WaterPIP
Water Productivity Improvement in Practice

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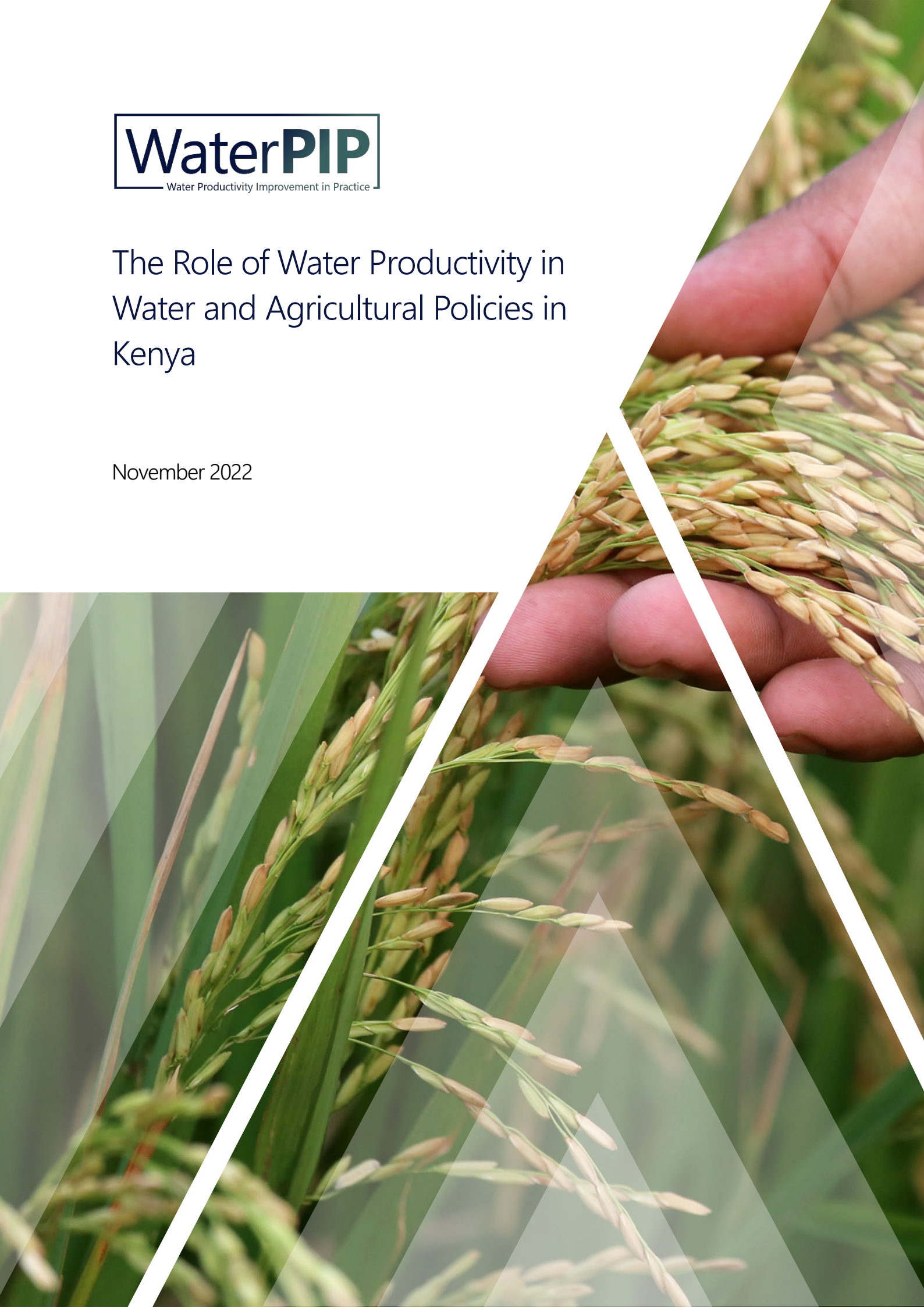
November 2022



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MetaMeta Kenya

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Prepared by MetaMeta Kenya in partnership with Wageningen University and Research and IHE Delft Institute for Water Education.

This report was developed by the Water Productivity Improvement in Practice (WaterPIP) project, which is supported by the IHE Delft Partnership Programme for Water and Development (DUPC2) under the programmatic cooperation between the Directorate-General for International Cooperation (DGIS) of the Ministry of Foreign Affairs of the Netherlands and IHE Delft (DGIS Activity DME0121369)

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of DGIS, DUPC, or its partners.

Acronyms

ASALs	Arid and Semi-Arid Lands
ASTGS	Agricultural Sector Transformation and Growth Strategy
BWRC	Basin Water Resource Committee
CAAC	Catchment Areas Advisory Committees
CIDU	County Irrigation Development Unit
EIP	Expanded Irrigation Programme
GDP	Gross Domestic Product
IWM	Irrigation Water Management
IWUAs	Irrigation Water Users Associations
MTP III	Third Medium Term Plan
MoALD	Ministry of Agriculture and Livestock Development
MoWSI	Ministry of Water, Sanitation and Irrigation
MCM	Metre Cubic Metres
NIA	National Irrigation Authority
NIWMIP	National Irrigation Water Management Improvement Programme
NWMP	National Water Master Plan
PPP	Public-Private-Partnership
SAGA	Semi-Autonomous Government Agency
SFD	Strategic Food Reserve
WRA	Water Resources Authority
WRUAs	Water Resource User Associations
WSPs	Water Services Providers
WSRB	Water Services Regulatory Board
WWDAs	Water Works Development Agencies

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1 Introduction

Irrigated agriculture is by far the largest water use worldwide, accounting for an estimated 70% of total freshwater withdrawals (Molden, 2013). As water becomes increasingly scarce, the management of agricultural irrigation moves to the centre of water management concerns. The question of how best to adapt agricultural water management is complex, not least because irrigated agriculture is at the centre of two large and conflicting trends. On one hand, irrigated agriculture is rapidly expanding with the growing demand for agricultural products. On the other hand, additional demands for irrigation water are increasingly difficult to accommodate in many parts of the world. The growing demand for water for both domestic uses and international transboundary water agreements is further intensifying the competition for water resources. Additionally, because water use in irrigated agriculture is seen as having relatively low net returns compared with other water uses, other sectors increasingly look to agriculture as a potential source of water, further increasing the pressure to use irrigation water for other purposes.

The most common and widely promoted approach for adapting agricultural water management to the increasing scarcity of water is to focus on improving agricultural water productivity and efficiency—and thus to achieve 'more crop per drop'. Such improvements would allow either higher agricultural production with the same amount of water, or the same amount of agricultural production with less water. In the latter case, the water savings could be reallocated to other higher value uses or freed up to ensure some level of environmental flows. The implicit assumption is that such improvements in water productivity and efficiency would help address the trade-off between increased agricultural production and agricultural water conservation and reallocation. As a result, many international organisations and national agencies concerned with water management are promoting an increase in agricultural water productivity and efficiency as an important policy goal.

However, advocating for maximizing agricultural water productivity and increasing the 'crop per drop' are simplifying the complex goals and objectives of agricultural water management while also obscuring important decision-making processes focused on balancing multiple socio-economic objectives of national development strategies (such as increasing employment, promoting environmental sustainability, and ensuring food security). As such, water productivity should move beyond the narrow approach of more crop per drop (Scheierling and Tréguer, 2018). In this context, this policy review aims to shed light into the Kenyan national plans for agricultural water management in relation to water productivity and the related socio-economic objectives of national development that can be met through agricultural water management.

