Food and Agriculture Organization of the United Nations

AgWA
Partnership for agricultural water for Africa

National Investment Profile

Water for Agriculture and Energy

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EXECUTIVE SUMMARY

Agriculture is of great importance to the development of the Kingdom of Swaziland in both economic and social terms. In 2011, agriculture accounted for 7.48 percent of the total GDP of the country (World Bank, 2014) and it employed approximately 11 percent of the total economically active population (FAOSTAT, 2014). However, agriculture's contribution to the economy has decreased gradually over the last two decades, to the extent that the poor performance of this sector has turned the country into a net importer of agricultural commodities (Thompson, 2014).

The agricultural sector has a dualistic character as it is divided into commercial and subsistence subsectors. Subsistence farming is characterized by low levels of investment, irrigation and generally low productivity while commercial agriculture is characterized by high levels of investment, irrigation and high productivity. The farming systems in the country are still predominantly subsistence-based and rain-fed, thereby explaining the country's low productivity levels with gaps between current and potential yields.

According to AQUASTAT, the irrigation potential of the country was estimated at 93 220 hectares with 49 843 hectares equipped for irrigation, while the area actually irrigated was 90 percent of the area equipped for irrigation (44 859 hectares) (AQUASTAT 2012). Irrigation is the major user of water in the country accounting for 96.6 percent of water withdrawal. The main crops produced are sugarcane, citrus fruits, pineapples, vegetables and cotton (NDS, 2014). The Swazi Government recognizes the important role of irrigation in contributing to closing the yield gaps which is reflected in the planned investment of approximately US$444.5 million in irrigation projects by the government over a 10 year period (SNAIP, 2014).

Regarding energy resources, the country's river network offers considerable potential for developing hydropower in the country, particularly for mini and micro plants that utilize run-of-river flows.

The National Vision 2022 highlights the need to raising the capability of the agricultural sector. To this end, Swaziland launched in 2010 the Comprehensive Africa Agriculture Development Programme (CAADP) process and prepared several policy documents, like National Development Strategy 1997; 2014, National Water Policy 2005, Comprehensive Agriculture Sector Development Programme (CASP) 2005, National Irrigation Policy 2005, National Food Security Policy (2005), National Agriculture Summit Report (2007), National Program for Food Security (Sectorial Development Plan for Agriculture (2008/09-2010/11) and more recently the Swaziland's National Agriculture Investment Plan (SNAIP) 2015-2025. All these plans aim to increase the area under irrigation, although with different specific targets and time frames.

To translate these goals into reality, Swaziland is planning to implement a number of irrigation and hydropower projects for a total estimated at US$665.4 million (18% of Swaziland's GDP in 2013, World bank) of which US$427.2 million is allocated to the development of small scale irrigation schemes, US$51.2 million to the development of small/medium scale hydropower, US$14.8

million to the rehabilitation/modernization of irrigation schemes, US$2.5 million to the development of large scale irrigation schemes and US$470 000 to the development of large scale hydropower projects. The others category is worth US$169.2 million and is allocated for activities such as training, awareness raising and strengthening of sector institutions. No funding is allocated to the rehabilitation of hydropower plants.

These figures show that investment in small-scale irrigation is predominant in the envelope. Investment will be mostly executed by public sources, some major irrigation projects are long term which coincides with the planned long term investment projects that are mainly in the SNAIP.

It is important for the country to ensure an adequate institutional and political environment for the success of these investments. It is also recommended that mechanisms are put in place to encourage the participation of the private sector in developing water resources and to support project formulation in the long term for hydropower projects.

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1. CONTEXT

This chapter will give an introduction into the contextual information of agriculture and food security (chapter 1.1), water resources and hydropower (chapter 1.2) and climate change in Swaziland (chapter 1.3).

1.1 AGRICULTURE AND FOOD SECURITY

Agriculture

The Kingdom of Swaziland is a landlocked country, with an estimated 1.3 million inhabitants in 2014 of which 79 percent are rural (World Bank, 2014). In recent years, the population has been growing at a slow rate. The annual population growth rate was estimated at 1.64 percent in 2010 and had declined to 1.49 percent in 2013 (World Bank, 2014). In contrast, the economy has been growing at a fast rate, the annual growth rate of the Gross Domestic Product (GDP) increased from 1.92 percent in 2012 to 2.79 in 2013 (World Bank, 2014). Agriculture, accounting for 7.48 percent of the total GDP of the country in 2011 (World Bank, 2014) and employing around 11 percent of the total economically active population (FAOSTAT, 2014), is of great importance in both economic and social terms.

Agriculture's contribution to the GDP has decreased gradually over the last two decades. The share of agriculture to GDP fell from 15 percent in 1989 to 13 percent in 1999, 10 percent in 2001 and 7 percent in 2011 (World Bank, 2014). Agriculture's share of GDP has consistently been lower than 15 percent since 1990 (World Bank, 2014). However, agriculture is more important for Swaziland's population and national economic development than its contribution to GDP suggests, because over 70 percent of the population and households rely on agricultural output as a major source of income and food security (NDS, 2014).

The performance of the agriculture sector has been affected by repeated droughts, underinvestment and the devastating effects of HIV/AIDS and as a result, the poor performance of this sector has turned the country into a net importer of agricultural commodities (Thompson, 2014). The value of agricultural imports in 2012 was SZL3 273 million (US$275.74 million), an increase from SZL2 655 million (US$223.7 million) in 2011 while the value of agricultural exports in 2012 was SZL7 190 million (US$605.73 million), as opposed to SZL10 867 million (US$915.5 million)[1] in 2011 (CBS, 2013). Thus, the agricultural sector of Swaziland has not recorded much growth; the average growth rate from 2005- 2011 is 1.31 percent (World Bank, 2014).

The agricultural sector has a dualistic character as it is divided into commercial and subsistence subsectors. The subsistence sub-sector is done on Swazi National Land (SNL) while the Title Deed Land (TDL) is mainly used for commercial agriculture. Subsistence farming is characterized by low levels of investment, irrigation and generally low productivity while commercial agriculture is characterized by high levels of investment, irrigation and high productivity.

[1] 1US$=11.87SZL in 2011 (retrieved on www.oanda.com on 13-07-2015)

TDL, covering 46 percent of the country, is privately owned land and it is used mainly for ranching, forestry or estate production of crops such as sugar cane (the main irrigated crop), citrus and pineapples. SNL, covering 54 percent of the country, is land held in trust by the King for the Swazi people, 61 percent of SNL farm holdings are less than one hectare in size (Thompson, 2014).

The country is divided into four agro-ecological zones, based on elevation, landforms, geology, soils and vegetation. The Highveld, Middleveld and Lowveld occupy about 30 percent of the country each, while the Lubombo Plateau occupies less than one-tenth of the country. Poor soils restrict the agriculture of the Highveld to mainly grazing activities, as only 3 percent of the area of the region constitutes good arable soils. Close to 15 percent of the Middleveld have arable soils of good to fair quality, whilst about 20 percent of the Lowveld has good or fair soils. The Lubombo Plateau has about 12 percent arable soils of good to fair quality (Manyatsi and Brown, 2009).

The country occupies a total land area of 1.7 million hectares which consists of about 1.2 million hectares of agricultural land. Of the latter, about 0.2 million hectares were actually cultivated; 178 000 hectares is arable land and 12 000 hectares are used for permanent crops (AQUASTAT, 2014). This indicates that there is still an evidence of food security challenges in Swaziland.

Maize is the staple food and the most important crop grown in Swaziland. It is the most important subsistence crop on SNL, followed by groundnuts, pumpkins, beans, sweet potatoes and vegetables. Sorghum, cowpeas, jugo beans, melons, watermelons, cassava, bananas, peaches and avocados are also produced, but in limited quantities. The yield of maize in Swaziland is far below that of its neighbor country, South Africa; for example, yields in South Africa were 3 766 kg/ha for the 2012/2013 season, which is more than triple the yield of 1 086 kg/ha in Swaziland. The yields of potatoes, vegetables, citrus and bananas are also far less than that of South Africa too (FAOSTAT, 2014). As mentioned, maize is often produced by the vast majority of the small subsistence farmers with little or no access to irrigation, and production fluctuates depending on climatic conditions. In recent years maize production has been falling short of demand and the shortfall is imported mainly from South Africa. Maize was actually the main agricultural import commodity in the period 2007 -2011 (FAOSTAT, 2014).

Figure 1 below compares average yields of the aforementioned crops for the period 2000-2012 in Swaziland with other developing countries. It can be seen that yield gaps can go over 200 percent, as it is the case for maize, which is a staple crop for the country, and as high as 600 percent for bananas when compared with South Africa. South Africa reaches outputs of around 35 365 kg per ha of maize, whereas Swaziland only produces about 11 767 kg/ha.

