EISSN: 2707-0425

East African Journal of Science, Technology and Innovation, Vol. 2 (Special issue): May 2021

Unseen barrier of water risks to sustainable consumption and production in micro, small and medium enterprises (MSMES) in Kenya

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Abstract

World economic reports cite MSMEs as important vehicles for sustainable economic growth for any country. With changing climatic conditions, water as a resource has become scarce thus water risks have been underscored to be an unseen barrier to the posterity of MSMEs with potential of impacting on their unsustainable consumption patterns. Global city populations projected to double by 2050; water issues and availability are rendered high risk for businesses. Kenya termed as a water scarce country, transfers the harsh reality of water risks as an unseen barrier to any MSMEs. The aim of the study was to investigate the unseen barrier of water risks to sustainable consumption and production in MSMEs and their threat to business bottom lines. The study was conducted through a systematic literature review of articles on water crisis and MSMEs globally and Nairobi. Findings of the study indicate that water crisis may result in insufficient water for a business to maintain production, while poor water quality could increase pre-treatment costs for industry explicating water risk as an unseen barrier. Water risks are further impacted by weak water governance which results in erratic water deliveries, resulting in production delays. Water risks manifest in inadequate water quantity or quality, which require MSMEs to relocate water-intense operations to water secure areas and pursuing alternatives such as building artificial storage. Water risks require huge investments to resolve it underscoring its unseen barrier for the posterity of the MSMEs. To mitigate water risks, cost effective measures that can be taken comprise putting guidelines on water efficiency, measuring consumption of water and investing in new technology that ensures efficient use of water.

Keywords: *Water risk; water crisis; sustainable consumption and production; MSMEs; Kenya*

Cite as: *Kathambi et al., (2021).* Unseen barrier of water risks to sustainable consumption and production in micro, small and medium enterprises (MSMES) in Kenya. *East African Journal of Science, Technology and Innovation 2 (Special Issue).*

Received: 24/04/21
Accepted: 13/05/21
Published: 25/05/21

Introduction

Micro, Small and Medium Enterprises (MSMEs) have a crucial economic function in most countries globally. Approximately 60% of the gross domestic product (GDP) as well as 90% of employment can be attributed to informal and formal MSMEs in both advanced and developing economies illustrating the pivotal role of MSMEs in country's GDPs (FAO, 2015). On a global lense, MSMEs are potential sources of job creation, social transformation as well as enhanced economic growth. In Kenya, the MSME sector has been acknowledged for its role in creating employment opportunities, alleviating poverty, nurturing innovation, increasing competitiveness

as well as providing goods and services (Abisuga-Oyekunle *et al.,* 2020; James, 2015; KNBS, 2016).

MSMEs can be referred to as a catalyzing agent of the economy in both developing and developed economies. This is due to the fact that they possess more flexible production opportunities as compared to large companies; in addition, they acclimatize to variations in demand in a shorter duration of time as well as attain maximum competition conditions faster. They therefore contribute to nationwide income, entrepreneur training, productivity and employment (Erdin and Ozkaya, 2020)

In Kenya, MSMEs are defined as enterprises that employ between 1 – 99 employees. Micro enterprises have less than 10 employees, small enterprises have between 10 – 49 employees while medium enterprises have 50 – 99 employees (KNBS, 2016). The Micro and Small Enterprise Act further defines micro enterprises as having a maximum annual turnover 500,000 Kenyan shillings, small enterprises have a turnover of between 500,000 to 5 million Kenyan shillings. Medium enterprises are not covered by the Act but have been reported as having a turnover of between 5 million to 8 million Kenyan shillings (Micro and Small Enterprises Act, 2012).

According to the micro, small and medium establishment survey carried out in 2016, it was reported that there are approximately 1.56 million MSMEs which have been licensed by the county governments of Kenya. Similarly, there are also MSMEs in operation however they have not been licensed. This survey established that there are about 5.85 million unlicensed MSMEs and these businesses were identified at the household level. MSMEs contributed 33.8% towards Kenya's gross domestic product (GDP) in 2015 and this output was estimated to be worth KShs 3,371.7 billion (KNBS, 2016).

Water is essential for economic progression, environmental sustainability and societal development therefore playing a critical role in sustainable consumption and production of MSMEs posterity (Machete, 2011). Fresh water is not only a major processing element but also a fundamental ingredient in food processing; in addition, it is irreplaceable which further points out its high risk nature (Olmez, 2014; Sachidananda *et al.,* 2016; WWF-UK, 2015). The challenge of global water scarcity as well as reduction in the availability of water has forced the food processing subsector to prioritize management of water on its agenda so as to ensure sustainability of this sector (Olmez, 2014; Water Services Regulatory Board (WASREB), 2020).

The food processing industry is one of the major water intensive industries after the chemical and refinery industries (FDM-BREF, 2006). Increased pressure on fresh water supplies, continual uncertainties in the supply of fresh water as well as costs associated to compliance to legislation have place water use minimization strategies at the top of the agenda of manufacturing businesses. Measures aimed at water reduction include practicing good housekeeping measures (Sachidananda *et al.,* 2016). Good housekeeping measures entail prompt repair of leakages, closing taps after use, continual training and sensitization of employees on efficient use of water, using dry cleaning methods among others. The annual water usage of the food and drink industry is approximately 3000 Mm^3/year which explicates the critical role water plays in MSMEs and the unseen barrier it can be to the future and sustainability of MSMEs (FDM-BREF, 2006).

Water takes on a myriad of uses especially as a vital resource thus it's critical for all types of industry such as manufacturing, service provision and agriculture which are economic pillars of any country (James, 2015; Murphy, 2013). The fulfillment of these significant roles is dependent on supply risk as well as reliability in terms of water access and water quality for consumption and production. It has been estimated based on the current economic growth rates that the demand for fresh water will outstrip current water supplies by more than 40%. Currently, the demand from manufacturing sector accounts for 22% of global fresh water withdrawal; in a majority of the developed countries, water consumed by industry has surpassed amount of water consumed for agriculture thus water is a significant aspect of sustainability (Sachidananda *et al.,* 2016; Water Services Regulatory Board (WASREB), 2020).