The structure of this policy review is as follows: Section 2 presents a general theoretical distinction between different types of water economies, and Section 3 introduces the Kenyan context. Section 4 shows the importance of the agricultural sector and thus the agricultural water use, for the economy of Kenya. In Section 5, the different agricultural areas, production systems and projects taking place in Kenya are presented. Next, Section 6 discusses the main policy objectives of the most recent national development plan for Kenya. Further this chapter discusses the roles, plans and strategies that the Ministry of Water, Sanitation and Irrigation (MoWSI) and the Ministry of Agriculture and Livestock Development (MoALD) adopted in order to meet the objectives of the national development plan. Section 7 highlights the synergies and contradictions of the reviewed policies. Lastly, Section 8 discusses if and in what form water productivity is conceptually adopted in official policy documents and donors' projects.

2 Water Productivity and Water Economies

Worldwide, agriculture uses the greatest amount of water. However, other productive sectors of the economy demand growing quantities of water, resulting in water competition and water scarcity. Randall (1981) defines two different types of water economies; the expansionary and the mature water economy. The expansionary phase is characterized by a growing demand for agricultural water which can be met by investing in new, relatively low-cost infrastructure. In economic terms, it is expected that the benefits of these new infrastructural projects are greater than the costs.

Contrary, when the costs of investing in new water infrastructure are high for relatively small improvements in terms of meeting the growing demand for water, the water economy has moved towards the maturity phase. In this phase, the demand for water for agriculture continues to rise while other sectors also demand more water. Since agriculture is a low value water use sector compared to other sectors, water savings in agriculture and reallocation to higher water uses might have greater economic benefits than investing in new water infrastructure. Water competition is enhanced more by necessary environmental flows and ecosystem services through water conservation.

In terms of policy, the two phases focus on different objectives. The expansionary phase is mostly concerned with increasing agricultural production and agricultural income while the mature phase focuses on finding equilibriums to balance trade-offs between agriculture and water conservation or reallocation (Randall, 1981)

3 Kenyan Context

Figure 1: Map of Kenya. Retrieved from: https://www.mapsland.com/africa/kenya/large-map-of-kenya-with-cities

The Republic of Kenya is a country on the equator in Eastern Africa and has a population of about 53 million people (The World Bank, 2019). Kenya borders with Tanzania, Uganda, South Sudan, Ethiopia and Somalia and has access to the Indian Ocean. It is a diverse nation with 42 ethnic groups and the official languages are Swahili and English (Interactions Eldis, 2013).

The country gained political stability, social development and economic growth among others due to its significant political and economic reforms over the past decades (The World Bank, 2021b). Kenya has the largest economy of East Africa with an average annual growth rate of 5% between 2010 and 2020 (The World Bank, 2021a; USAID, 2021b). The corona crisis had a huge impact on the country's economy through supply and demand shocks (The World Bank, 2021b). Although Kenya has potential for further growth and reduction of poverty due to its relatively high Human Development Index, its natural resources and human capital, wealth has not been equally distributed (Interactions Eldis, 2013). About 70 percent of the Kenyan population live below the poverty line and are chronically vulnerable to food insecurity and economic inequality (USAID, 2021). The poverty rate is highest in the (semi-)arid areas, that cover about 80% of the country but only 20% of the population lives there (Interactions Eldis, 2013).

4 Water, Agriculture and Economy in Kenya

4.1 Kenya's Water Resources

According to the 2019 Kenya census, Kenya has a total of 47.6 inhabitants with a projected of 53.38 million and 56.77 million in 2025 and 2027 respectively. Kenya is consider one of the water-scarce countries with the current renewable freshwater of about 650m^3 per capita per annum (Government of Kenya, 2008, 2013; The Kenya Ministry of Water, 2018; USAID & SWP, 2021). As the population is increasing the water demand is also expected to increase (Figure 2).

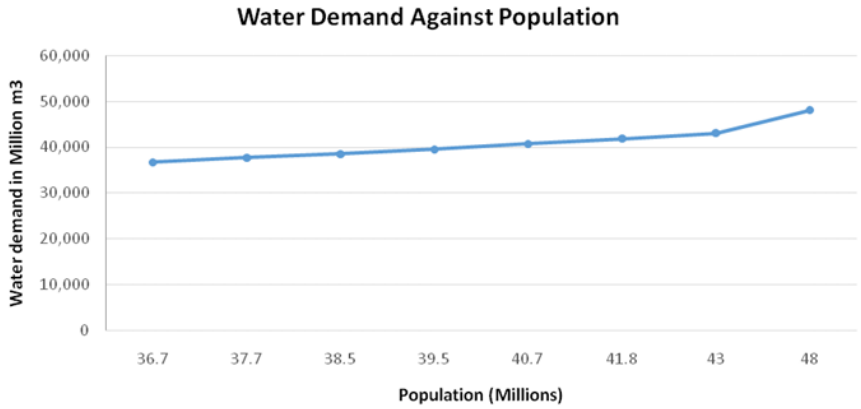

Figure 2: Population growth and total water demand (The Kenya Ministry of Water, 2018)

The water resources of Kenya are documented in detail in the National Water Master Plan (NWMP 2030), which is also summarised in the Water resources situation report (Water Resources Authority, August 2020). It provides an overview of available water resources and water demand per basin. Kenya has five major basins namely: Lake Victoria, sub-divided in north (LVNCA) and south (LVSCA), Rift valley (RVCA), Athi (ACA), Tana (TCA) and Ewaso Ng'iro North (ENNCA) (Figure 3).

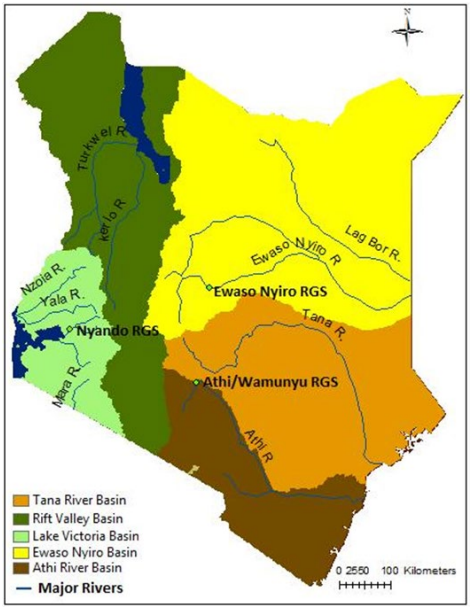

Figure 3: Kenya water Resources (source: Onjira, Pauline. 2014)

The water availability and demand vary per basin depending on its location as seen in Table 1. In all basins, the registered demand was far below the water availability, indicating a low water use compared to the potential for 2010. In the ACA river basin the average water availability is the lowest and the water demand is the highest, leaving only 350 Mm^3/yr unutilized. This low water demand over the water availability shows the opportunities towards irrigation expansion. Considering that the national water master plan forecasts that all basins except Ewaso Ng'iro North will receive increased rainfall due to impacts of climate change towards 2030 and 2050 (Table 1), opportunities for irrigated area expansion are enlarged. The increase however should be seen in context, where the semi-arid and arid Ewaso Ng'iro North basin is expected to become drier (decrease of 20% comparing 2010 and 2050 values) and the wet basins in South and West wetter (increase ranging from 53% and 18% comparing 2010 and 2050 values). Also the increases and decreases are both predicted to come with erratic rainfall (resulting in erosion, landscape degradation and flooding) thereafter intense or prolonged periods of droughts. This points towards difficulties in storing the rainwater and thus making its utilization uncertain.