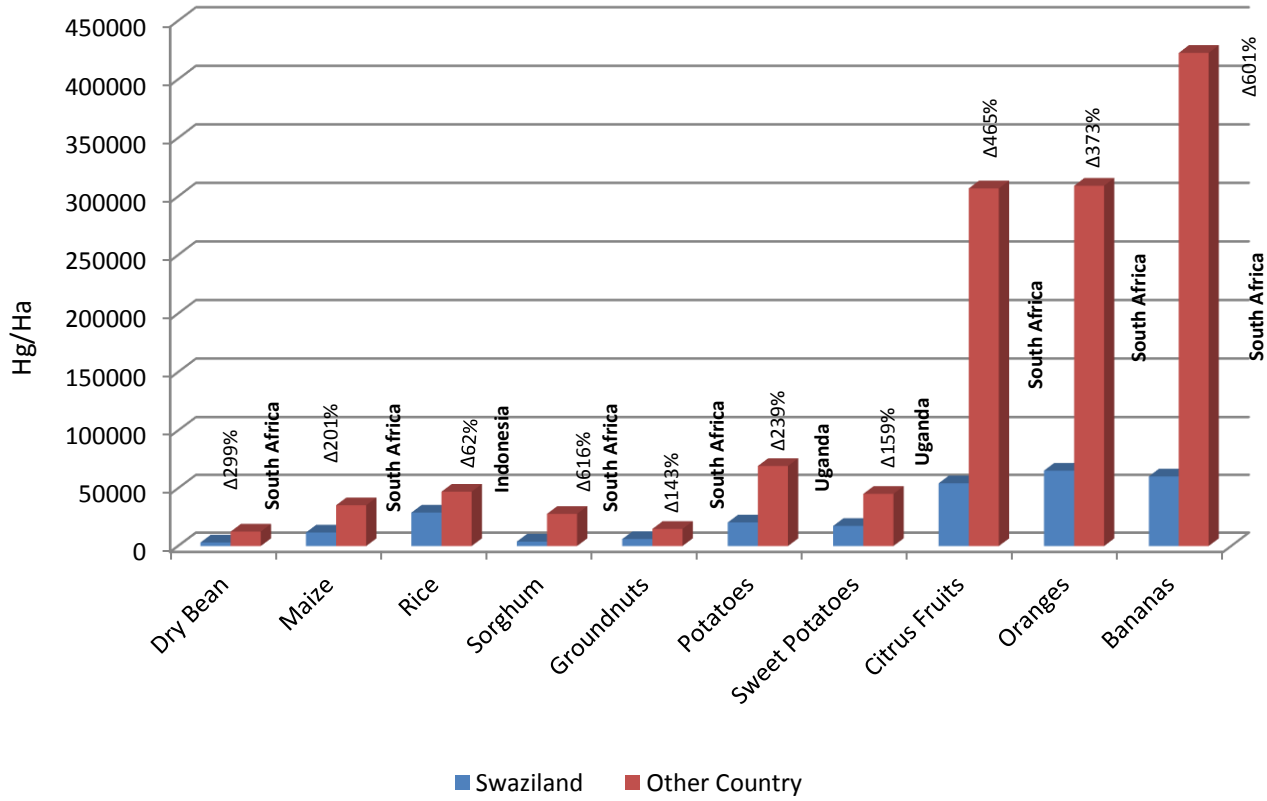
Livestock production is a major agricultural activity in Swaziland too, with small farmers owning about 77 percent of the total cattle population. Cattle are the main livestock; other animal species raised in Swaziland are goats, sheep, pigs, equines and poultry. The traditional SNL sector manages about 86 percent of cattle and 95 percent of small stock whereas the commercial TDL system carries the rest; the stocking rate on SNL is two times larger than on TDL (CBS, 2010). Livestock production is a major activity in subsistence farming. About 80 percent of the national herd is owned by SNL farmers and the rest is owned by a small but very well developed commercial cattle industry.

It is evident from the foregoing that the farming systems in the country are still predominantly subsistence-based and rain-fed, which makes them dependent on weather fluctuations. In addition, many agricultural policies have also been ineffective. Due to these challenges, the Government of Swaziland has identified the modernization of the agricultural sector as a major priority (NDS 2014). The role of irrigation in closing the yield gaps is also acknowledged by the Swazi government (SNAIP 2014).

According to His Majesty's Government Programme of Action (MGPA) (2013 – 2018), the country is adopting a paradigm shift from current dry-land, subsistence farming to irrigated, commercial agriculture.

For the country to attain First World status, agriculture is expected to receive an accelerated support in three key areas – broader access to water for irrigation purposes, assistance in the diversification of crop production and encouragement of adding value to primary crops through an increase in agro-processing activity (MGPA, 2013-2018).

Figure 1: Yield gaps between Swaziland and other producing countries (2000-2012)



Own elaboration using FAOSTAT 2014 data

Irrigation and water control

The country is rich in water resources with a high irrigation potential. According to AQUASTAT, the irrigation potential for the country, based on the physical land capability and water availability, is estimated at 93 220 hectares. In 2000, 49 843 hectares of the land was equipped for irrigation, with over 41 500 hectares being used for irrigated sugar cane. Of the total equipped for irrigation, around 48 843 hectares comes from surface water and 1 000 hectares comes from groundwater. In 2002 the harvested irrigated crop area was 45 480 hectares resulting in a cropping intensity of 101 percent (AQUASTAT 2012). More than 84 percent of the irrigated land is found in the Lowveld, with about 15 percent in the Middleveld. In the year 2002 the area actually irrigated was 90 percent of the area equipped for irrigation (44 859 hectares) (AQUASTAT, 2012). Public and private large scale schemes usually extract the irrigation water from reservoirs; while in small scale private schemes, irrigation water is normally abstracted from the rivers using electric pumps (FAO, 2014).

About 10 large irrigation schemes (> 500 hectares) occupy 67 percent of the irrigated land. Medium irrigation schemes (50-500 hectares) and small irrigation schemes (< 50 ha) occupy 20 percent and 13 percent of the land respectively (AQUASTAT, 2005). Large schemes are dominant in TDL, while small schemes are dominant in SNL. In the latter, there are several micro-irrigation schemes which are communal projects funded by several NGOs and IFAD through the Swaziland Ministry of Agriculture and Cooperatives. These schemes occupy about 1 500 hectares of land scattered around the country (AQUASTAT, 2005).

About 52 percent of the land is under surface irrigation, followed by overhead irrigation (drag lines, fixed sprinklers, center pivots, etc.) on 42 percent of the area. The remaining 6 percent of the area is under localized irrigation (Regional Report, 2005).

Irrigation is the major user of water in the country accounting for 96.6 percent of water withdrawal. And the crops that are grown are sugarcane, citrus fruits, pineapples, vegetables and cotton (NDS, 2014). The dominant irrigated crop is sugar cane which covers over 91 percent of the harvested irrigated cropped area followed by citrus at approximately 6 percent (AQUASTAT, 2012). Smaller areas are covered by vegetables, maize, potatoes, rice and bananas. Temporary crops are irrigated only during dry summer, from April to August (AQUASTAT, 2005).

Most of the irrigation activities are located in the Lowveld, which is the dryer part of the country, with low levels of annual rainfall rendering it more prone to droughts. Swaziland areas are categorized into three drought risk zones namely little/none, moderate and severe. The northwest Highveld region is in the little/none drought risk zone, with the highest amount of rainfall (1200–1500 mm). The south west Highveld, Middleveld and Lubombo regions are in the moderate drought risk zone with annual rainfall values ranging from 700 to 1 200 mm. The Lowveld region is in the severe drought risk zone with annual rainfall ranging from 500 to 700 mm (MTEA, 2011).

Several irrigation and water resources development programmes exist in Swaziland. Relative improvements in large and medium-sized dam construction for enhancing agricultural production have been made. For instance, the development of Maguga and Lubovane dams under the Komati Basin

Water Authority Lower Usuthu Smallholder Irrigation Projects (KOBWA LUSIP) respectively has increased the areas under cultivation especially for sugar cane production (NDS, 2014).

Food security

According to the Comprehensive Agricultural Sector Policy (CASP) (2005), persistent shortages in satisfying domestic food requirements have caused a significant proportion of the population to suffer from under-nutrition, a high death toll in extreme cases, stunted growth among children and an estimated 348 000 people to be vulnerable and food insecure in the country. As of 2005, 12 percent of the population was estimated to be malnourished, and nearly one-third of the population needed food aid to survive (CASP, 2005).

According to FAOSTAT (2014), Swaziland has not made appreciable progress in reducing the levels of undernourishment. The share of undernourished in the total population increased from 16 percent in the period 1991-93 to around 34 percent in 2010-12. However, the percent of children under five suffering from malnutrition fell from 36 percent in 2000 to 31 percent in 2010 (FAOSTAT, 2014).