The United Nations Sustainable Development Goals (SDGs) emphasizes on the urgent need for businesses to operate in a manner that is healthy for both the people and planet underscoring sustainability by all measure (Mugagga and Nabaasa, 2016; UNDP, 2017). Notably, the manufacturing sector serves as a crucial sector with a need to focus on how MSMEs in this sector can reconsider the actions of obtaining raw materials, production, consumption as well as managing goods plus the successive waste generated if they are to manage the water risk as an unseen barrier (Olmez, 2014; Sachidananda *et al.,* 2016; WWF-UK, 2015). In the past decade, lean and green thinking has arisen as a desirable strategy for advancing efficiency as well as environmental results geared at sustainable business practice that achieves the objectives of a circular economy (Caldera *et al.,* 2019; James, 2015).

The Oslo Symposium of 1994 defined sustainable consumption and production (SCP) as "*the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations*". Thus it's important that humanity are transformed in the ways in which they consume and produce so as to enable the attainment of global sustainable development (Mugagga and Nabaasa, 2016; UNEP, 2014). The United Nations Sustainable Development goals (SDGs) lays emphasis on collaborative, urgent and direct efforts from the industrial sector to practice SCP thus focusing not only on the environmental but also on the social and economic aspects as well (UNDP, 2017; UN-HABITAT, 2016).

In the path of economic growth in developing countries, MSMEs challenges are numerous and multifaceted enhancing the risk index for them attaining their full potential in sustainable consumption and production. The challenges range from business licenses, business premises to business locations which impact directly to MSMEs bottom lines where water access and supply are not guaranteed (Irungu and Arasa, 2016; World Bank, 2020). Kenya ranked among the water scarce countries elucidates the potential of water risks as an unseen barrier to MSMEs in sustainable consumption and production (UNEP, 2012; UN-HABITAT, 2016, 2010). With an estimated rapid growing urban population and migration, MSMEs have to contend with water scarcity as barrier to their sustainable consumption and production if they are to make returns to their investments (Jacobsen *et al.,* 2013; Kenya National Bureau of Statistics (KNBS), 2019).

In reference to an analysis conducted by the International Food Policy Research Institute, roughly 63 trillion USD worth of water productivity will be at risk by 2050 if a 'business as usual' approach towards water management practices continues (WWF-UK, 2015). Water is a scarce resource thus if the business as usual approach is maintained in the management of water resources in MSMEs then the cost of production will not be sustainable. In addition, Kenya will soon face a 30% deficiency between available fresh water supply and demand by 2030 explicating why water is a risk that could bar the growth and prosperity of MSMEs. In spite of concerted efforts to minimize losses, levels of non-revenue water (NRW) have relatively stagnated between 41% and 47% over the last 10 years illustrating that water has significant impact in sustainable consumption and production for MSMEs (Olmez, 2014; Sachidananda *et al.,* 2016). Such losses threaten Kenya's water security further highlighting water risks as barriers for sustainable consumption by MSMEs when not factored in their day to day running. In view of the current NRW, the water sector will need to intensify production of water to 2.5 times the present level so as to meet the current demand if MSMEs can mitigate the risk (Water Services Regulatory Board (WASREB, 2020).

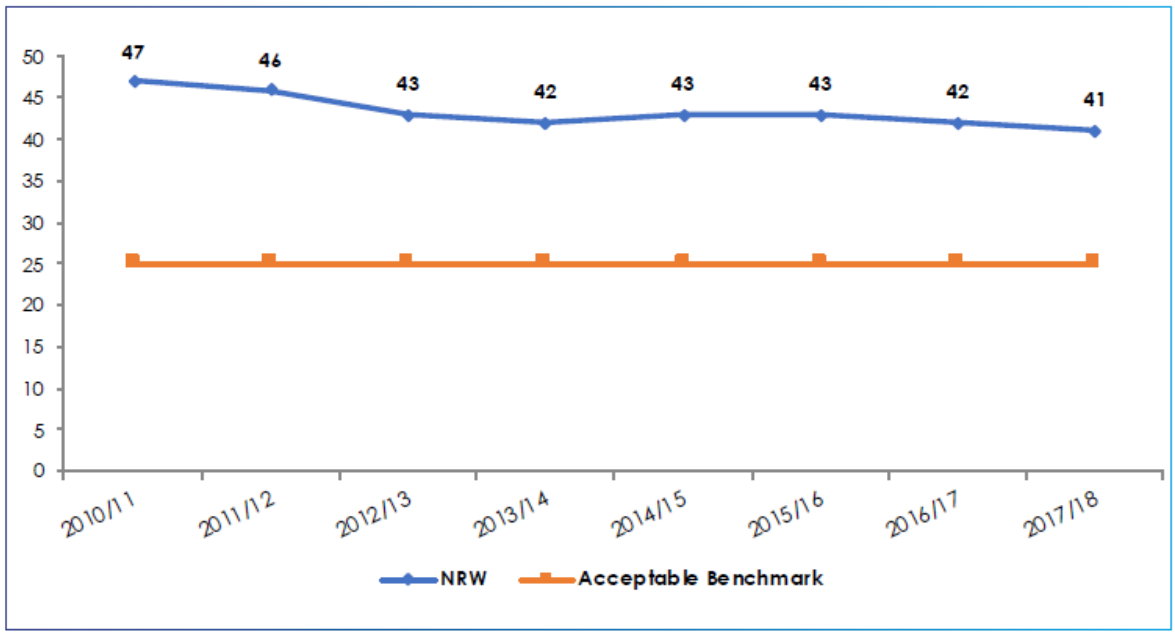

Figure 1. Non-Revenue Water Trend
Source: WASREB, 2020

Water risk as a business reality can be transformed as business opportunity or threat in Kenya and globally which requires much attention for sustainability of MSMEs in regard to sustainable consumption and production (Iro Ong'Or and Long-Cang, 2007; James, 2015; Ledant, 2013). Moreover, water risks in MSMEs are related to water quality and availability (physical risk), to regulatory action in ensuring water availability for sustainable consumption are observed and upheld (Leclert *et al.,* 2016; Muriithi, 2017; Murphy, 2013). The intricacies of water risks take the form of water scarcity resulting in insufficient water for MSMEs to maintain production, and poor water quality which could increase pre-treatment costs (Abisuga-Oyekunle *et al.,* 2020; Irungu and Arasa, 2016; Muriithi, 2017).