Table 1: Summary of the Available Water Resources and water demand by basins in Kenya (units in Mm^3/yr.)

Basin	Catchment Area (km^2)	2010		2030		2050	
		Available water	Water demands	Available water	Water demands	Available water	Water demands
LVNCA	18,374	4,742	228	5,077	1,337	5,595	1,573
LVSCA	31,734	4,976	385	5,937	2,953	7,195	3,251
RVCA	130,452	2,559	357	3,147	1,494	3,903	1,689
ACA	58,639	1,503	1,145	1,634	4,586	2,043	5,202
TCA	126,026	6,533	891	7,828	8,241	7,891	8,476
ENNCA	210,226	2,251	212	3,011	2,857	1,810	2,950
Total	**575,451**	**22,564**	**3,218**	**26,634**	**21,468**	**28,437**	**23,141**

These basins are challenged by different challenges and vulnerabilities, the Athi and Tana being more affected. Such challenges include water scarcity and variability, catchment degradation, climate change (floods and droughts) (Figure 4). Catchment degradation in highly seen in most of the basins that leads to more risk on water use in different areas such as irrigation (2030 Water Resource Group, 2015).

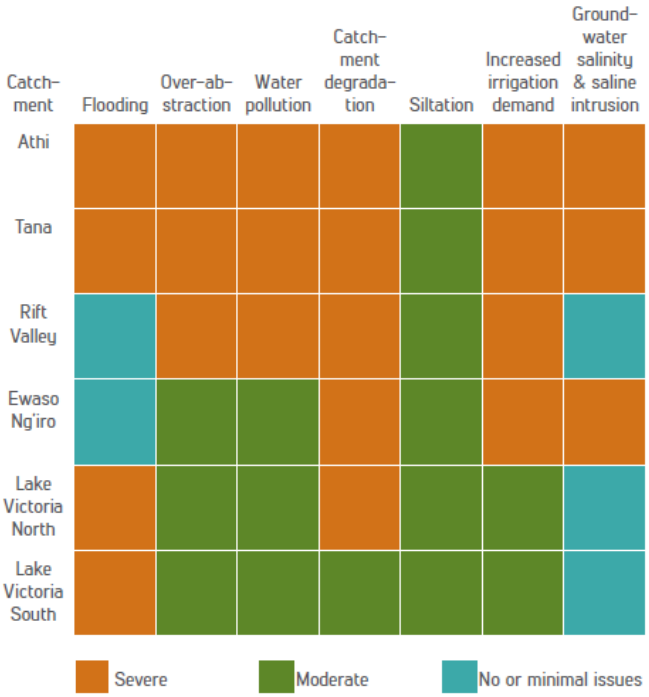

Figure 4: Challenges and vulnerabilities in different basins ((2030 Water Resource Group, 2015)

Kenya is estimated to have 619 Mm^3 ground water resources with only less than 5% of the water being used for irrigation coming from ground water (Pavelic et al., 2012; Plumpton, n.d.). It is estimated that total irrigation water in Kenya is 16,446 Mm^3/year (overall average of 13,705 m^3/ha assuming 160% annual cropping intensity and 60% irrigation efficiency). The annual total irrigation water demand for future projected irrigated area of 765,575 ha in 2030 and is estimated at 8,063 Mm^3/year, equivalent to a water demand of 94,949 m^3/ha/year (Government of Kenya, 2013)

4.2 Kenya's Agricultural Sector

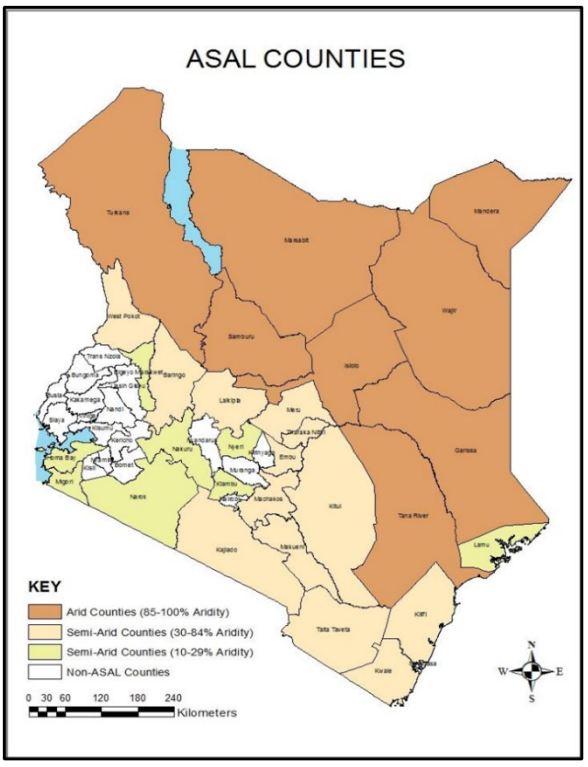

Figure 5: Map showing arid, semi-arid and humid regions in Kenya (Birch, 2018).

The agricultural sector is highly important to the Kenyan economy, contributing up to 30% of the Gross Domestic Product (GDP) and employing more than 40% of the country's population of which 70% are the rural population (FAO, n.d.; USAID, 2021a). Agriculture is the main source of income for rural areas, where about 38 million people live, which is 72 percent of the total population (The World Bank, 2020). These rural areas rely on smallholder agriculture for their food security and job opportunities. The rural population is growing resulting to more pressure on the available agricultural land and natural resources (Birch, 2018). Although the rural population is growing in absolute numbers, the percentage living in rural areas is declining (Birch, 2018).

The North and East of the country contain arid bushlands with high temperatures up to 40ºC with annual rainfall of only 250 to 500 mm/yr (Ayugi et al., 2016). Figure 5 shows that more than 80% of Kenya's land surface is semi-arid or arid, which is unsuitable for rainfed agriculture due to low and erratic rainfall (2030 Water Resources Group, 2016; D'Alessandro et al., 2015). About 20% of Kenya's population lives in these areas, together with 50 to 70% of the country's livestock. These households therefore rely mainly on extensive livestock production systems such as ranching and pastoralism (D'Alessandro et al., 2015). Most people live in Western or Central Kenya where there is sufficient rainfall and opportunities for rainfed agriculture (2030 Water Resources Group, 2016). Only 10% of the country's land is arable land (The World Bank, 2017), producing 70% of the agricultural output in humid areas, 20% in semi-arid areas and 10% in arid areas (International Trade Administration, 2020).

Only about 3% of the cultivated land in Kenya is irrigated, which regard mainly large-scale farmers or the horticultural subsector (2030 Water Resources Group, 2016). Agriculture in Kenya is dominated by smallholder production on farms of 0.2 to 5 hectares that rely on rainfed agriculture (Birch, 2018; Food and Agriculture Organization of the United Nations, 2015; Koomen et al., 2018). Rainfed farms are thus heavily dependent on the availability of rainwater, making farmers highly vulnerable to changes in rainfall patterns. Climate change is therefore a threat for farmers because temperature is expected to rise and rainfall will become more unreliable, leading to droughts and unpredictable weather patterns (Bryan et al., 2013; FAO, n.d.; Ochieng et al., 2016). Next to rainfall patterns, factors such as climate and terrain determine Kenya's agricultural productivity (D'Alessandro et al., 2015). Climatic conditions in Kenya vary from tropical regions to very humid highlands and to arid inlands. West and central Kenya are characterised by high mountains and the Kenyan Rift valley with two rainy seasons from March to May and a short season from October until December (Ayugi et al., 2016). The coastal region is a tropical region where the rainfall depends on the monsoon (Ayugi et al., 2016).