In order for the country to be food secured by 2022, the government has indicated its commitment to continually build the capacity of the farmers to increase yields of food crops. Specifically the government plans to increase maize production to 140 000 ton by 2018 and to 160 000 ton by 2022, which represent a 60 percent increase on present levels (MGPA, 2013 – 2018).

Food self sufficiency

Since 1980 Swaziland has not been self-sufficient in its maize production (Figure 2). In the 1990s Swaziland produced about 60 percent of its own staple food (maize) requirements, but since 2001 production has fallen under 40 percent (Table 2). The shortfall to cover consumption needs has always been satisfied by commercial imports and food aid. Table 2 shows the maize production and imports for the seasons from 2000/01 to 2010/11. In 2007/08, 650 000 beneficiaries received emergency food relief under free food distribution (NDS, 2014). The serious gap in supply of maize has contributed to a 45 percent food price increase since 1998, which has further eroded the purchasing power of poor households, and reduced their access to food (CASP, 2005).

As mentioned before, the largely subsistence-based agricultural sector in the country has failed to keep up with rapid population growth, making Swaziland a net food and agricultural commodities importer. The value of agricultural imports in 2011 was US$234 million which had a slight increase from 2010 for a value of US$223 million. The value of agricultural exports in 2011 was US$277 million, an increase from US$245 million in 2010 (FAOSTAT, 2014). Thus, the agricultural sector of Swaziland has not recorded much growth, the average growth rate from 2005-2011 is 1.31 percent (World Bank, 2012). Figure 3 shows how Swaziland's import bill for agricultural products has been on the rise ever since the late 1980s. It grew from US$42 million in 1986 to almost US$234 million in 2011. The sharpest increase was in 2004, when the bill almost doubled. The main imported products (in value) for the period 2007-2011 were maize, wheat, food wastes and food prep nes (processed agricultural products) (FAOSTAT, 2014).

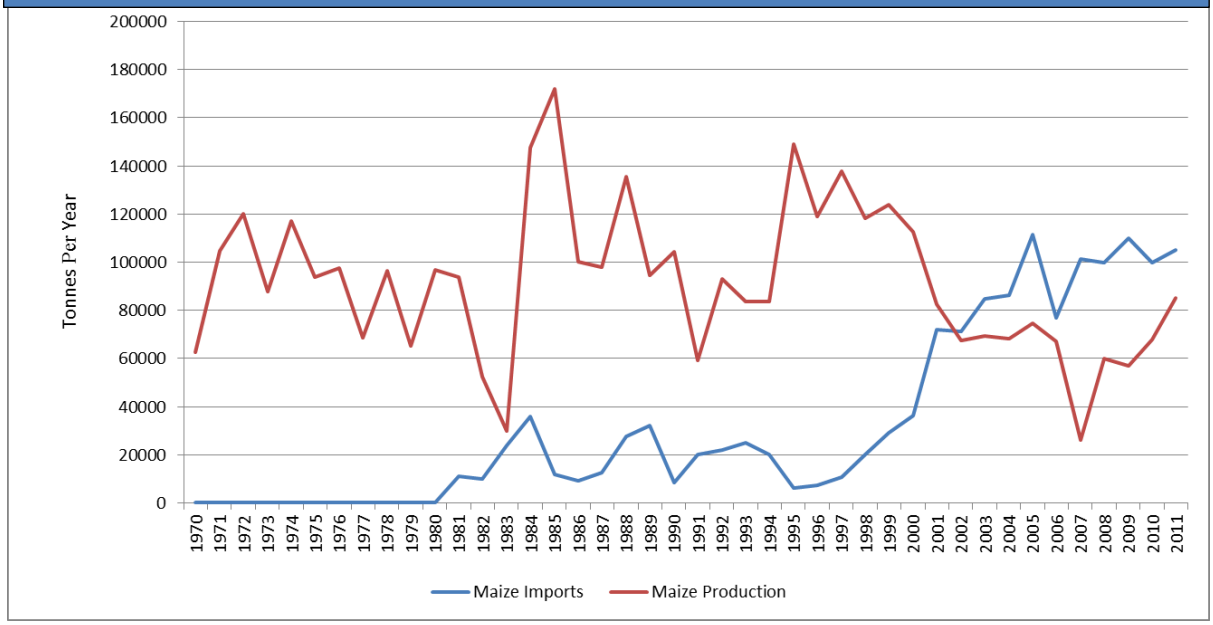
As for exports, there has also been an increase from the late 1980s, but at a much slower pace than imports. The export earnings for agriculture went up from US$100 million in 1986 to around US$277 million in 2011. Main exported products (in value) for the period 2007-2011 were sugar, edible concentrate, wood pulp and citrus fruits.

Table 2: Maize production and imports for years from 2001 to 2011 in Swaziland

Year	Production (1 000 tonnes)	Imports (1 000 tonnes)	Total Consumption (1 000 tonnes)	Imports as percentage of total consumption (percent)
2001	82 536	72 124	154 660	47
2002	67 639	71 327	138 966	51
2003	69 273	84 775	154 048	55
2004	68 087	86 200	154 287	56
2005	74 540	111 600	186 140	60
2006	67 127	76888	144015	53
2007	26 170	101494	127 664	79
2008	60 012	100000	160012	62
2009	57 007	110000	167007	66
2010	68 000	100000	168000	60
2011	85 000	105000	190000	55

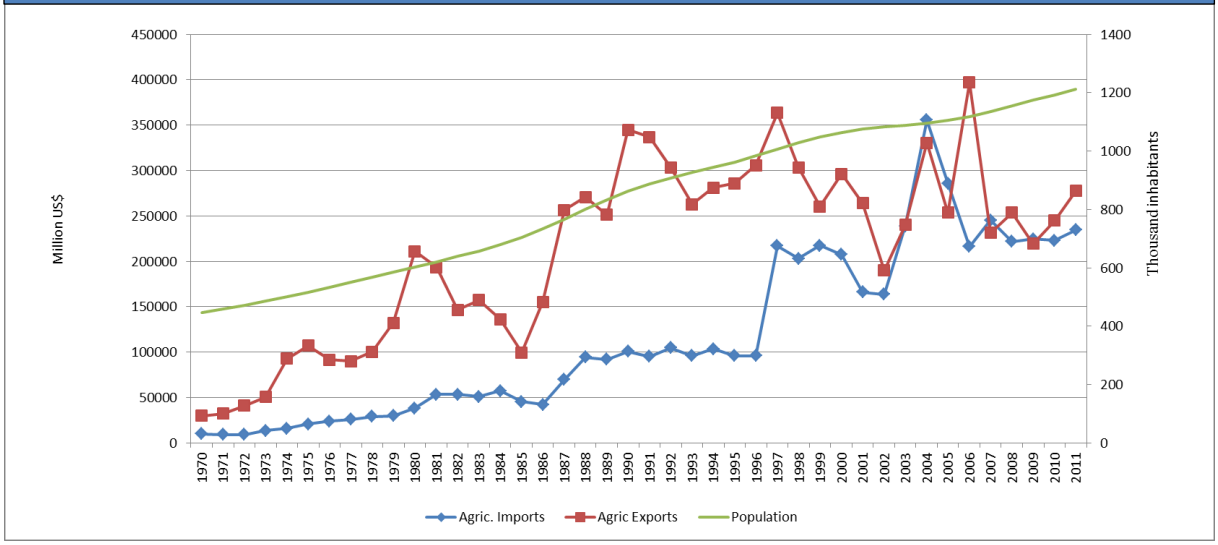
Source: FAOSTAT 2014

Figure 2: Maize Production and Imports in Swaziland 1970-2011



Own elaboration using FAOSTAT 2014 data

Figure 3: Trade in agricultural products in value 1970-2011



Own elaboration using FAOSTAT 2014 data

1.2 WATER RESOURCES AND HYDROPOWER

Swaziland is well endowed with surface water resources, but has limited groundwater resources. Swaziland has 7 river basins (Figure 4). All except Komati, Usutu and Lomati originate from Swaziland. Development of the water resources from the three rivers (Komati, Usutu and Lomati) is subject to Southern African Development Community (SADC) protocols on shared water courses.