Water risks are further aggravated by the weak water governance which result in erratic water deliveries, poor water quality and water scarcity hampering production in MSMEs in Nairobi (Avidar, 2018; Chini and Stillwell, 2020; James, 2015). MSMEs in cities such as Nairobi, are forced to have alternatives to their water demands thereby impacting greatly on their bottom lines in unseen costs of procuring water services through pricy water vendors (Abisuga-Oyekunle *et al.,* 2020; Muriithi, 2017; World Bank, 2020). The unseen barrier of water risks which was not given consideration has seen MSMEs in Kenya starting to adjust their operating modes to address inadequate water quantity or quality, by relocating water-intense operations to areas with more water, securing alternative sources of supply, or building artificial storage (Chini and Stillwell, 2020; Hassenforder and Barone, 2019; World Bank, 2020).

Water risks in urban areas and cities require urban water governance framework in addressing critical water issues by having inclusive policy for sustainable consumptions for MSMEs (Angoua *et al.,* 2018; Chini and Stillwell, 2020; James, 2015; Karar and Jacobs-Mata, 2016). Water footprint is necessary for advancing urban environments in the face of climate change and resource constraints in ensuring sustainable consumption by MSMEs in Nairobi and more so addressing the water risks potentials (Chini and Stillwell, 2020; Muriithi, 2017; World Bank, 2020).

Global sustainability is facing crisis from major negative impacts from natural, social and economic dynamics thereby impacting on

sustainable consumption by any business or organization (Govindan, 2018; Omole and Ndambuki, 2014). The demand for ecosystem services goes beyond what the planet can provide, notwithstanding human activities in various domains that profoundly alter the underlying earth systems where water is sourced which further impact the water supply and availaibility (Li *et al.,* 2019; Lukman *et al.,* 2016). Based on these sustainability challenges more emphasis is placed on the need to better understand consumption patterns so as to shape the societal sustainability transition in MSMEs on the issue of water in its management and governance (Akenji *et al.,* 2015; Doreen *et al.,* 2020).

Addressing this unseen barrier to MSMEs will require water efficiency models that ensure there is sustainable consumption in their production and mitigate the costs water risks have on their business viability by creating alternatives and embracing circular economies (Abisuga-Oyekunle *et al.,* 2020; Chini and Stillwell, 2020). This paper explicates the consideration of the unseen barrier of water risks and its impacts on sustainable consumption and production of MSMEs in Kenya.

Materials and methods

The study used systemic literature reviews on water crisis, sustainable consumptions by MSMEs at a global and national level. The methodology employed in this literature review consisted of literature search, identifying articles to be included in the detailed systematic review and finally analysis of the selected articles for inclusion in the study. The authors reviewed articles published between 2010 to 2020. The methodology that was followed in conducting this study is depicted in figure 2.

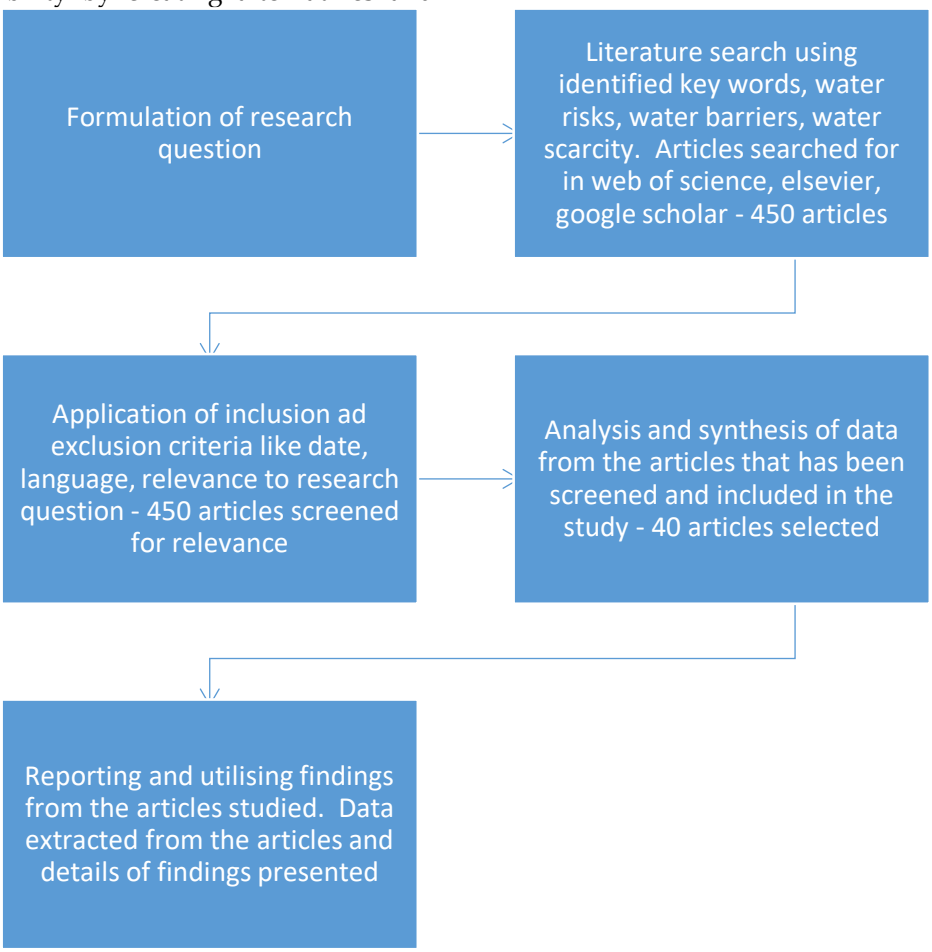

Figure 2. Methodology used for the systematic review

Data used was extracted from previous literature review using desktop analysis and adapted to the research (Creswell and Creswell, 2018; Williams, 2011). Data focused on water risks as business reality, MSMEs role in sustainable consumption, water institutions and organizations as structures for water governance in Nairobi City. Water policies, water policy implementation, and institutional mandates information was captured so as to explicate water risks in MSMEs. The study also surveyed water risk mitigation opportunities, skills and threats faced by MSMEs and the role of urban water governance as mitigation strategy.