Irrigation schemes in Kenya covered 222,240 ha of land in 2018 (MWSI, 2019). Public or national schemes, which are large in scale, increased from around 9,000 ha in the late 1990s to 24,240 ha in 2018 (MWSI, 2019). The greatest change however occurred in private schemes (mainly large commercial farms) and

community-based smallholder schemes, which have increased from around 40,000 ha in the late 1990s to about 88,000 ha and 110,000 ha in 2018. Main large scale irrigated crops include rice and vegetables; besides key crops such as coffee, fruit, sugarcane, and cotton.

5 Agricultural Production

Kenya's Vision 2030 and other development strategies identify agriculture as one of the key sectors to deliver the desired 10% annual economic growth for the country including delivering of adequate, healthy and nutritious food. The agri-food systems in Kenya include crop, livestock production and blue economy systems. According to the Agricultural Sector Growth and Transformation Strategy (2018), agriculture covers 65% of the total exports and employs 18% and 70% of formal and informal workers in rural areas. Therefore, because of its weight on the country's economy improvements in agricultural wages would have large benefits on diminishing poverty among Kenyans (Njeru & Gichimu, 2014) . However, these systems have remained subsistent and constrained by inadequate access to quality inputs, marketing inefficiencies, non-conducive investment environment, climate change, inadequate soil and water management practices, land fragmentation, weak implementation of agriculture policies and legislation, small non-commercial production models and low adoption of productivity-enhancing technologies, low levels of innovation and entrepreneurial skills and limited inclusivity of women and youth (L. and F. (K) Ministry of Agriculture, 2019).

The agricultural sector is dominated by small holder farmers (0.2 – 5 ha) who depend on rainfed agriculture(Birch, 2018; Food and Agriculture Organization of the United Nations, 2015; Koomen et al., 2018). They make up to 78% of total agricultural production and 70% of commercial production (Amwata, 2020). It is therefore quite evident that Kenyans are fed by small holder farmers as they produce food for their own family and local and national markets (Nasike, 2020). The main crop produced is maize, the most important staple crop in Kenya which is also used for animal feed. Together with dry beans, maize covers more than half of the total cropped area (D'Alessandro et al., 2015). Next to these outputs, sorghum, cowpea, tea, coffee, wheat, potatoes, pigeon peas and millet are important crops produced. In the humid, high-potential areas of Kenya, a high variety of food and cash crops are produced, whereas in the (semi-) arid areas the cropping diversity is less with mainly maize, pulses, roots and tubers being produced (D'Alessandro et al., 2015). In these regions, extensive pastoralism is the main source of livelihoods. small scale irrigation farmers are highly affected by different factors such as poor land use practices; low levels of investments; limited access to factors of production namely inputs, credit, technologies, markets; that are fundamental for inclusive growth; limited value addition; and weak institutional coordination.

Large-scale agriculture (>50ha) accounts for 22% of traded agrarian food (D'Alessandro et al., 2015), of which 90% is for the export market (Kibe, 2011). Large-scale agricultural lands are up to 30,000 hectares big, producing commercial crops such as tea, coffee, maize, sugarcane, wheat and cut flowers (Birch, 2018; D'Alessandro et al., 2015). Large-scale farmers often have access to an irrigation system and the export market, contributing greatly to the economic development of the country. With current climate change impacts, smallholder farmers in especially (semi-)arid areas are more affected than the large-scale farmers in high-potential areas with sufficient rainfall or irrigation water. The Kenya policies, legal frameworks and strategies regarding 100% food and nutrition security are focused towards enhancing agricultural productivity (for both large scale and small-scale farmers). It does so by investing in irrigation and water harvesting and storage facilities to reduce the overdependence on rainfed agriculture. For example, under the irrigation development projects and the Expanded Irrigation Programme (EIP), the National Irrigation Authority (NIA) is taking the lead in the development of large-scale irrigation projects, small-scale community managed irrigation projects and expansion of public irrigation schemes through construction

and rehabilitation of irrigation infrastructure and research (through Mwea Irrigation Agricultural Development Center (MIAD).

Crop production has grown steadily with an average annual increase of 6.2% from 1990 to 2012, mainly driven by area expansion. However, the growth in crop production is not keeping up with the enormous growth of Kenya's population, leading to structural deficits in staple crops such as maize, wheat and rice. To address the deficit, the country depends heavily on imports. (D'Alessandro et al., 2015)

6 Agriculture and Water Policies

To understand the aspired development and the plans of Kenya in agricultural water management, it is important to understand the national strategic development targets of the country as well as the specific policies from the ministries. In Section 6.1, the national strategic development plans and targets of Kenya are presented based on the most recent national plans (Constitution of Kenya 2020, Kenya Vision 2030, the big 4 Agenda). In Section 6.2, the institutional bodies, roles, strategies and targets of the MoWSI and Ministry of irrigation are discussed.

6.1 National Strategic Development Plans and Targets

6.1.1 The Constitution of Kenya (CoK)

The Constitution underwent a tremendous change in governance, management, and service delivery modified in the constitution of Kenya 2010 that transformed the previously unitary state to 47 county governments with immense powers, including legislative. Counties have taken over most functions related to governance, implementation, and public functions, while the national government manages issues that could not be effectively managed by the devolved counties. With the changes in the constitution Kenya's ultimate law-sectoral statutes, institutions and functions had to change. Article 43 (of Economic and Social Rights) of the Constitution recognises water and sanitation services as a basic human right (Kanda et al., 2013) and putting more efforts on ensuring everyone in the country has the right to be free from hunger and have access to adequate and quality food (Constitution of Kenya, 2010). This addition in the Constitution has many implications for the water and agriculture sector. Currently, counties have the ability to form their own policies to domesticate the national policies and result in County Integrated Development Plans (CIDP).

6.1.2 Kenya Vision 2030

Global climate change is becoming a great challenge in Kenya. Currently, drought and flood risks are increasing. The situation in the water sector has changed so much that the Kenya Vision 2030 was prepared in 2007, a blueprint covering the period of 2008 to 2030. The Vision 2030 aims to transform Kenya into a newly industrialised, "middle-income country providing a high quality of life to all its citizens by the year 2030" (Government of the Republic of Kenya, 2018a). The Vision 2030 is based on three pillars of development namely, economic, the social and the political. The economic pillar aims to achieve an average GDP growth rate of 10% per annum beginning in 2012. The social pillar seeks to build a just and cohesive society with social equity in a clean and secure environment. The political pillar aims to realise a democratic political system and protects the rights and freedoms of every individual in Kenyan society. The national development targets on the water sector in the Vision 2030 are as follows:

1) **Water and sanitation** - to ensure that improved water and sanitation are available and accessible to all by 2030,
2) **Agriculture** - to increase the area under irrigation to 1.2 million ha by 2030 for increase of agricultural production,

3) **Environment** - to be a nation that has a clean, secure and sustainable environment by 2030,
4) **Energy** - to generate more energy and increase efficiency in energy sector.

As this policy review focuses on agriculture and water use, the second target will be discussed in detail. Due to the low water demand and increased water availability towards 2030 (see Table 1), the Vision 2030 has focused on substantially increasing the water allocated for irrigation from around 1,600 Mm^3/year in 2010 to around 18,000 Mm^3/year in 2030 (Figure 6). This would require additional investments in water storage in order to increase the water captured by 31%. The National Water Master Plan 2030 estimates irrigation potential to be 765,575 ha without investments in water storage, rising to 1.2 million ha with investments in water storage (JICA, 2013). This indicates a maximum increase of 977,760 ha for irrigation.