Swaziland's total annual renewable water resources are estimated at 4.51 km^3. Annual internally renewable water resources amount to 2.64 km^3 made up of 2.64 km^3 surface water and 0.66 km^3 groundwater, while 0.66 km^3 of the former is assumed to be an overlap between surface water and groundwater. External water resources are estimated at 1.87 km^3 /year originating from surface water from South Africa. The total renewable water resources of the country are estimated at 4.5 km^3/year, with 42 percent originating from South Africa. The five main river systems in the country are the Komati, the Lomati, the Mbuluzi, the Usutu and the Ngwavuma. The sixth river system contributing to surface water in Swaziland is the Pongola River, which is found on the South African side, south of Swaziland. The Jozini dam built on the South African side, floods some land on the Swaziland side and its water is available for use in Swaziland. Swaziland has nine major dams, of which seven are used for irrigation purposes, one for hydroelectric purposes and one for water supply. The total dam storage capacity as of 2010 is estimated at 585 million m^3 (AQUASTAT, 2014).

According to AQUASTAT, the total annual water withdrawal was estimated at 1.042 km^3 for the year 2000. Irrigation was the main water user with 0.993 km^3 (95.3 percent), followed by municipalities with 0.024 km^3 (2.3 percent), livestock with 0.013 km^3 (1.2 percent) and industry with 0.012 km^3 (1.15 percent) (AQUASTAT, 2014). According to Regional Report (2005), 95 percent of the water resources in the country were used for irrigation.

The bulk of the groundwater resources occurs in the Highveld and Middleveld regions. With the exception of the post-Karoo igneous intrusive formation and the recent thin alluvia along the major river valleys, the strongly consolidated rocks of the Archean Basement Complex and the Karoo system underlie practically all of Swaziland and limit the groundwater development potential of the country (Regional Report 2005).

There are over 2 000 boreholes in the country, with over 1 340 boreholes in the Swaziland portion of the Maputo River basin only. It is estimated that groundwater recharge rates in Swaziland range between 2 percent and 10 percent of average annual rainfall (Regional Report, 2005).

Regarding energy resources, the river network of the country offers considerable potential for developing hydropower, particularly for mini and micro plants that utilize run-of-river flows. This potential is, however, dependent on the country receiving good amounts of rainfall, which is not easy to guarantee in view of the impact of climate change on the water resources of the country (Matondo and Msibi, 2002).

Swaziland's main electricity production is by hydro generation with a production capacity of 70.1 MW. Swaziland produces hydroelectric power through four hydroelectric schemes, contributing to about 23 percent of energy supply in the country (NDS, 2014). Swaziland also has considerable amount of potential for expanding its electricity generation through harnessing hydropower. Not only is there new untapped capacity in a form of mini and micro hydropower plants, but there is also potential to expand existing capacity (Mwendera, 2006).

Hydropower is the major source (more than 90 percent) of nationally produced electricity with installed capacity. The Swaziland Electricity Company has conducted several studies for expanding the

hydropower capacity. Two possible sites (Lower Maguduza, Ngwempisi) with a capacity of 20 MW and one on the Ngwempisi River with a potential 120 MW) have been earmarked (NDS, 2014).

Due to limited capacity to generate hydropower, the Swaziland Electricity Board (SEB) imported most of the electricity from the Electricity Supply Commission (ESKOM) in South Africa. In 2013, the imported power was about 77 percent of the total electricity consumed in Swaziland (SEC, 2013). While the future of locally generated hydropower is limited by dwindling water flows, the capacity to generate more power can be increased by constructing additional dams (Mwendera, 2006).

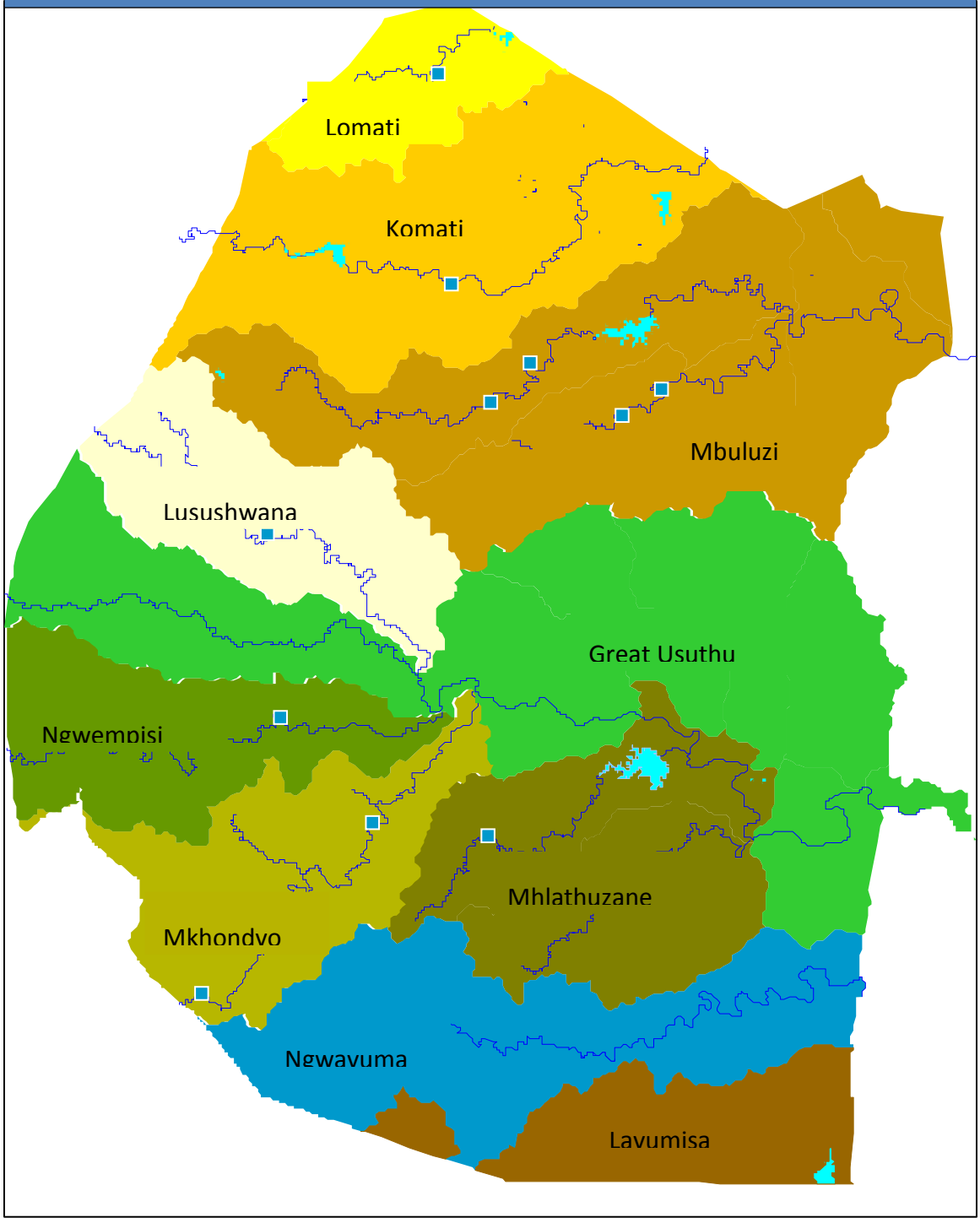
In order to facilitate the development of water resources of common interest, in 1992 the governments of Swaziland and South Africa signed a treaty for the establishment and functioning of the Joint Water Commission. The Commission advises the two countries on all technical matters relating to the allocation, development and control of water resources of common interest (AQUASTAT, 2005).

Another international body is the Komati Basin Water Authority (KOBWA) formed in 1993 by the two governments to implement Phase 1 of the Komati River Basin Development Project comprising the design, construction and maintenance of Driekoppes Dam in South Africa and the Maguga Dam in Swaziland (AQUASTAT, 2005).

A Tripartite Technical Committee (TCTP), established under the Tripartite Agreements between Swaziland, South Africa and Mozambique, is responsible inter alia for the identification and prioritization of capacity-building challenges and opportunities in the water sectors of the three parties and the establishment of regime allocations (AQUASTAT, 2005).

The member states of the Southern African Development Community (SADC) signed a protocol on shared watercourses (Protocol on Shared Watercourses in SADC, 2000). The overall objectives of the protocol are to foster closer cooperation for judicious, sustainable and coordinated management, protection and utilization of shared watercourses and to advance the SADC agenda of regional integration and poverty alleviation (AQUASTAT, 2005).

Figure 4: Main river basins with potential dam sites (blue boxes) in Swaziland



Source: Mwendera, 2006

1.3 CLIMATE CHANGE

Swaziland has a subtropical climate with wet hot summers. Approximately 75 percent of the annual rainfall occurs in the period from October to March (Regional report, 2005) and cold dry winters (April-September). The climatic conditions range from sub-humid and temperate in the Highveld to semi-arid and warm in the Lowveld. The climate of Swaziland is generally temperate in the western parts of the country and subtropical in the eastern regions. The country experiences four distinct seasons (NDS, 2014).

