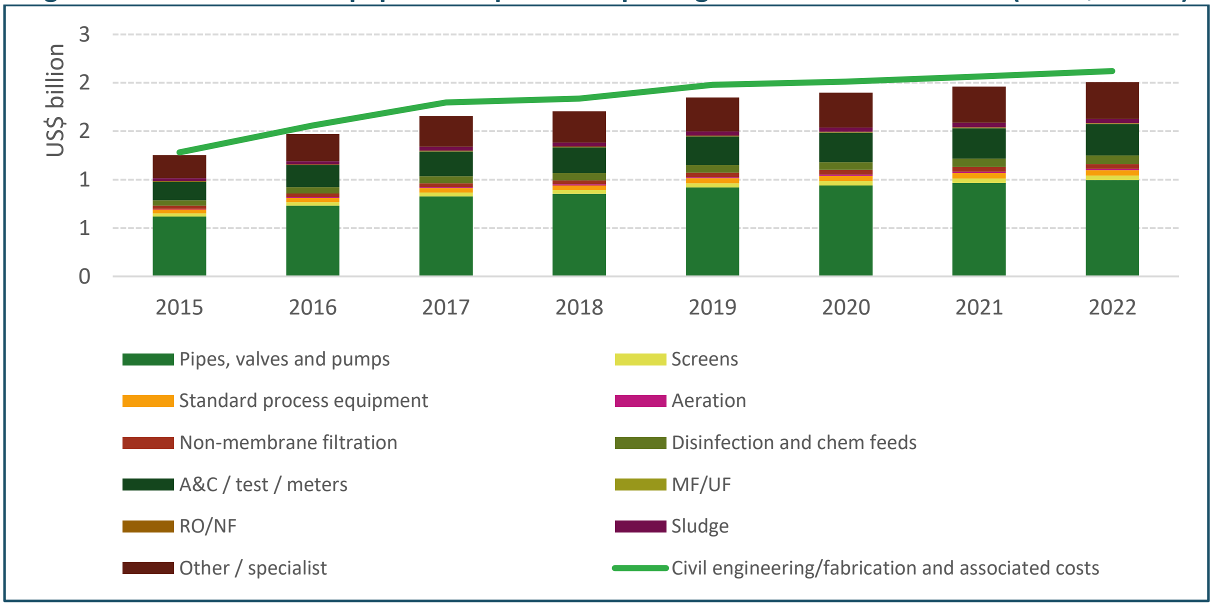
On the other hand, South Africa's water market, while small on a global scale (slightly more than 1%), is significant at the local level. Rising at 6.2% a year from 2015 to 2022, it is expected to reach US$11.7 billion at the end of forecast period (Figure 30). The civil engineering and equipment and components (Figure 31), 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 30: South Africa's capital and operational expenditure (in US$ billion)



Source: Author, based on data from GWI

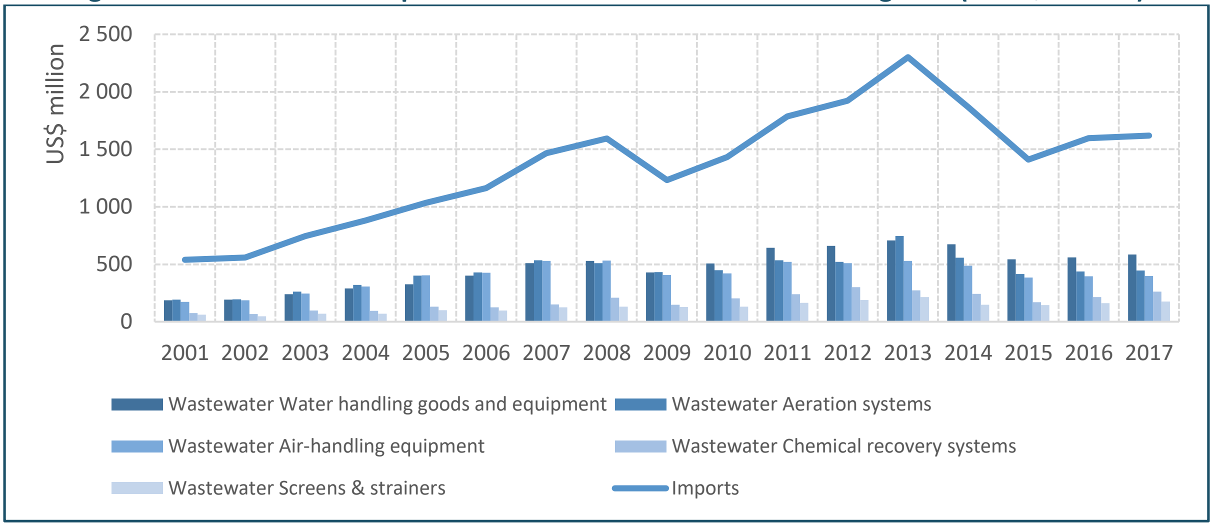
Figure 31: South Africa's equipment expenditure per segment from 2015 to 2022 (in US$ billion)



Source: Author, based on data from GWI

The South African market is nevertheless heavily dependent on imports (Figures 32 and 33). Despite noteworthy exports (between US$0.8 billion and US$1.1 billion over the 2012-2017 period), imports of water- and wastewater-related products are materially larger (between US$1.4 billion and US$2.3 billion over the same period). This could open opportunities for import substitution, particularly for pipes, pumps and valves (50% of total South African equipment market) as well as automation and control equipment (16%) which accounts for the bulk of the equipment demand in the country.