With regards to the expansion of small-scale farms all studies confirm Kenya's great potential for expanding smallholder irrigation, including the usage of water efficient distribution and application methods such as drip and sprinklers (Hornum and Bolwig, 2020).

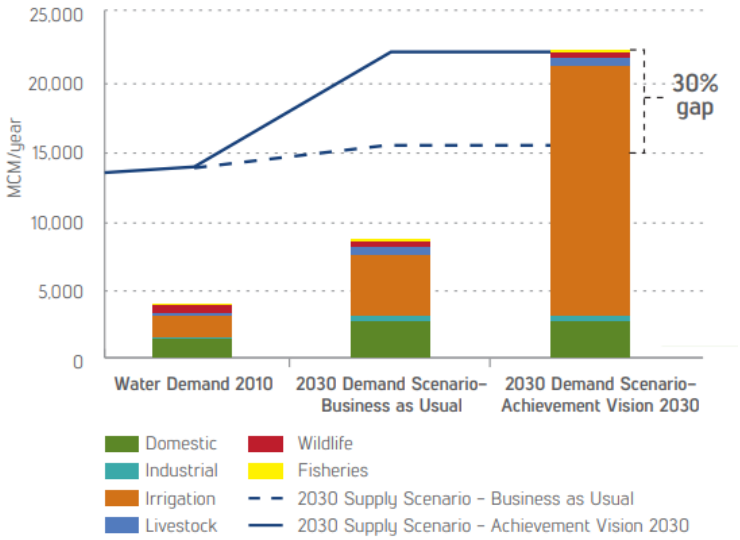

Figure 6: National Water gap analysis (2030 Water Resource Group, 2015)

6.1.3 The Big Four Agenda 2017-2022

The Big 4 Agenda is President's Uhuru Kenyatta's blueprint towards actualizing his development manifesto in Kenya. It comprises of four pillars towards 2030; namely Food Security; Affordable Housing; Manufacturing and Affordable Healthcare. Third Medium Term (MTP3) of the Vision 2013 will be driven and achieved through this Big Four Agenda. The focus areas of the MTP3 include: Irrigation Expansion and Agro-productivity, Productivity and competitiveness improvement, Sustainable Development Goals, Africa's Agenda 2063, National Spatial Planning, Ending Drought Emergencies (Government of the Republic of Kenya, 2018). The agenda looks towards having a 100% food and nutrition security through job creation, increased agricultural production (construction of large-scale multi-purpose and smaller dams for irrigation projects) and having good and quality food storage facilities.

6.2 Ministry of Water, Sanitation and Irrigation (MoWSI)

The MoWSI was until 1974 a department in the Ministry of Agriculture. After the National Water Master Plan of 1974, it was decided to be made a separate Ministry of Water and Irrigation. In 1992 it was merged with other departments to form the Ministry of Land Reclamation and Regional Development, and after 1998 the Ministry of Water Resources were formed. In later years, other departments came together and were split again after some years, forming again the Ministry of Water, Sanitation and Irrigation (MoWSI) in 2015 (Ministry of Water and Irrigation, 2017).

The objective of the MoWSI is "to contribute to national development by promoting and supporting integrated water resource management to enhance water availability and accessibility". The MWI is thus responsible for the water availability and accessibility to Kenyans, which they aim to do by accelerating the implementation of water sector reforms, improving the sustainable management of water resources, improving the provision of water and sewerage services, improving the utilisation of land through irrigation and land reclamation, strengthening institutions in the Ministry and water sector, and mobilising resources and promoting efficiency in their utilization (Ministry of Water and Irrigation, 2017). By doing this, they aim to realise the goals of the Millennium Development Goals declaration and the Vision 2030 concerning access to safe and affordable water and basic sanitation (Ministry of Water and Irrigation, 2007). There are six subsectors within the MWI, which are Water Supply Services, Sewer & Non-Sewer Sanitation Services, Water Harvesting and Storage, Water Resource Management, Water Sector Investment Planning and Transboundary Waters. Each of these departments have their own functions and responsibilities.

6.2.1 The National Water Master Plan (NWMP) 2030

Today's institutional arrangements for the management of the Kenyan water sector can be traced back to the launch of the National Water Master Plan 2030 (NWMP) in March 2014. The primary aim of this Plan was to ensure availability of potable water at reasonable distance to all households of Kenya by the year 2000. The master plan also recognized the 24% of GDP contribution from agriculture. This motivated the formulation of the irrigation development plan in the NWMP 2030 under water-saving irrigation for crop and paddy cultivation to maximize the new irrigation developments in the country. Different indicators are proposed to be used to assess the progress; namely irrigation efficiency, cropping intensity and area coverage of water-saving irrigation technologies (Government of Kenya, 2013). The irrigation development plan also recognizes that if the water-saving irrigation is not actualized, the new irrigation developments in 2030 will have to decrease by 15%.

To achieve this, the NWMP aimed to actively develop water supply systems, requiring the government to directly provide water services to consumers and regulating the use of water resources and financing activities in the water sector. The NWMP was reformulated in 1992 , updated in 1999 (Mumma, 2007) and launched in 2014 (Water Services Regulatory Board (WASREB), n.d.). The legal framework for carrying out the functions of the NWMP was found in the Water Act, which is part of the Kenyan Law.

6.2.2 The water Act 2016

The updated water act was finally enacted in April 2016, bringing with it significant changes to the mandate, responsibilities, and functions of water sector institutions. Water act 2016 was enacted making it a progressive legislation in that it recognised water as a basic right, fully in conformity with the Constitution of Kenya (CoK) 2010, which has enshrined the right to water in its bill of rights. In addition, the act recognised devolution of water management activities between the two levels of government- national and county.

The objective of the Water Act is to provide for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes (Government of the Republic

of Kenya, 2016). In 2002, The Water Act introduced radical changes to the legal framework for the management of the Kenyan water sector in accordance with the Dublin Principles (Kanda et al., 2013). The reforms can be categorised in four themes, namely the separation (1) and decentralisation of functions (2), the involvement of non-government entities (3) and the separation of policy making from administration and regulation (4) (Mumma, 2007). Under the older Water Act, the Department of Water Development carried out all the function in the water sector (Mumma, 2007). The Water Act 2002 separates water resources management from the delivery of water services by creating new institutions and stakeholder participation (Kanda et al., 2013). In addition, it decentralises functions to lower-level public institutions (Mumma, 2007)

The Water Act of 2016 aligns the water sector with the Constitution's objective to decentralise the functions of the management of the water sector (WRG, 2016). In addition, it gives priority to use water for domestic purposes over irrigation and other uses (WRG, 2016). As a result of the decentralisation, institutions are established who all have their own functions and responsibilities. These institutions all fall under the final responsibility of the MoWSI of Kenya. Figure 7 shows the institutional set-up of the water sector in Kenya.