Swaziland lies at the transition of major climatic zones, being influenced by air masses from different origins: equatorial convergence zone (summer rains), subtropical eastern continental moist maritime (onshore flow with occasional cyclones), dry continental tropical and marine west Mediterranean (winter rains, with rare snow) (NDS, 2014).

Mean annual rainfall ranges from about 1 500 mm in the northern Highveld to 500 mm in the southern Lowveld (MoTEA, 2011). Precipitation varies considerably from year to year, which either may lead to periods of flash flooding or drought. Drought is an inherent feature of the current semi-arid climate (Ministry of Tourism and Environmental Affairs, 2011).

The mean annual temperature varies from 16°C in the Highveld to 22°C in the Lowveld. The climatic pattern, especially rainfall, has become very unpredictable and erratic with annual fluctuations and variability in rainfall amounts and distribution attributed to the influence of climate change. Impacts of climate change and especially the persistent drought and high temperature have affected agricultural productivity adversely. The result is chronic food shortages with many households depending on food aid (UNDP, 2010).

In Swaziland's First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) (Ministry of Public Works and Transport), the expected climate changes were analysed for the period 1961-2075. The main findings are as summarized below:

1. Temperature increases in future years with varying magnitudes;
2. Precipitation projections on the other hand give mixed results;
3. As most of the country's annual rainfall is received over the summer period, an increase in precipitation over this period is likely to result in flooding conditions;
4. The projections of winter rainfall reduction also pose the problem of higher possibilities of drought occurrences.

Agriculture, being predominantly rain-fed, is very vulnerable to climate change. The general observation was that for the maize crop, most of the country could be unsuitable for its growth since yields are estimated to decrease considerably. In the other regions yields could be improved by changing the planting season from the traditional second week of October to the second week of August. For sorghum and beans, yields are also projected to decrease in general with the exception of the western parts where these are currently not grown extensively.

The First National Communication of Swaziland to the UNFCCC proposes measures centred in the energy and forestry sectors to adapt and cope with climate change. These include i) the use of high-pressure steam turbines burning bagasse and wood-pulp residue as input fuel in electricity generation, ii) use of energy efficient boilers, and electric motors, iii) matching electric supply to demand, iv) Improved maintenance and inspection of motor vehicles and v) gasoline/ethanol blending among other measures.

In Swaziland's Second National Communication to the UNFCCC the expected climate changes are analysed for the periods 2046 – 2065 and 2081 - 2100. The results showed:

1. A significant increase in the observed annual mean temperature. Temperatures would continue to rise with the latter period having a relatively higher rate of warming than the former;
2. Trends in rainfall indices were much more heterogeneous than those for temperature, whilst there were statistically significant increases in some intensity related indices at specific locations and for specific periods (Second National Communication to UNFCCC 2011).

In Swaziland, climate change is expected to affect production of crops differently depending on the crop type, the agro-ecological zone and the planting time period for the particular crop. For example, maize yields are most likely to be high when planted in the first week of December rather than when planted in mid-October when there is enough rain. Increased maize yields are most likely from the Middleveld than in any other region (Second National Communication to UNFCCC, 2011).

The Second National Communication of Swaziland to the UNFCCC proposes the following measures to adapt and cope with climate change: i) shifting planting periods, ii) growing of drought tolerant crops, and iii) raising suitable crops in appropriate regions.

Since the publication of its First National Communication, Swaziland has undertaken a number of activities that can broadly be presented as addressing the needs of climate change and these include: the establishment of a National Climate Change Committee (NCCC) and a Designated National Authority (DNA) to handle and manage Clean Development Mechanism (CDM) project applications and processes, and conducting various programmes on public awareness at grassroots level.

Besides establishment of the NCCC and DNA, Swaziland is working toward developing a climate change strategy and action plan with financial support from the UNDP Country Office.

One notable activity related to technology transfer was the undertaking of a Technology Needs Assessment (TNA) in 2010. The objective of this exercise was to identify and evaluate climate change mitigation and adaptation technologies and measures that are in line with national development priorities in Swaziland (MoTEA, 2011).

In September 2010, the Ministry of Tourism and Environmental Affairs established a multi-sectorial NCCC comprised of various Swaziland government Ministries. The NCCC is responsible for developing and coordinating programmes and projects aimed at addressing climate change in line with the country's development priorities (Ministry of Tourism and Environmental Affairs, 2011).

2 NATIONAL STRATEGIES FOR WATER, AGRICULTURE AND ENERGY

This chapter will discuss the national strategies for water, agriculture and energy divided over four categories: overall development strategies, agriculture and irrigation, water resources and energy and hydropower.

Overall development strategies

Swaziland's overall development agenda is guided by its National Vision 2022 that was launched in 1997. Vision 2022 aims to build a truly Twenty-First Century Kingdom of Swaziland, culturally united, integrated and stable, economically prosperous and socially well organised with equal opportunities for all, irrespective of gender, and responsibility from all. Vision 2022 has been incorporated into the national development planning process through the development of the National Development Strategy (NDS). The goal of the NDS is that by the year 2022, the Kingdom of Swaziland will be in the top ten percent of the medium human development group of countries founded on sustainable economic development, social justice and political stability (Dlamini, 2010).

The NDS guides the long-term socio-economic development of the country and gives direction for the development of key economic sectors including agriculture. The NDS highlights the need of raising the capability of the agricultural sector to generate a higher volume of goods and services for given factors of production, without destroying the environment. It emphasizes the importance of food security at the household and community levels, commercialisation of agriculture on SNL, efficient water resource management and usage, and rational land allocation and utilization (CASP, 2005).

In pursuit of achieving the vision and mission of the NDS, the Government formulated the Poverty Reduction Strategy and Action Programme (PRSAP) in 2006. The goal of the PRSAP is to reduce poverty by more than 50 percent in 2015, currently at 63 percent of the total population (World Bank, 2014), and absolutely eradicate it by 2022. It is a critical component for operationalising the NDS and achieving this vision. It is the overarching framework for addressing poverty and challenges related to poverty.

The PRSAP is composed of six pillars, where agricultural development mainly falls in pillar number three: "*Empowering the Poor to Generate Income and Reduce Inequalities"*. However, across all the pillars, strategies for addressing agricultural development still appear because agriculture has been identified as a key driver for poverty reduction (NDS, 2014). The vision of the updated NDS proclaims the following:

"By the Year 2022 the Kingdom of Swaziland will have attained a level of development akin to that of developed countries while ensuring, that all citizens are able to sustainably pursue their life goals, enjoy lives of value and dignity in a safe and secure environment in line with the objectives of Sustainable Development."

The vision attaches a high premium on improving the quality of life and prosperity for all individual citizens in the country and proclaims that from the year 2014, the Kingdom of Swaziland will improve its world standing in terms of measurable indices of sustainable human development considerably.

Underpinning the vision is the need to fast track the growth of the economy and transform Swaziland from its current limited agricultural and manufacturing base to a higher state of industrialization which will ultimately pave the way for an advanced information-based society and knowledge-based economy.

The attainment of this vision hinges on four thematic areas namely i) good governance, ii) a vibrant and diverse economy, iii) environmental sustainability and iv) highest human capital and social development (NDS 2014). Above all, every citizen is expected to contribute towards the attainment of the strategic goals of the vision. By its very nature, this vision is quantifiable and can be measured on the basis of objective criteria. Some of its dimensions are reflected in the Human Development Index (HDI) and Swazi Development Index (SDI).

Agriculture and irrigation

The NDS gives directions for the development of various economic sectors including agriculture. To drive the agricultural development programme, the Government formulated the Comprehensive Agriculture Sector Policy (CASP), which is currently the guide for all agricultural programmes. The CASP goal and objectives have been formulated in accordance with the national aspirations as stated in the Vision 2022 and the NDS. CASP aims to focus on the contribution of the agriculture sector to the realization of the Vision 2022 and to the achievement of national development goals of the NDS. The goal of CASP is, therefore, to ensure that the agriculture sector contributes fully to the socio-economic development of the country. The broad objective is to provide clear guidance on policy options and measures necessary to enhance sustainable agriculture sector development and its contribution to overall economic growth, poverty alleviation, food security and sustainable natural resources management. The following specific objectives are set to be pursued by CASP:

- Increase agricultural output and productivity;
- Increase the earnings for those engaged in agriculture by promoting adoption of diversification and sustainable intensification and use of appropriate technology;
- Enhance food security;
- Ensure sustainable use and management of land and water resources;
- Stabilize agricultural markets.

As a sign of commitment to agricultural development, the Government of the Kingdom of Swaziland hosted a summit in July 2007, where various Heads of State and stakeholders were present. After deliberations in this Summit, a resolution was made, and all stakeholders agreed that agriculture is the backbone of the economy. The Summit resolved to transform the agriculture sector through farmer empowerment. To speed up implementation of these policy initiatives, in 2008 a five-year Government Action Plan was produced. Food security became one of the priorities along with health services (CAADP, 2010).