Results

According to a study conducted by Sentsho *et al.,* (2009) on the performance and competitiveness of MSMEs in Botswana's manufacturing sector, a majority of the enterprises cited the cost and unreliable supply of water and electricity as among the major constraints barring their competitiveness. The high cost and unreliable supply of these two resources leads to increased business uncertainties, reduced competitiveness as well as lost output which is mirrored in today's MSMEs (Obokoh and Goldman, 2016).

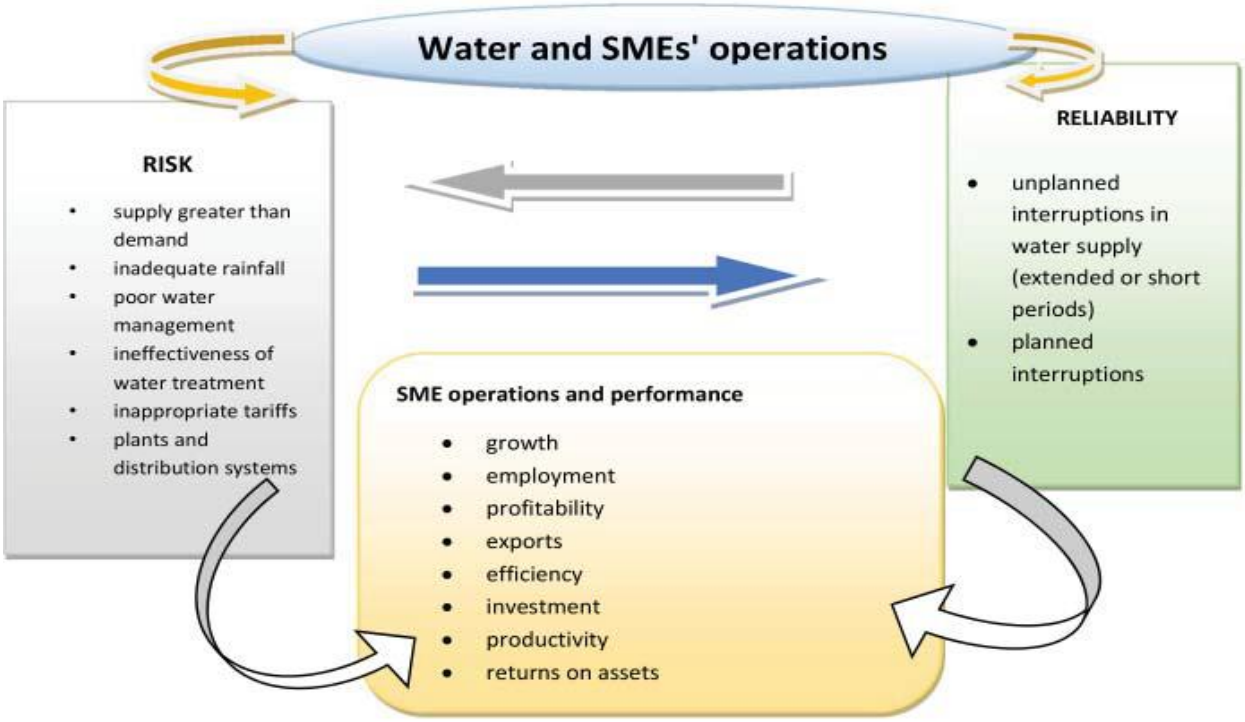

Figure 3. The potential role of water in SME performance
Source: Frederick and Selase, 2014

Inadequate supply of water and other infrastructure considered as necessity contributes to the major challenges faced by MSMEs with the said infrastructure failing in water efficiency and management (Shemi, 2013). An unreliable water supply could thus affect the overall operations of MSMEs on a large scale over prolonged period would lead to unknown losses (Irungu and Arasa, 2016; Muriithi, 2017; Selelo *et al.,* 2017). The fruit and vegetable sector is the most water intensive sector in the MSMEs which require huge amounts of water for their production thereby unreliable water supply would ground their operations if not addressed as evidenced in table 1. Close to 90% reduction in fresh water demand might be achieved through reusing process waste water after treating in some specific process operations during food processing which serves as a mitigation strategy for water risks (Doreen *et al.,* 2020; Lukman *et al.,* 2016; Olmez, 2014).

Table 1. Water Consumption and waste water generation rates in food industry MSMEs

Sector	Water Consumption (m^3/t)	Wastewater generation (m^3/t)
Fruit and Vegetable	2.4 – 11	11 – 23
Meat and Poultry	2 – 20	10 – 25
Dairy	0.6 – 60	0.4 – 60
Fish and seafood	3.3 – 32	2 – 40

(Source FDM-BREF, 2006)