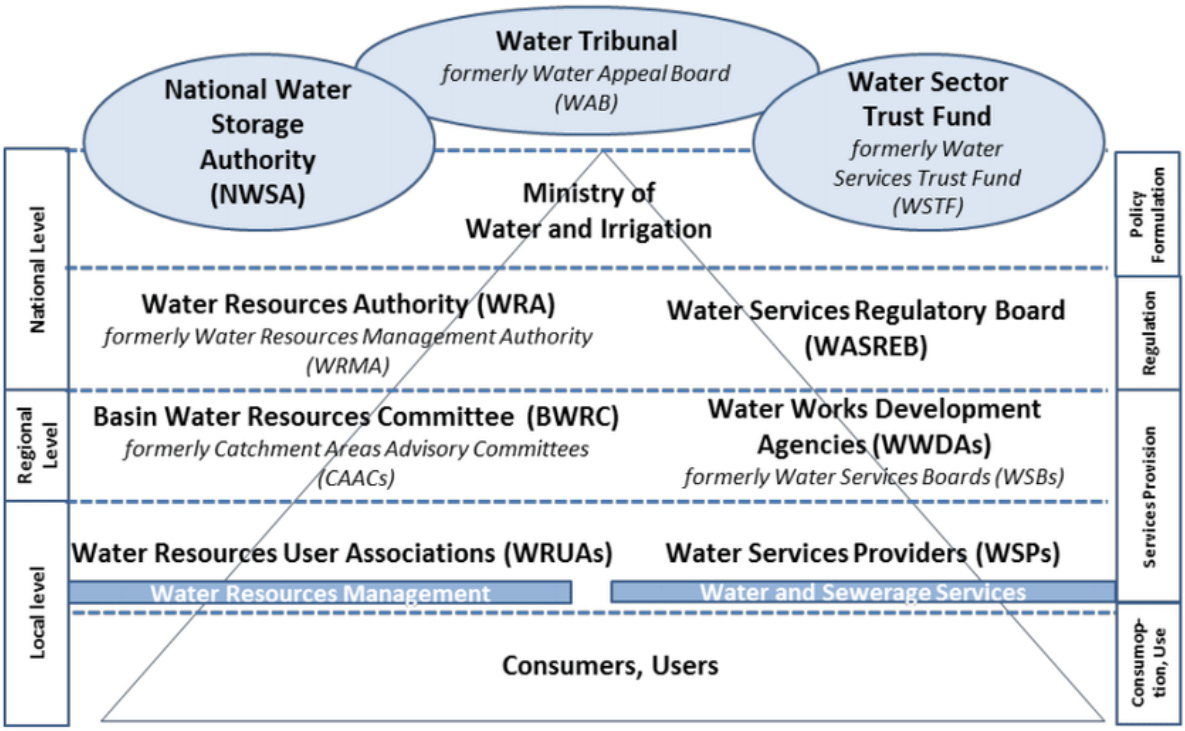

Figure 7: Institutional set-up of the Kenya's water sector (adapted from Water Act 2016)

6.2.2.1 Institutional set-up (institutional bodies and responsibilities)

Water Resources Authority (WRA): The objective of the new WRA is to protect, conserve, control and regulate the use of water resources through the establishment of a national water resource strategy. In addition, the WRA is responsible for:

- Formulation and enforcement of standards, procedures and regulation for the management and use of water resources.
- Policy development.
- Planning and issuing of water abstraction permits.
- Setting and collecting permits and water use fees.

Irrigation Water Management Department (IWM): The IWM Department of the MWI has the function of increasing water efficiency and productivity, capacity building and providing technical support for county officers, Irrigation Water Users Associations (IWUAs), individual irrigators and other stakeholders; development of strategies, guidelines and manuals; establishment and updating of an irrigation data base; and promotion of green houses, drip irrigation, solar/wind powered irrigation systems, and other efficient irrigation technologies. Other activities include installation of irrigation water measuring devices at every scheme.

The IWM Department, in line with its mandate for increasing efficiency and productivity, has an implicit interest in assessing water productivity. The IWM Department is in the process of developing a National Irrigation Water Management Improvement Programme (NIWMIP) that covers six thematic areas:

1. Formulation of Policy and legislations and enforcement of standards on IWM and productivity.
2. Research and innovations for development of water efficient irrigation technologies and good practices.
3. Promotion and up scaling of developed efficient irrigation technologies and good practices for increased water and yield productivity.
4. Capacity building and training for stakeholders, farmers, farmer IWUAs and county officers in water management and management of schemes.
5. Planning, M&E and information management (especially, establishment and updating data base on irrigation at County and National levels).
6. Renovation/ improvement and modernization of existing schemes for increased water efficiency and productivity of the schemes.

Basin Water Resource Committee (BWRC): Catchment Areas Advisory Committees (CAAS), which previously played a regulatory function at the regional level, have been replaced with BWRCs. The latter will be committees of WRA whose members will be drawn from stakeholders within the basin and aim to achieve wide stakeholder participation in the management of water resources at the basin level. The new BWRCs will retain the same regional functions as the former CAACs, which is: to manage catchments, to facilitate establishment of Water Resource User Associations and to play an advisory role to the WRA. The county government will have a representative in the BWRC whose water resources rest within the county government's geographical jurisdiction.

Water Resource User Associations (WRUAs): The act provides for establishment of WRUAs, which are community based associations for collective management of water resources and resolution of conflicts concerning the use of water resources. The BWRC may contract WRUAs as agents to perform certain duties in water resource management.

Water Services Regulatory Board (WASREB): The constitutionally guaranteed right to water and the need to protect consumers provides a strong basis for the national regulation and monitoring of water and sewerage services. This is critical to protect the interests and rights of consumers from exploitation and to set minimum national standards. As such, the functions of WASREB have been maintained in the 2016 act. WASREB holds the mandate to approve tariffs, monitor and enforce water services standards and issue licenses to Water Service Providers.

Water Works Development Agencies (WWDAs): In the water Act 2016, WWDAs is tasked over the water resources in the country and is county in nature. It is financed by the national government from the national revenue and is intended to serve a function of the national government. These may include assets such as water storage and water works for the bulk distribution of water services. Furthermore, it specifies that development and management of national public works will be undertaken by the WWDAs

whilst county public works will be a responsibility of the respective county. WWDAs are responsible for the:

- development, maintenance and management of national public works;
- operation of the national public waterworks and provision of water services as a water service provider;
- provision of technical services and capacity building to county governments and water service providers within its region.

Water Services Providers (WSPs): WSPs are now a responsibility of county governments who have the mandate to provide water services. WSPs are responsible for provision of water services within the area specified in their licenses and development of county assets.

6.3 Ministry of Agriculture and Livestock Development (MoALD)

6.3.1 The 2019-2029 Agricultural Sector Transformation and Growth Strategy (ASTGS)

The ASTGS aims at enhancing the achievement of 100% food and nutrition security through nine pillars the creation of a sustainable path to the modern agricultural sector over the next 10 years. It takes into consideration the current agricultural status review of data, learning more about global practices and local actions. It also looks towards actualizing the targets set under the vision 2030 and the Big Four Agenda through nine pillars (priority flagship interventions) that include:

1. Targeting nearly 1 million farmers with about 1,000 farmer-facing SMEs in selected 40 high-productivity zones.
2. Shift nationwide subsidy programme focus to empower 1.4 million registered high-needs farmers to access a wide range of inputs (seeds, crop protection, fertilizer, equipment) from a variety of private and public providers, using e-vouchers with digital service delivery.
3. Establish 6 large-scale agro- and food processing hubs across the country through a rapid Public-Private-Partnership (PPP) process (i.e. one-stop shop) targeting both domestic and export markets.
4. Unlock 50 new large-scale private farms (>2,500 acres each) with about 150,000 acres under sustainable irrigation from existing projects (e.g., rehabilitate dams) with government provided infrastructure (e.g., power, roads) and protected land ownership.
5. Restructure governance and operations of the Strategic Food Reserve (SFR) to better serve 4 million vulnerable Kenyans.
6. Boost food resilience of 1.3 million farming and pastoralist households in arid and semi-arid lands (ASALs) through community driven design of interventions.
7. Launch three knowledge and skills programmes using a field and-forum approach to target about 200 national and county government leaders, key implementers including the 1,000 SMEs and 3000 youth extension agents.
8. Strengthen research and innovation as launch priority digital and data use cases to better drive decision-making and performance management.
9. Actively monitor two key food system risks including sustainable and climate smart natural resource management, and crisis management for pests and diseases, climate and global price shocks.