The Government agenda for ensuring agricultural growth, poverty reduction and food and nutrition security is guided by the following development policies and strategies i) NDS (Vision 2022), PRSAP 2006, CASP 2005, National Food Security Policy (2005), National Agriculture Summit Report (2007),

National Program for Food Security , Sectorial Development Plan for Agriculture (2008/09-2010/11). The overall objective of the agricultural sector as outlined in the CASP is to facilitate and support the development of a sustainable and competitive agricultural sector that ensures food security at national and household levels and maximizes the sector's contribution to the GDP.

The overall goal of the 2005 National Irrigation Policy is to ensure that the irrigated agriculture sub-sector in Swaziland contributes fully to economic growth and poverty alleviation in accordance with national development goals, the Water Act of 2003 and the need to use the country's resources in a sustainable manner. The Policy has three specific objectives: optimize the productivity of water in the country's agricultural sector and broaden the scope for agricultural intensification and diversification; establish an irrigation sector institutional landscape characterised by transparent regulation and strong, participatory and/or responsive and accountable institutions in Swaziland and ; enhance the structure of the irrigated sub-sector by promoting new public and private investment opportunities for emerging farmers (Dlamini, 2010). The policy covers areas such as water productivity in agriculture, soil erosion, exploitation of wetlands, control of alien invasive plant species, efficiency of irrigation systems, construction of irrigation infrastructure including dam construction and water allocation issues as well as the active participation of youth and women in irrigated agriculture. This Water Act of 2003 was developed to harmonise the management of water resources in the country through the establishment of a National Water Authority and formulation of a Water Resources Master Plan.

According to His Majesty's Government Programme of Action (MGPA) (2013 – 2018), the government plans to increase the area under irrigation by 10 000 hectares by 2018 with an additional increase of 4 000 hectares by 2022 by constructing 25 medium-sized dams and 12 earth dams per year.

The long-term goal of the National Food Security Policy (NFSP) (2005) is to ensure that "All people in Swaziland, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." This goal is based on the four pillars of food security, namely, food availability, access to food, food utilisation and nutritional requirements. It has four specific objectives: i) ensure that a sufficient quantity of food of appropriate quality is available to all people in Swaziland through domestic production and import; ii) ensure that there is access by all individuals in Swaziland to adequate resources (entitlements) to acquire appropriate foods for a nutritious diet; iii) ensure that all individuals in Swaziland reach a state of nutritional wellbeing for which all physiological needs are met and; iv) and ensure that all people in Swaziland have access to adequate food at all times (NFSP, 2005).

At the international level, the Comprehensive Africa Agricultural Development Programme (CAADP) has been endorsed by the African Heads of State and Government as a framework for the restoration of agriculture growth, food security, and rural development in Africa. The CAADP is an initiative of the African Union (AU) within the context of The New Partnership for Africa's Development (NEPAD). The CAADP framework and process is core to efforts being undertaken by African Governments to accelerate economic growth, enhance food and nutrition security and eliminate hunger in the continent. The CAADP framework and process is expected to clarify sector policy, budgetary and investment

commitments. This initiative will help accelerate the county's realisation of its goals and aspirations in the agricultural sector. In Swaziland these goals and aspirations are as stipulated in several national development documents, e.g. NDS, National Agriculture Summit and Agenda for Action (NASAA), PRSAP, and the National Food Security Policy.

CAADP has four pillars which serve as the bases for its implementation: i) Land and water management, ii) Market access, iii) Food supply and hunger, and iv) Agricultural research (CAADP, 2010).

A wide range of programmes; sub-programmes and projects, have been identified by the Swazi government as investment options that can accelerate agriculture development and reduce poverty. These programmes are aligned with the CAADP pillars. The primary CAADP goal is agriculture led development that eliminates hunger, reduces poverty and food insecurity, opening the way for export expansion. To this end, countries are expected to increase agricultural productivity by at least 6 percent per annum and increase public investment in agriculture by up to 10 percent of the national annual budget. In the case of Swaziland, neither the targeted productivity nor the budgetary allocations have thus far been attained (NDS 2014). Chapter three will elaborate on the public investment in irrigation and hydropower projects.

The NDS, CASP, PRSAP, National Water Policy, National Irrigation Policy and the CAADP were the basis for the development of the Swaziland National Investment Plan (SNAIP) (2014). The overall goal of the SNAIP is to increase the contribution of agriculture to economic development, reduce rural poverty and improve food and nutrition security. The development objective of the SNAIP is to achieve six percent agricultural growth, consistent with national objectives for natural resource management, rural poverty reduction and food and nutrition security. The major impact indicators of the SNAIP are closely aligned with continental CAADP initiative and national policies. For example, one of the targets is to achieve an average agriculture annual growth rate of 6 percent, up from the average of 3.6 percent through supporting public expenditure of at least 10 percent of the national budget (SNAIP 2014).

The SNAIP concentrates on five main programmes for investment in the next ten years and embodies the 2022 vision of the NDS. These are interrelated and complementary towards achieving the overall goals and objectives of the plan. The five programmes are: i) Sustainable Natural Resources Management; ii) Improved Access to Markets and Value Chains; iii) Food Supply and Reducing Hunger; iv) Agricultural Research, Training and Extension and; v) Agricultural Knowledge Management. Cross-cutting issues such as climate resilience, involvement of marginalized and vulnerable groups, poverty reduction, and food and nutrition security are mainstreamed across all the programmes. Each programme includes sub-programmes in the form of ongoing projects/programmes and developmental interventions which require new projects and up-scaling in terms of geographical coverage, increased number of beneficiaries and enhanced output.

Programme 1 focuses on sustainable use of natural resources (water, land, and environment). A key element of the SNAIP, consistent with pillar 1 of the CAADP compact, is the management of Swaziland's land and water resources in ways that improve overall productivity in a sustainable manner. This translates into capturing and storing as much rainfall as possible in the soil or in storage structures so

that it can be used efficiently for rain fed and irrigated crops; as well as sustainable management of land resources to maintain and increase their productivity (SNAIP, 2014).

As per programme 1 objectives, water harvesting will be done at different levels starting from the main river basins where the target is to develop one large scale dam (Ethemba) and provide funds for feasibility studies of another large scale dam (Nsilingane). These dams are expected to provide sufficient water to irrigate up to 10 000 hectares and provide water for electricity generation and domestic and industrial uses. The next level is the construction of 15 medium scale dams with a combined capacity to irrigate more than 750 hectares of non-sugar crops[2] and 45 small scale earth dams to provide drinking water for livestock in the dry regions of the country as well as downstream water for irrigated gardening for income generation and household food security. In addition, the construction and rehabilitation of irrigation schemes to provide land equipped with irrigation infrastructure in excess of 1 000 hectares is planned. This is expected to benefit 1 000 households directly (SNAIP, 2014).

Improvement of land use planning and environmental management at local level will be done through developing and up-scaling the concept of chiefdom development planning (targeting a total of 30 chiefdoms within ten years of the plan). Land rehabilitation and environmental conservation are included as specific components of the programme, including development of fisheries, forestry and improving rangeland management and control of alien invasive species (SNAIP, 2014).

Water resources

A National Water Policy was promulgated in 2009 after the incorporation of inputs from stakeholders in the water sector. The policy promotes sustainable water development and management in the interest of the entire country and region without abdicating state integrity and responsibility towards neighboring countries. It provides guidance to stakeholders in the water sector regarding integrated planning, development and management of water resources, with particular emphasis on the role and responsibility of stakeholders. It also seeks to ensure equitable access to water resources by all sectors of society without prejudicing existing users.

The Draft National Water Policy (2009) also acknowledges the need for water conservation in relation to irrigation. One of the strategies for water conservation in irrigated agriculture is to promote the use of efficient irrigation systems, re-use of water and the construction of water storage facilities for irrigation purposes.

The Integrated Water Resources Master Plan (IWRMP) was developed in line with the Constitution declarations, Government Vision and other national documents such as NDS. The plan is to provide strategic guidance to decision and policy makers, water managers and water users on how best to develop and manage the country's water resources (Swaziland Government 2011).

The establishment of a National Water Authority, through the Water Act of 2003, is responsible for overseeing all water resources development and management issues in the country.

[2] Includes fruit trees, beans, vegetables and bananas

Energy and hydropower

The National Energy Policy (NEP) was promulgated in 2003. Its overall goal is to ensure that the development goals of the country are met through the sustainable supply and use of energy for the benefit of all the citizens of the country through five specific objectives: i) ensure access to energy for all; ii) enhance employment creation; iii) ensure security of energy supply; iv) stimulate economic growth and development and; v) ensure environmental and health sustainability. Swaziland has several renewable energy resources including biomass, solar energy, and hydro energy. The two main renewable sources of energy in Swaziland are biomass and hydroelectric power (NDS, 2014).