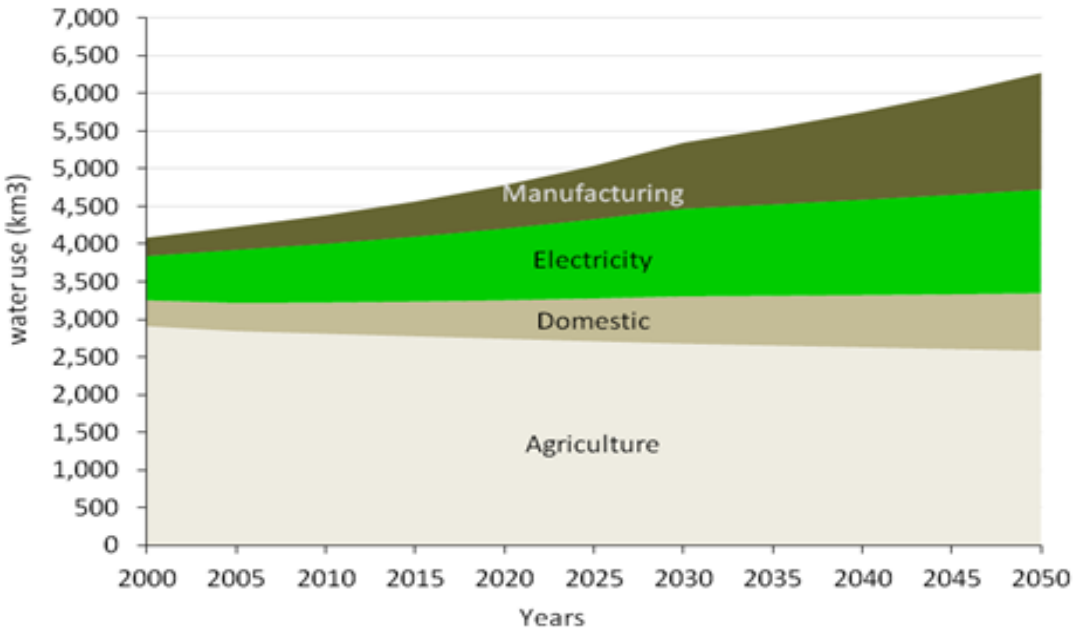

Figure 4: Projected growth in global water consumption by sector
Source: OECD Environmental Outlook Baseline

On a global outlook in figure 3, agriculture has a large water consumption which indicates the need to change the business as usual if water risks are to be mitigated. With such a high-water consumption projection, MSMEs will need to underscore the unseen barrier of water as a risk if sustainable consumption and production principles are to be taken up. The salient nature of this unseen barrier tends to be tacked away as a non-essential yet the implications of the same affect bottom lines of MSMEs on keen scrutiny (Li *et al.,* 2019; World Bank, 2020).

Table 2. Annual Volume of Water Abstracted under Permit from 2015 to 2019 (million cubic meters)

Water source	2015	2016	2017	2018	2019
Surface water	30,513.4	30,674.4	30,743.8	31,195.3	32,075.3
Ground water	77.6	102.9	140.6	175.6	211.7
Total	**30,591.0**	**30,777.3**	**30,884.5**	**31,370.9**	**32,286.9**

Source: Water Resources Authority

Table 2 indicates the volumes of water which were abstracted under permit; the overall capacity of water abstracted under permit rose by 2.9% from 31.4 billion m^3 to 32.3 billion m3 in 2019. Surface water abstraction accounted for 99.3% of the total water abstracted from 2015 to 2019. MSMEs require water for production thus increased volumes of water abstraction poses a threat to sustainable water supply illustrating the unseen barrier of water as a risk in sustainable consumption and production if not well addressed (Water Services Regulatory Board (WASREB), 2020).

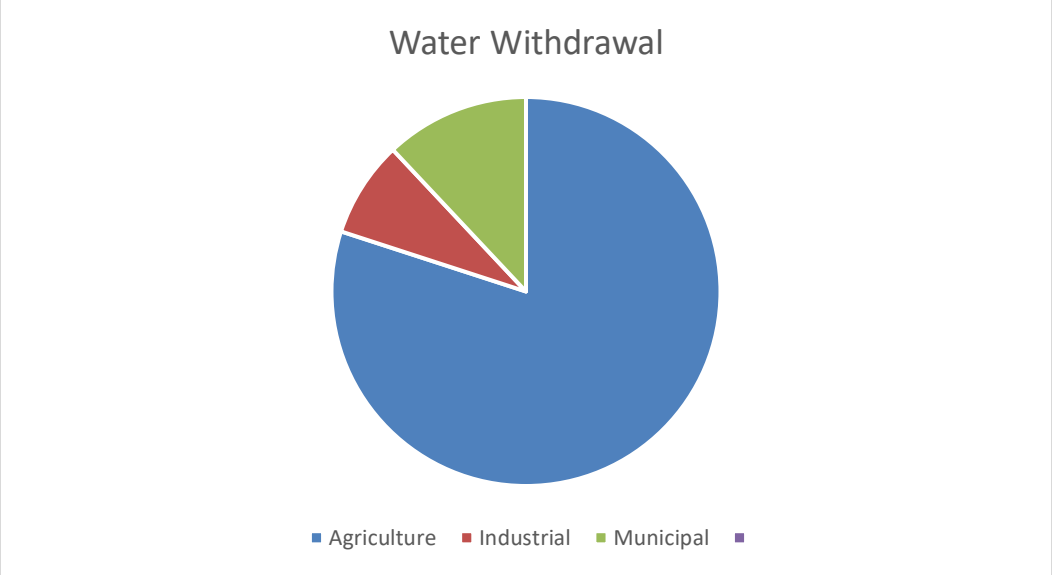

Figure 5. Water Withdrawals by Sector
Source: AQUASTAT

Figure 5 indicates the total amount of water withdrawn in 2016 was 4,032 million cubic meters with agriculture accounting for 80% of the withdrawals that is 3,234 million cubic meters; industrial water withdrawal was 0.303 million cubic meters while municipalities' water withdrawal was 0.495 million cubic meters. With a projected double population in the urban areas and cities by 2050, water scarcity will become a reality that will affect sustainable consumption and production by all sectors including MSMEs (Angoua *et al.,* 2018; Li *et al.,* 2019; Water Services Regulatory Board (WASREB), 2020). Paying cognizant to water withdrawals elucidates water as risk that needs to noted and mitigation measures put in place to improve water efficiency in the sustainable consumption and production process by MSMEs.