6.3.2 The Agriculture Policy

In collaboration with County governments and relevant stakeholders, the MoALD has formulated the Agricultural Policy, which is the basis of legislation, strategies, plans, projects, and programs for the country's agricultural development. The policy has been developed considering the provisions in the constitution to provide a clear road map for achieving Vision 2030 agricultural goals and targets. The main goal of the policy is to improve food and nutrition security and maximize incomes through optimal utilization of resources in the Agricultural Sector. This is achieved through (i) transforming crop, livestock and fisheries products into commercially oriented enterprises that ensures sustainable food and nutrition security, and (ii) providing a framework for the support and intensification of cooperation and consultation between the National and County governments and among other stakeholders for enhanced development of crops, livestock and fisheries (L. and F. Ministry of Agriculture, 2021).

It identifies current challenges in the Agricultural Sector and outlines suitable guidelines to address them. Some of the challenges include:

i. Declining agricultural land due to a combination of factors including uncontrolled subdivision, inappropriate land product development and storage technologies undiversified production and productivity due to high cost of inputs, low availability of inputs in remote areas, lack of targeted subsides, low quality inputs, declining soil fertility, inadequate use of modern technologies, pests and diseases among other factors.

ii. Unfavorable taxation and tax regimes that increase production costs reduce opportunities for processing due to high cost of technologies and lower product comp-competitiveness in the local and international markets.

iii. Ineffective and inefficient inter-sectoral linkages and coordination for development of agriculture and its contribution to improved food and nutrition security.

iv. Inadequate demand-driven research for development in agriculture, low uptake of appropriate agricultural technologies, and, weak research-extension-farmer linkages.

v. Unpredictable weather patterns and rainfall variability.

vi. Low budgetary allocation to the agricultural sector.

vii. Inadequate structured interactive farmer government to address issues affecting the agricultural sector.

viii. It provides measures towards sustainable use of natural resources, particularly land and water, which are expected to boost agricultural production and productivity

To solve the challenges, the policy is guided by two principles i.e (i) support and strengthening of the food, health and national security interrelationship, and (ii) effective and sustainable agricultural development. This is actualized in different activities such as:

- Ensuring household and national food and nutrition security.
- Pursuing commercial agriculture by increasing and diversifying agricultural production and productivity using appropriate, good quality and affordable inputs.
- Promoting demand driven research and timely dissemination of research findings in the agricultural sector.

- Strengthening agricultural institutions, develop institutional linkages and enhance collaboration to create harmony and synergy in developing agriculture.
- Promote sustainable natural resource use and management for agriculture.

6.3.3 Kenya Climate-Smart Agriculture Strategy (KCSAS) 2017-2026

The KCSAS aims at guiding different actions for building climate resilience of agricultural systems through transformation and reorientation of the agricultural systems for enhanced food and nutrition security and livelihoods in the country (Government of Kenya, 2017). The strategy is working under four objectives/strategic areas that include:

i. Increased agricultural productivity and income generation -Enhancement of the adaptive and resilience capacity of farmers and pastoralists to adverse climate change impacts.
ii. Reduced greenhouse emissions from agricultural production systems.
iii. Inclusive and enabling legal regulations and institutional framework.
iv. Addressing cross-cutting issues that adversely impact Climate-Smart Agriculture (CSA).

6.3.4 The Irrigation Act 2019

Irrigation in Kenya is well anchored in Vision 2030, the Third Medium Term Plan (MTP III) 2018-2022, Big Four Agenda 2018-2022 and further cascaded in the Authority's Strategic Plan 2019-2023. The Irrigation Act 2019 is further intended to support sustainable food production by clearly outlining the roles of national and county governments in facilitating irrigation activities in Kenya (National Irrigation Authority, 2021a). It is an Act of parliament enacted to provide for the development, management and regulation of irrigation, to support sustainable food security and socioeconomic development in Kenya and for connected purposes. The provisions of this apply to matters relating to the development, management, financing, provision of support services and regulation of the entire irrigation sector in Kenya (Government of the Republic of Kenya, 2019).

The Irrigation Act 2019 stipulates the role of the government in development, management and regulation of irrigation in Kenya. It outlines the roles of the cabinet secretary as:

1. Ensure the effective exercise and performance by any authority or person under the authority of the cabinet Secretary of their powers and duties in relation to irrigation and drainage, including water harvesting and storage for irrigation.
2. With regard to irrigation development the cabinet secretary shall have the responsibility to:
    - Formulate policy and make legislative proposals to parliament, provide sector regulation, coordination and guidance, and monitoring and evaluation.
    - Develop general principles, guidelines, and standards for promoting development and for the coordination of irrigation planning.
    - Establishing through a gazette notice, national, public or strategic schemes of any category as defined in the act.
    - Promoting use of efficient irrigation systems in Kenya.
    - Subject to resource constraints, ensure availability and adequacy of water for irrigation.
    - receiving and determining applications for any irrigation projects, including issuance of irrigation licences for irrigation schemes
    - monitoring and enforcement of conditions attached to licenses for all irrigation projects.
    - Reporting to both houses of parliament annually, and as may be necessary, on the state of, and needs for, irrigation development and management in the country.
    - Gathering information and maintain data bases on irrigation development and management.

- Conducting periodic technical and management audits of irrigation schemes infrastructure, governance, management and financing.
- Maintaining storage investments for their proper use implementation.

3. Consult and seek support of other government ministries and agencies, council of governors, county governments and other non-governmental entities in order to encourage broad support for irrigation development and management.
4. Formulate and publish in the Kenya Gazette, a five-year national irrigation services strategy, based on, among others, the national irrigation policy for the time being in force.
5. Ensure effective implementation of the national irrigation services strategy.

6.3.4.1 Institutional set-up (institutional bodies and responsibilities)

Two institutional bodies were held responsible for the implementation of the Irrigation Act 2019; namely the county governments and the NIA.

The county governments are stipulated in the Irrigation Act 2019 as followed:

1. Each county government may, within its area of jurisdiction, establish a county irrigation development unit (CIDU) for the better carrying out of its functions with respect to irrigation pursuant to Part 2 of the Fourth Schedule of the Kenyan Constitution.
2. For purposes of ensuring uniformity and national standards in the irrigation sub-sector, through its legislative and administrative action, implement and act in accordance with the national policy guidelines issued by the Cabinet Secretary and approved by both Houses of Parliament
3. Functions of the CIDU's will be:
    - Formulating and implementing a county irrigation strategy in collaboration with relevant stakeholders, in line with national policies and strategies.
    - Developing and maintaining an irrigation database and integrating a systematic monitoring and evaluation strategy.
    - Identifying community-based smallholder schemes for implementation in line with national guidelines.
    - Mainstreaming irrigation related statutory obligations such as those that relate to the environment, water and health.
    - Providing capacity building for farmers and support establishment of viable farmer organizations, and in particular irrigation water users associations to develop and manage irrigation schemes including actively participating in conflicts resolution within irrigation schemes.
    - Setting up measures to implement adaptation and mitigation to climate change, and enhance sustainable environmental management.