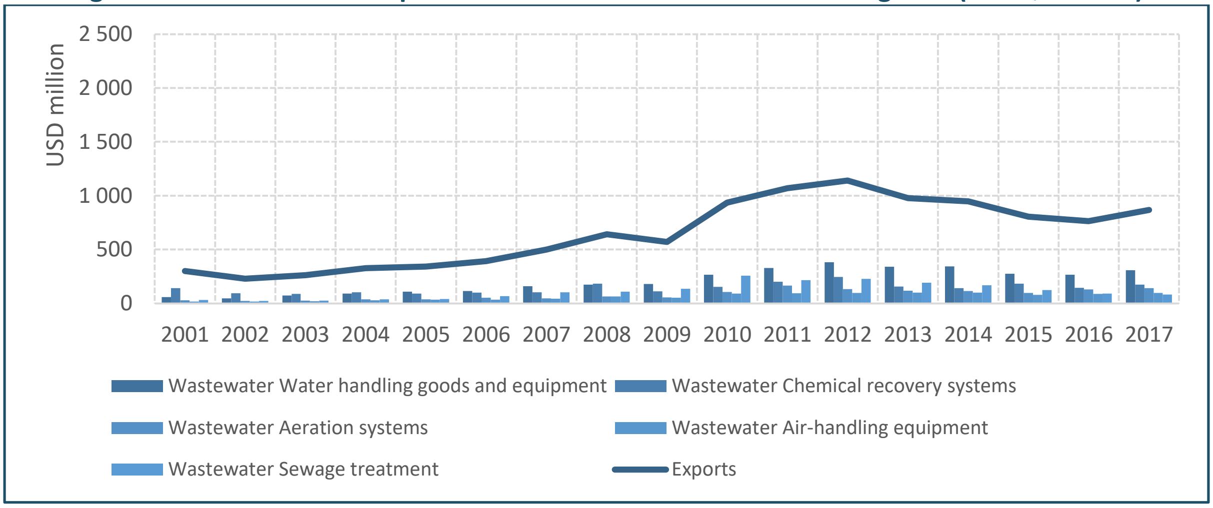
Figure 32: South Africa's import of water- and wastewater-related goods (in US$ million)



Source: Author, based on Trade Map data

Note: "Imports" depict total South African imports of water- and wastewater-related goods. Other categories represent the leading five categories (out of 18). These are not additive due to some products featuring in more than one category.

Figure 33: South Africa's export of water- and wastewater-related goods (in US$ million)



Source: Author, based on Trade Map data

Note: Exports depicts total South African exports of water- and wastewater-related goods. Other categories represent the leading five categories (out of 18). These are not additive due to some products featuring in more than one category.

Engaging on the export market would appear more difficult, off the existing basis. South Africa currently supplies only 0.2% of global trade in water- and wastewater-related goods and, although the market is fairly disaggregated, competition is fierce. The market is dominated by civil works and engineering, which are generally highly localised, and most equipments and technologies originate from a limited number of countries, and while the supply market is relatively disaggregated, strong, leading firms operate in most countries. Coupled with trade barriers (primarily non-tariff barriers, such as localisation requirements), this limits the ability to transform a potential opportunity into a genuine market. The existing industrial base could, however, provide the capabilities to position local firms as stronger suppliers on a number of export markets. The move towards smart, digital, decentralised and efficient and circular systems appears to be an opportunity worth exploring (GreenCape, 2018, 2017). Doing so requires careful, in-depth assessments of global and local supply and demand dynamics at the segment level.

6. CONCLUSION

The global water and sanitation sector is a vibrant market, growing at a strong pace. It is also a sector in transition, facing structural challenges both internally (such as financial constraints) and externally (such as climate change and urbanisation). The progressive restructuration of the sector to adapt to its new operating conditions are opening doors for prospects. The increase interest in innovative solutions and technologies does provide the platform for new companies to seize worthwhile market shares.

Demand remains largely dominated by (state-owned) utilities rather than industries or households. Water and sanitation issues are indeed essentially state-led in every country. Despite the need for significant improvement at the point of use and the increasing impetus by consumers to invest in improved water and sanitation solutions, the consumer market is dwarfed by utility-related expenditure. As utilities restructure and adapt to their new environment, notably by shifting from capital to operational expenditure, this opens new opportunities on the market.

From a South African industrial development perspective, systemic challenges are increasing the vulnerability of South Africa’s water and sanitation systems. In turn, necessary responses are forcing a reshuffling of the cards in the sector. Altogether, such dynamics are putting at risk industrial and economic development. At the same time, the nature of water and sanitation markets, both globally and locally, opens room for industrial development opportunities, particularly for import substitution.

In the end, the ability of South Africa to align industrial development and water policies and objectives will determine whether new dynamics in the water and sanitation sector hamper or support industrial development in the country.

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