Discussion

Sustainable water consumption has been poised as a challenge for MSMEs in cities characterized with an increasing urban population (Chini and Stillwell, 2020; UN-HABITAT, 2010; World Bank, 2020). Notably, a large share of population suffers from water scarcity as well as water consumption whose impact on the ecosystem damage is unmentioned (Akenji *et al.,* 2015; Osano, 2019; Yano *et al.,* 2016). The distribution of the water resource and its consumption make it a critical resource for MSMEs productivity and success pegged on the fact that it is a major raw material (Cosgrove and Loucks, 2015; Omole and Ndambuki, 2014; Rockstrom *et al.,* 2007). Unfortunately water problems in MSMEs are intensified rather than mitigated in developing countries' economies, reason being that prices and costs of production are guided by economies

rather than environmental impacts, with water management driven by demand and not the availability (Cosgrove and Loucks, 2015; Irungu and Arasa, 2016; Lukman *et al.,* 2016; Tsai *et al.,* 2018).

With Brundtland Report publication, production processes and consumption patterns towards sustainability have improved in MSMEs adopting these sustainable practices which highlight sustainability and circular natures with zero waste (Doreen *et al.,* 2020; Govindan, 2018). Increasingly, there are growing examples of achieving eco-efficiency in water systems (including urban), which further require economic incentives and governmental support, and practical experiences by MSMEs to mitigate the unseen barrier of water risk, more so enhancing circular economy (Chini and Stillwell, 2020; Murphy, 2013; Wang *et al.,* 2017; World Bank, 2020).

Global projections for water consumptions and water withdrawals illustrate the potential water scarcity in the face of increasing city population whose impacts on water demands, and its consequences on sustainable consumption production for MSMEs can be felt (Omole and Ndambuki, 2014; Osano, 2019; Tsai *et al.,* 2018). In agreement with the Global Risk Perception Survey conducted by the World Economic Forum reports that the highest level of societal impact over the next 10 years will be from water crises which also affect MSMEs as illustrated by the results in figure 1 (Murphy, 2013; Olagunju *et al.,* 2019; Prasanna *et al.,* 2019; Ribeiro and Johnsson, 2018). In retrospect, the past decades has seen the percentage increase in water use on a global scale exceed twice that of population growth in cities thus potential to affect sustainable consumption of MSMEs profits and productions (Irungu and Arasa, 2016; Muriithi, 2017; Ribeiro and Johnsson, 2018).

The consequences of increase on water crisis has led to water stress where the current restricted rates of water use and consumption, are unsustainable and explicating the risk index water has on profit margins and sustainability (Doreen *et al.,* 2020; Ondigo *et al.,* 2018). Water demands and supplies are changing denoting their unseen nature in becoming a barrier to sustainable consumption by MSMEs in Kenya (Cosgrove and Loucks, 2015; Ondigo *et al.,* 2018; Osano, 2019). Consumer demands are driven in part by population growth and higher per capita water consumption in growing urban, domestic, and industrial water sectors which spell out the water risks MSMEs in Kenya have to tackle (Chini and Stillwell, 2020; Ondigo *et al.,* 2018; World Bank, 2020).

The projections that by 2050, water needs will have tripled underscores the results in data above that water risks have the potential to be barriers for sustainable consumptions by MSMEs in Kenya (Abisuga-Oyekunle *et al.,* 2020; Angoua *et al.,* 2018; Olagunju *et al.,* 2019; Tsai *et al.,* 2018). To meet the increasing consumer needs of this additional city population, consideration on the amount of water that is consumed in the production of different goods by MSMEs will need a restructuring to mitigate water risks (Chini and Stillwell, 2020; OECD, 2020; World Bank, 2020).

Further to that trade in high water consumptive goods and services by MSMEs from water scarce regions may have short term economical profits but is not viable in the long term which elucidates on the threat to meeting other water related goals (UNDP, 2017, 2016; UNEP, 2016; UN-HABITAT, 2016). Other impacts revolve around pollution and environmental degradation which are not transferred along with the products to the consumer but impact water resources in the long run (Osano, 2019; Paul *et al.,* 2018; Romano and Akhmouch, 2019; van Leeuwen *et al.,* 2019). However, the complexity in water trade requires much more research to find real water-trade links and suggest possible solutions if trade is causing unsustainable water practices in MSMEs in city and urban settings (Chini and Stillwell, 2020; Tsai *et al.,* 2018; van Leeuwen *et al.,* 2019).

Changes in climate are altering the shape of the probability distribution of future hydrologic events and water demand for MSMEs impacting on their consumption patterns (Ondigo *et al.,* 2018; Prasanna *et al.,* 2019; UNDP, 2016). Subsequently, water demand for agricultural production will be influenced by climate change, technological development and urbanization and human responses which in turn affect the

sustainable consumption production for MSMEs in Kenya (Irungu and Arasa, 2016; Muriithi, 2017; Murphy, 2013; Paul *et al.,* 2018).

Conclusion and recommendations

The findings of this study demonstrate the significance of addressing water risks facing MSMEs if they are to attain sustainable consumption and production. To reduce impacts arising from water risks, it's crucial for MSMEs to appreciate water risks in addition to assessment, monitoring and enhancement of their risk management and business continuousness management capacity. Given the MSMEs size and roles in the nationwide and world economies and the fact that the development of the private sector's resilience is dependent on reduction of risks by MSMEs, there's need for more studies to enhance understanding of various aspects of MSMEs management of risks. Water demand and supply are ever changing hence the need for sustainable consumption and production to curtail the problem of over exploitation of water resources.

Water is a fundamental resource needed by MSMEs and it is among the determinants of MSMEs competitiveness and achievement of sustainable consumption and production. MSMEs face water scarcity in terms of water quality, quantity and reliable water supply. The national water policy for Kenya is advanced however its implementation is weak and this explains the ongoing illegal and unregulated extraction of water which leads to reduced water levels. Water reuse, recycling and waste water recovery will go a long way in reducing the water risks faced by MSMEs which can be strengthened by a circular economy.