The National Irrigation Authority (NIA): The Irrigation Act No. 14 of 2019 established the NIA under the MoALD on 16 August 2019, which has the following functions:

- Improving irrigation infrastructure for national or public schemes.
- Providing irrigation support services to private medium and smallholder schemes, in consultation and cooperation with county governments and other stakeholders.
- Providing technical advisory services to irrigation schemes in design, construction supervision, administration, operation and maintenance under appropriate modalities, including agency contracts, as may be elaborated in regulations to the Act.

NIA holds an important position in the institutional landscape of agricultural developments in Kenya, aiming to put into practices the agricultural policies and strategies. To this end, NIA developed a strategic plan, as discussed below.

6.3.5 National Irrigation Authority (NIA) Strategic Plan (2019-2023)

The NIA Strategic Plan 2019-2023 is aimed at facilitating the provision of irrigation-related goods, works, and services so that Kenya can attain food security, nutrition and economic growth as inspired for in the Sustainable Development Goals (SDGs), Vision 2030, Medium Term Plan III (2018-2022), Big Four Agenda (2018-2022), Agricultural Sector Transformation and Growth Strategy (2019-2029), Kenya National Food and Nutrition Security (2011), and Comprehensive African Agricultural Development Program (CAADP).It also enables NIA to recognize and realize their being of more relevant, competitive, and sustainable in the provision of sustainable irrigation development and management. Through this, NIA is able to achieve it Vision "Water to every irrigable acre" and Mission "Provide and coordinate Sustainable Development and Management of irrigation services in Kenya" (National Irrigation Authority, 2019).

The main objective of the Strategic Plan (2019-2023) is to contribute to the improvement in food security through increased food production and productivity as well as stability in year-to-year production, on an economically, socially, and environmentally sustainable basis. This strategic plan is aimed at achieving the following strategic objectives.

i. Increase area under irrigation by 518,000 acres (209,627 ha) in the plan period of 4 years
ii. Increase Irrigation water storage capacity by 400m^3.
iii. Achieve at least 200% utilization in each irrigation scheme.
iv. Form and strengthen at least one farmer organization in every NIA developed scheme to enter into agreements,
v. Identify and implement irrigation development advancement technologies.
vi. Develop and adopt sustainable irrigation management frameworks.
vii. Develop and implement a transition plan to the irrigation act.
viii. Develop and implement management systems to improve efficiency.

The long-term outcomes anticipated to be achieved include:

i. Increased irrigated agriculture production and productivity for local and export use using irrigation technologies considering climate change and community resiliency.
ii. Maximize national food self-reliance, improved national and household incomes, food and nutritional security.
iii. Improved irrigation service delivery.
iv. Increased employment and income creating opportunities.
v. Enhanced land and water productivity through sustainable land tenure arrangements, catchment management and water harvesting and;
vi. Reduced risk of disruptive variations in food supply.

With the support of modern data collection for decision support in irrigation and drainage service delivery, the plan encompasses an overarching emphasis on:

- The critical need to extend and improve the quality of irrigation and drainage services in the country,
- Focusing on rehabilitation and modernization of existing schemes and development of new ones.
- Facilitating and promoting investments in modern irrigation technologies for higher value crops and higher output quality,
- The facilitation of environmentally and financially sustainable irrigated agricultural systems and services and importance of modernizing management systems.

- Recognizing the importance of enhancing collaboration and partnership amongst the irrigation stakeholders with a view of improving the production environment for higher-value crops and higher-value-added products.

Through the NIA, Expanded Irrigation Programme (EIP) aims at enhancing irrigation coverage in the country towards making Kenya a net exporter of food and improving livelihoods. 168 irrigation projects have been completed countrywide, putting 129,769 acres under irrigation and directly benefiting 88,010 farmers. More irrigation 42 irrigation projects were started in the financial year 2020/2021 which will add more 14,000 acres under irrigation (National Irrigation Authority, 2021).

Strategic development plan of NIA aims towards similar outputs with the targets of the agricultural policy and the agricultural sector transformation and growth strategy but there is a lack of common understanding and assessment of agricultural development efforts. This results in the development of many different and scatter policies that are hard to implement.

7 Enabling Environment and Implementation Challenges

Enabling environment:

- Strong official policy commitment for increasing food security and providing food to all. There is a necessity for this.
- High irrigation potential: water availability is higher than the water demand, making it possible to increase irrigated area expansion. The water availability is also expected to increase due to positive projections of increased rainfall due to climate change. However, rainfall is expected to be erratic, causing uncertainties regarding the possibility of storing rainwater.
- Investments: Investing in water storage and harvesting is difficult and costly.
- Unregulated (river) abstractions: Regulating water abstraction is challenging. Policy experts informally estimated that around 70% of abstractions are unregulated. This does not give incentives for higher water productivity and efficiency at the farmer level. It was mentioned that Ewaso Ng'iro River basin is drying up. In Mwea irrigation scheme, farmers outside the irrigation scheme, making use of the unregulated abstraction conditions, are moving towards abstracting river water upstream. This might create water shortages for the farmers of the scheme.
- Groundwater: limited studies and information about Kenya's groundwater, making it challenging to point out the status of groundwater resources and implement targeted policies.
- Working in silos (scattered and contradicting policies): Different ministries and departments have different but closely related policies. This leads to a large amount of policy documents that aim to achieve similar outcomes. A comprehensive policy is thus missing. Indicative of the multiple policy documents is the example of achieving 100% food and nutrition security. The policies that discuss this aspect are: The Big Four Agenda 2017-2022, The 2019-2029 Agricultural Sector Transformation and Growth Strategy (ASTGS), Kenya Climate-Smart Agriculture Strategy (KCSAS) 2017-2026, The National Water Master Plan (NWMP) 2030, The water Act 2016, National Irrigation Authority Strategic Plan (2019-2023), The National Climate Change Strategy (NCCS), The National Climate Change Action Plan (NCCAP), The National Adaptation Plan (NAP) 2015-2030, The National Climate Change Policy, The National Climate Change Act 2016 and The Nationally Determined Contributions (NDCs) (Amwata, 2020). As seen in the previous sections, different targets under different time frames are set in these policies. This impedes the collaboration between different departments and results in working in silos, increasing the difficulties of achieving and assessing developments under a common understanding and framework.
- Farm size is decreasing, and land distribution is becoming more concentrated due the tremendously growing population of Kenya, leading to constraint on production, particularly for

smallholders. The population is growing; with 47.6 million people as per the 2019 census and a growth rate of about 2.2% p.a., the population is projected to be 66 million by the year 2030.

- **Pest and diseases** (agronomic challenges) are influencing the overall production and productivity. Improvements in these aspects could increase the overall productivity of water. For example, in the rice farms (Case of Mwea Irrigation Scheme), pests and diseases such as Bakanae fungal diseases are reducing the rice production.
- **Limited agricultural research, development and extension** is evident. Low number of farmers receive extension services and government spending on agricultural research has decreased. For example, in 2016 it was 0.48%, approximately one-third of its value in 2006 and well below the African Union target (Birch, 2018)

8 Water Productivity Related Indicators

The Third Medium Term Plan 2018-2022 mentions that the expansion of irrigation coverage led to an increased agricultural output, but no mention was made about how much water was used to do so.

In general, the application and use of biophysical water productivity seems to be limited in the Kenyan official policies as nothing explicitly is written about it. The focus of Kenyan policy papers is mainly on making water available and accessible for agriculture and domestic use and increasing the area under irrigation. This is in order to secure food security for all Kenyans and improve the economic development of the country. Thus, the aim area of concern is that of food security. Biophysical water productivity is limited in the current policies and seems not of direct interest. Instead, opportunities for biophysical water productivity might appear in using biophysical water productivity as a tool to make a concrete and comprehensive strategy for implementing already existing policies.

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