Regarding hydropower, Swaziland's main electricity production is by hydroelectricity with a production capacity of 60.4 MW. Swaziland produces hydroelectric power through four hydroelectric schemes, contributing to about 15-17 (Swaziland Electricity Company, 2014) percent of energy supply in the country. The Swaziland Electricity Company has conducted several studies for expanding the hydropower capacity. Two possible sites (Lower Maguduza with a capacity of 20 MW and one on the Ngwempisi River with a potential 120 MW) have been earmarked (NDS, 2014).

The major demand sectors for electricity in Swaziland are agriculture, industrial, commercial and domestic sectors reaching a maximum demand of 200 MW in 2011 (SEC, 2011). Notwithstanding, the current domestic energy generation capacity is very low and Swaziland depends highly on imported energy sources. In 2013, 821.9 GWh of electricity was imported and about 239.8 GWh was generated locally (SEC, 2013).

In order to increase the country's energy security, the central focus of the renewed strategy will be to develop domestic power generation capacity while at the same time using imported energy until self-sufficiency is attained. (NDS, 2014).

The Ministry of Natural Resources and Energy (MNRE) developed a Renewable Energy Action Plan in 1997 as a long-term programme for the development of renewable energy. A number of activities in the plan have already been undertaken but there are still activities requiring attention.

The vision of the MNRE is to create a conducive environment that promotes the efficient and effective utilization, beneficiation and management of natural resources in order to enhance sustainable socio-economic development**.** In pursuit of this vision, the MNRE formulated the 2014-2018 strategic plan as a vehicle for its effective implementation.

The MNRE's Strategic Plan for 2014-2018 is a composite document that will help improve the internal general program coordination and builds from the momentum of the Strategic Plan 2009-2011. The strategy is further informed by the imperatives of the Government Plan of Action for 2022. It seeks to position the MNRE to meet its obligations in respect to the Investor Roadmap, the Program of Action for Vision 2022, the NDS and the Millennium Development Goals (MDGs).

In view of the macro-environmental challenges that were confronted by the Ministry during the 2009-2011 period, some of the critical deliverables that were not attained in the period 2011-2013 have been incorporated into the strategic plan for 2014-2018. One of strategic objectives of the 2014-2018

strategic plan **is t**o expand local hydropower capacity by 160 MW, that is, to expand local hydropower capacity by 160 MW from 60.4 MW to 220.4 MW by developing Mnjoli Hydro Power Scheme (1.5 MW), Lower Maguduza Hydro Power (10 MW), Ngwempisi Hydropower (100 MW), and Biomass/Bagasse plant (50 MW) (MNRE, 2014). Unfortunately, the financial information of these projects is not available so these projects could not be included in the investment envelope of the next chapter.

In the 2014 updated NDS, numerous strategic objectives have also been suggested to enable the energy sector to fully assume its central role of being a sine qua non for achieving socio-economic development. Some of them are in the areas of: i) research and development, ii) efficiency, and iii) accessibility.

3 INVESTMENT ENVELOPE

The **investment envelope** is a matrix that presents current and planned investment in the development of water resources for agriculture and hydropower production in a given country.

The investment envelope is produced through the application of AgWA's **Financial Diagnostic Tool**. This tool processes project-based information to derive the investment estimates at country level. The fundamental project information to plug in the tool is: project description, project characteristics, funding partners, time-scale, total cost and type of project. The Financial Diagnostic Tool also incorporates a number of variables such as the project cost distribution over time and the relevance of the water component as a percentage of the total cost in order to develop a detailed analysis of investment. A currency conversion application (annual average and projection of growth of foreign exchange rates using exponential regression analyses) is built in this model to present the output in a single currency.

Project types included in the tool are the following:

1. Small scale irrigation development[3]
2. Rehabilitation/modernization of irrigation
3. Large scale irrigation development
4. Small/medium scale hydropower development
5. Rehabilitation of hydropower plants
6. Large scale hydropower development
7. Others (water supply, training, strengthening of institutions, etc.)

This tool also supports conducting **complementary financial analyses** such as investment by type of project, investment by source of funding, investment by timespan of the project,

[3] Small scale: < 500 hectares, large scale: > 500 hectares

hectares to develop or rehabilitate by crop, calculation of the Internal Rate of Return, etc. These complementary financial analyses are presented in Figures 4 to 16.

The investment envelope (Table 2) presents investment estimates according the project characteristics mentioned above and distributed over three time scales: short-term (less than 4 years), medium-term (between 4 and 8 years), and long-term (more than 8 years)[4].

Description of project portfolio

In the case of Swaziland, the investment envelope has been calculated based on 20 on-going projects and 9 pipeline projects (Table 1). The last on-going project is scheduled to be completed in 2018 whereas the last pipeline project is planned to be in full operation at the end of 2025. The on-going projects range from a cost of about US$5 500 to a maximum of US$563 million. The investment cost of pipeline projects range between a minimum of US$510 000 and a maximum of US$201 million. The average investment costs of on-going projects and pipeline projects are respectively US$37 million and US$66 million.

Table 1. Summary statistics of the Projects Portfolio

	On-going	Pipeline
Number of Projects	20	9
Min (million US$)	0.0055	0.51
Max (million US$)	563	201
Average (million US$)	37	66

A closer look at the distribution of costs among on-going projects (Figure 4) shows that only one project involves an investment of more than US$150 million, i.e. US$ 563 million for the Lower Usuth Smallholder Irrigation Project (LUSIP) Phase 1. This project has as main objective to enable smallholder farmers to intensify and diversify their agricultural production building on existing market linkages with the private sector, and aims to develop 3 357 hectares of irrigated land. Four projects (20%) cost between US$563 million and US$5 million with an average of US$182 million. The remaining 80% requires an investment cost between US$5 million and US$5 500 with an average of US$522 500 (Figure 4). Figure 4 thus shows that the project portfolio of on-going projects depends primarily on the four projects with the highest investment cost which add up to a total of US$729 million.

[4] The baseline year considered for the analysis is 2014. Therefore investment in the short-term would be executed from 2014 to the end of 2017, in the medium term, from 2018 to the end of 2021 and in the long term, from 2021 onwards.

Figure 5 displays the distribution of investment costs of the nine pipeline projects that will be implemented in Swaziland. LUSIP Phase 2 requires the highest investment cost of the pipeline projects with US$201 million. Phase 2 of this project aims to foster sustainable improvement in agricultural techniques, leading to a reduction of poverty amongst a population of approx. 10 000 people of the rural poor of Swaziland. The Ethemba Dam Construction project involves an investment of US$200 million and aims to provide 3MW of hydropower electricity and 2 500 hectares of irrigated land. The related Ethemba Downstream Irrigation project costs US$150 million and will deliver 4 500 hectares of irrigated land by the end of 2025. The investment cost of the remaining 67% of the pipeline project portfolio varies from US$15.2 million to US$510,000 with an average of US$8 million. The spread of the distribution of investment cost of the pipeline projects is thus less dispersed than for the on-going projects.

The relevance numbers (relevance of the water component as a percentage of the total investment cost) were not taken into account when analyzing this project cost distribution since all components within infrastructure projects have proven to be interdependent.

Figure 4. Project Cost distribution – On-going Projects

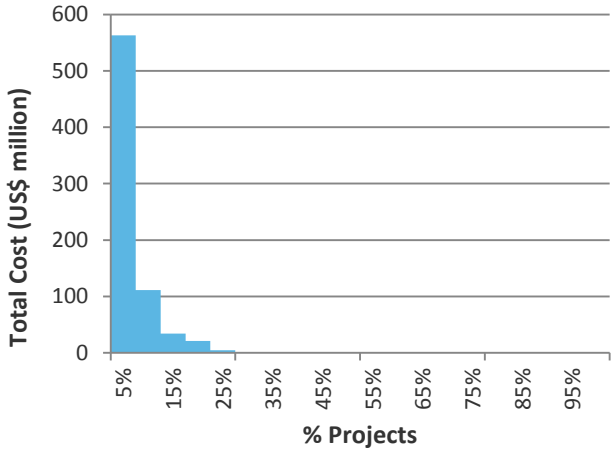
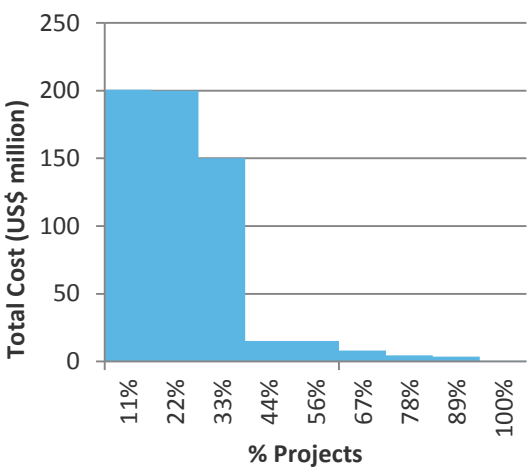


Figure 5. Project Cost distribution – Pipeline Projects



Investment envelope

The total investment envelope of on-going and pipeline projects for Swaziland (Table 2) is estimated at US$665.4 million (18 percent of Swaziland's GDP in 2013, Worldbank) of which US$427.2 million is allocated to the development of small scale irrigation schemes, US$51.2 million to the development of small/medium scale hydropower, US$14.8 million to the rehabilitation/modernization of irrigation schemes, US$2.5 million to the development of large scale irrigation schemes and US$470,000 to the development of large scale hydropower projects. The others category is worth US$169.2 million and is allocated for activities such as training, awareness raising and strengthening of sector institutions. Both LUSIP Phase 1 and

Phase 2 contribute the highest investment cost to the others category with respectively US$44.8 million (out of total cost of US$563 million) and US$48.1 million (out of total cost of US$201 million). No funding is allocated to the rehabilitation of hydropower plants.