References

Abisuga-Oyekunle, O.A., Patra, S.K., Muchie, M., 2020. SMEs in sustainable development: Their role in poverty reduction and employment generation in sub-Saharan Africa. African Journal of Science, Technology, Innovation and Development 12, 405–419. https://doi.org/10.1080/20421338.2019.1656428

Akenji, L., Briggs, E., United Nations Environment Programme, 2015. Sustainable consumption and production: a handbook for policymakers.

Angoua, E.L.E., Dongo, K., Templeton, M.R., Zinsstag, J., Bonfoh, B., 2018. Barriers to access improved water and sanitation in poor peri-urban settlements of Abidjan, Côte d'Ivoire. PLoS ONE 13, e0202928. https://doi.org/10.1371/journal.pone.0202928

Avidar, O., 2018. Half-hearted Devolution: A view of Kenya's water governance from Siaya County, Kenya. The Journal of the Middle East and Africa 9, 319–338. https://doi.org/10.1080/21520844.2018.1528421

Caldera, H.T.S., Desha, C., Dawes, L., 2019. Transforming manufacturing to be 'good for planet and people', through enabling lean and green thinking in small and medium-sized enterprises. Sustainable Earth 2, 1–20. https://doi.org/10.1186/s42055-019-0011-z

Chini, C.M., Stillwell, A.S., 2020. Envisioning Blue Cities: Urban Water Governance and Water Footprinting. J. Water Resour. Plann. Manage. 146, 04020001. https://doi.org/10.1061/(ASCE)WR.1943-5452.0001171

Cosgrove, W.J., Loucks, D.P., 2015. Water management: Current and future challenges and research directions: Water management research challenges. Water Resour. Res. 51, 4823–4839. https://doi.org/10.1002/2014WR016869

Creswell, J.W., Creswell, J.D., 2018. Research design: Qualitative, quantitative, and mixed method approaches., 18th ed. Sage, Los Angelos.

Doreen, C., Anne, S., Andrew, K., 2020. Water Resource Management and Sustainability in Kipkelion West Sub-County, Kenya. IJECC 31–38. https://doi.org/10.9734/ijecc/2020/v10i430193

Erdin, C. and Ozkaya, G. (2020) 'Contribution of small and medium enterprises to economic development and quality of life in Turkey', *Heliyon*, 6(2), p. e03215. doi: 10.1016/j.heliyon.2020.e03215.

FAO, 2015. Policy Measures for micro, small and medium fod processing enterprises (MSMFEs) in the Asian Region. Bankok, Thailand.

Govindan, K., 2018. Sustainable consumption and production in the food supply chain: A conceptual framework. International Journal of Production Economics 195, 419–431. https://doi.org/10.1016/j.ijpe.2017.03.003

Hassenforder, E., Barone, S., 2019. Institutional arrangements for water governance. International Journal of Water Resources Development 35, 783–807. https://doi.org/10.1080/07900627.2018.1431526

Iro Ong'Or, B.T., Long-Cang, S., 2007. Water Supply Crisis and Mitigation Options in Kisumu City, Kenya. International Journal of Water Resources Development 23, 485–500. https://doi.org/10.1080/07900620701488554

Irungu, A., Arasa, R., 2016. FACTORS INFLUENCING COMPETITIVENESS OF SMEs IN NAIROBI COUNTY, KENYA. International Journal of Entrepreneurship and Project Management S1.V2, 22–46.

Jacobsen, M., Webster, M., Vairavamoorthy, K., n.d. The Future of Water in African Cities 226.

James, L., 2015. Sustainability footprints in SMEs: strategy and case studies for entrepreneurs and small business. Wiley, Hoboken, New Jersey.

Karar, E., Jacobs-Mata, I., 2016. Inclusive Governance: The Role of Knowledge in Fulfilling the Obligations of Citizens. Aquatic Procedia 6, 15–22. https://doi.org/10.1016/j.aqpro.2016.06.003

Kenya National Bureau of Statistics (KNBS), 2019. Population and house results. Kenya Bureau of Statistics KNBS, Kenya.

KNBS, 2016. Micro, Small & Medium Establishments (MSME) Survey. Nairobi.

Leclert, L., Nzioki, R.M., Feuerstein, L., 2016. Addressing Governance and Management Challenges in Small Water Supply Systems – The Integrity Management Approach in Kenya. Aquatic Procedia 6, 39–50. https://doi.org/10.1016/j.aqpro.2016.06.006

Ledant, M., 2013. Water in Nairobi: Unveiling inequalities and its causes. com 66, 335–348. https://doi.org/10.4000/com.6951

Li, H., Xia, Q., Wen, S., Wang, L., Lv, L., 2019. Identifying Factors Affecting the Sustainability of Water Environment Treatment Public-Private Partnership Projects. Advances in Civil Engineering 2019, 1–15. https://doi.org/10.1155/2019/7907234

Lukman, R.K., Glavič, P., Carpenter, A., Virtič, P., 2016. Sustainable consumption and production – Research, experience, and development – The Europe we want. Journal of Cleaner Production 138, 139–147. https://doi.org/10.1016/j.jclepro.2016.08.049

Machete, E.M., 2011. The causes and impact of water shortage on the households of Ga-Kgapane. South Africa. Turfloop Graduate School of Leadership: University of Limpopo.

Micro and Small Enterprise Act, 2012

Mugagga, F., Nabaasa, B.B., 2016. The centrality of water resources to the realization of Sustainable Development Goals (SDG). A review of potentials and constraints on the African continent. International Soil and Water Conservation Research 4, 215–223. https://doi.org/10.1016/j.iswcr.2016.05.004

Muriithi, S.M., 2017. African Small and Medium Enterprises (SMEs) Contributions, Challenges And Solutions. European Journal of Research and Reflection in Management Sciences 5.

Murphy, E., 2013. Sustainable Development in SMEs, in: Idowu, S.O., Capaldi, N., Zu, L., Gupta, A.D. (Eds.), Encyclopedia of Corporate Social Responsibility. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 2435–2442. https://doi.org/10.1007/978-3-642-28036-8_59

Obokoh, L.O., Goldman, G., 2016. Infrastructure deficiency and the performance of small- and medium-sized enterprises in Nigeria's Liberalised Economy. Acta Commercii 16, 339–348.

OECD, 2020. Financing Water Supply, Sanitation and Flood Protection: Challenges in EU Member States and Policy Options, OECD Studies on Water. OECD. https://doi.org/10.1787/6893cdac-en

Olagunju, A., Thondhlana, G., Chilima, J.S., Sène-Harper, A., Compaoré, W.R.N., Ohiozebau, E., 2019. Water governance research in Africa: progress, challenges and an agenda for research and action. Water International 44, 382–407. https://doi.org/10.1080/02508060.2019.1594576

Olmez, H., 2014. Water Consumption, Reuse and Reduction Strategies in Food Processing, in: Tiwari, B.K., Norton, T., Holden, N.M. (Eds.), Sustainable Food Processing. John Wiley & Sons, West Sussex, UK, pp. 401–434. https://doi.org/10.1002/9781118634301

Omole, D., Ndambuki, J., 2014. Sustainable Living in Africa: Case of Water, Sanitation, Air Pollution and Energy. Sustainability 6, 5187–5202. https://doi.org/10.3390/su6085187

Ondigo, D.A., Kavoo, A.M., Kebwaro, J., 2018. Water Resources and Management under Increasing Urban Demography: A Kenyan Perspective—A Review. JWARP 10, 919–938. https://doi.org/10.4236/jwarp.2018.109054

Osano, H.M., 2019. Global expansion of SMEs: role of global market strategy for Kenyan SMEs. J Innov Entrep 8, 13. https://doi.org/10.1186/s13731-019-0109-8

Paul, A.K., Bhattacharyya, D.K., Anand, S. (Eds.), 2018. Green Initiatives for Business Sustainability and Value Creation:, Advances in Business Strategy and Competitive Advantage. IGI Global. https://doi.org/10.4018/978-1-5225-2662-9

Prasanna, R., Jayasundara, J., Naradda Gamage, S.K., Ekanayake, E., Rajapakshe, P., Abeyrathne, G., 2019. Sustainability of SMEs in the Competition: A Systemic Review on Technological Challenges and SME Performance. JOItmC 5, 100. https://doi.org/10.3390/joitmc5040100

Rampa, F., 2018. Analysing governance in the water sector in Kenya 40.

Ribeiro, N.B., Johnsson, R.M.F., 2018. DISCUSSIONS ON WATER GOVERNANCE: PATTERNS AND COMMON PATHS. Ambient. soc. 21. https://doi.org/10.1590/1809-4422asoc0125r2vu18l1ao

Rockstrom, J., Lannerstad, M., Falkenmark, M., 2007. Assessing the water challenge of a new green revolution in developing countries. Proceedings of the National Academy of Sciences 104, 6253–6260. https://doi.org/10.1073/pnas.0605739104

Romano, O., Akhmouch, A., 2019. Water Governance in Cities: Current Trends and Future Challenges. Water 11, 500. https://doi.org/10.3390/w11030500

Sachidananda, M., Patrick Webb, D., Rahimifard, S., 2016. A concept of water usage efficiency to support water reduction in manufacturing industry. Sustainability (Switzerland) 8, 1–15. https://doi.org/10.3390/su8121222

Selelo, L.R., Madigele, P.K., Ntaka, P., Moetedi, K., 2017. The effects of extended water supply disruptions on the operations of SMEs. Southern African Business Review 21, 480-500–500.

Shemi, P., 2013. Challenges of e-commerce adoption in SMEs: an interpretive case study of Botswana. Botswana Journal of Business 6, 17–30.

Tsai, S.-B., Liu, B., Li, Y. (Eds.), 2018. Green Production Strategies for Sustainability:, Advances in Environmental Engineering and Green Technologies. IGI Global. https://doi.org/10.4018/978-1-5225-3537-9

UNDP, 2017. Sustainable Development Goals: Post-2015 Localizing SDGs in Kenya: Building on the Lessons Learned of the MDGs. What Role Can the UN System Play in the Process?

UNDP, 2016. sustainable urbanization strategy, s support to sustainable, inclusive, and resilient cities in the developing world. UNDP.

UNEP, 2016. Frontiers report emerging issues of environmental concern. UNEP, Nairobi.

UNEP, 2014. Sustainable Consumption and Production (SCP) Targets and Indicators.

UNEP, 2012. Global environmental outlook 5: environment for the future we want. UNEP, Nairobi.

UN-HABITAT, 2016. UN-Habitat launches the World Cities Report 2016, Urbanization and Development: Emerging Futures. UN-HABITAT.

UN-HABITAT, 2010. Solid Waste Management in the World Cities: Water and sanitation in the world's cities.

van Leeuwen, K., Hofman, J., Driessen, P., Frijns, J., 2019. The Challenges of Water Management and Governance in Cities. Water 11, 1180. https://doi.org/10.3390/w11061180

Wang, X., van Dam, K.H., Triantafyllidis, C., Koppelaar, R.H.E.M., Shah, N., 2017. Water and Energy Systems in Sustainable City Development: A Case of Sub-saharan Africa. Procedia Engineering 198, 948–957. https://doi.org/10.1016/j.proeng.2017.07.140

Water Services Regulatory Board (WASREB), 2020. A Performance Report of Kenya's Water Services Sector -2018/2019. Issue 12/2020. Nairobi.

Williams, C., 2011. Research Methods. JBER 5. https://doi.org/10.19030/jber.v5i3.2532

World Bank, 2020. Providing Sustainable Sanitation and Water services to Low-income Communities in Nairobi [WWW Document]. World Bank. URL https://www.worldbank.org/en/news/feature/2020/02/19/providing-sustainable-sanitation-and-water-services-to-low-income-communities-in-nairobi (accessed 9.7.20).

WWF-UK, 2015. From risk to Resilience: Does Your Business Know its Water Risk? Scotland.

Yano, S., Hanasaki, N., Itsubo, N., Oki, T., 2016. Potential Impacts of Food Production on Freshwater Availability Considering Water Sources. Water 8, 163. https://doi.org/10.3390/w8040163