The investment envelope only accounts for costs to be invested with reference year 2014; costs for on-going projects that already have been invested before 2014 are therefore not taken into account. Relevance numbers (the relevance of the water component as a percentage of the total cost) have been applied to develop this investment envelope.

Table 2. Total Investment Envelope in US$ million and in percentage (On-going & Pipeline projects)

Time Frame	Short-term		Medium-term		Long-term		**Total**	
Size of project	M US$	%	M US$	%	M US$	%	M US$	%
Small scale irrigation development	301.4	45%	82.7	12%	43.2	6%	427.2	64%
Rehabilitation/ modernization of irrigation schemes	5.4	1%	6.1	1%	3.2	0%	14.8	2%
Large scale irrigation development	2.5	0.4%	0	0%	0	0%	2.5	0.4%
Small/medium scale hydropower	17	3%	22.3	3%	11.9	2%	51.2	8%
Rehabilitation of hydropower plants	0	0%	0	0%	0	0%	0	0%
Large scale hydropower development	0.47	0.1%	0	0%	0	0%	0.47	0.1%
Others	88.6	13%	63.6	10%	16.9	3%	169.2	25%
Total	**415.4**	**62%**	**147.7**	**26%**	**75.3**	**11%**	**665.4**	**100%**

Table 2 shows that the majority of investment (64 percent) in water for agriculture and energy in Swaziland is allocated to the development of small scale irrigation development. The most relevant projects within this small scale irrigation category are LUSIP Phase 2 (US$112 million), LUSIP Phase 1 (US$105 million) and the Ethemba Downstream Irrigation Development project (US$96 million). These projects have in common that they aim to help subsistence farmers to undertake commercial farming in order to improve their livelihoods.

The total amount of funding allocated to irrigation categories is US$444.5 million (67 percent of the envelope) while the total amount of funding allocated to hydropower categories amounts to US$51.7 million (8 percent of the envelope).

Majority of investment (62 percent) will take place in the short-term whereas 26 percent of the total investment will take place in the medium-term and only 11 percent of the total investment is allocated for long-term projects.

Cost distribution

Figures 6 to 8 illustrate the distribution of project costs in time and by type of project for on-going, pipeline and the total of all projects combined. As aforementioned, it can be observed that the majority of investment will be spent in the short-term (Figure 6); none of the on-going projects even have a long-term planning (Figure 7). This trend is observed in many other developing countries and might be a result of the fact that governments tend to plan their budget with a timespan no longer than eight years. The underinvestment in the long-term timescale in this analysis therefore does not by definition reflect reality.

Figure 6. Cost distribution in time per typology – All Projects (US$ million)

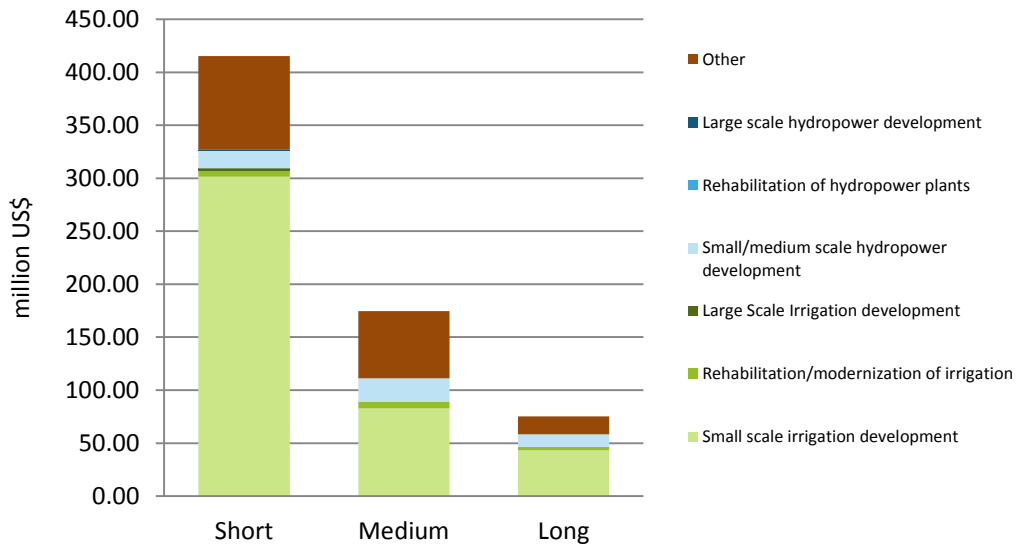


Figure 7 shows an undesirable degree of underinvestment in the medium- and long-term for on-going projects. This negative relation between time and investment (also for all projects combined, see Figure 6) imposes an adverse effect on the sustainability of agricultural and hydropower growth in Swaziland.

The reference year of this analysis is 2014 which means that the investment costs spent before 2014 are not taken into account. This aforementioned underinvestment is thus partially explained by the fact that most on-going projects are nearing its deadlines; the last on-going project is scheduled to be finalized in 2018 and the average deadline of on-going projects is mid-2015. The development of new projects in Swaziland therefore is desirable.

The major pipeline projects (LUSIP Phase 2, Ethemba Dam Construction and Ethemba Downstream Irrigation Development) are all scheduled to start in 2016. The investment gap over time is therefore one year, which is within limits.

Figure 7. Cost distribution in time per typology – On-going Projects (US$ million)

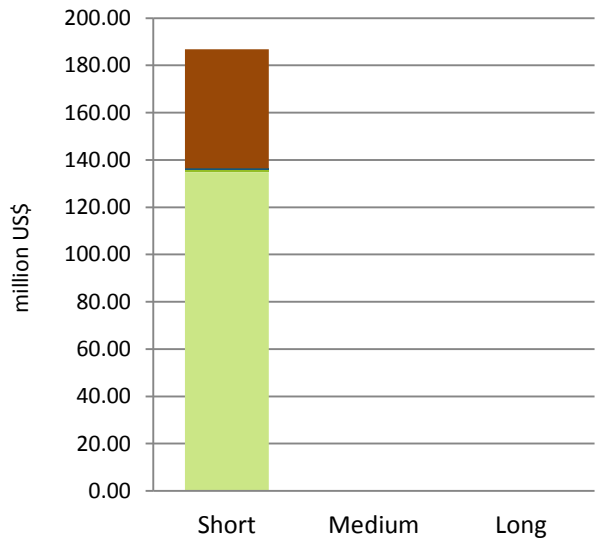
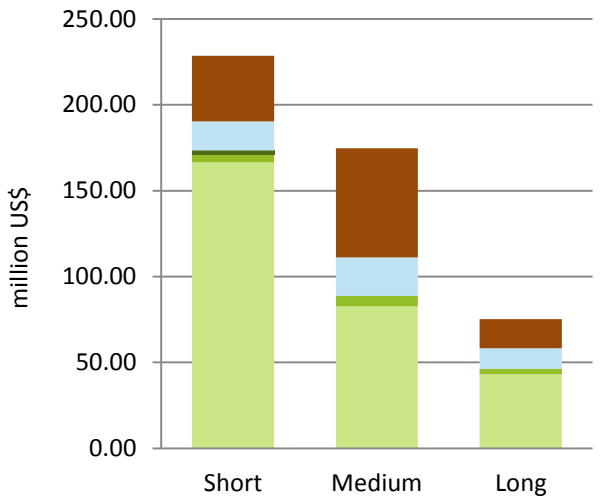


Figure 8. Cost distribution in time per typology – Pipeline Projects (US$ million)



The on-going projects of this envelope account for US$187 million (28 percent of total envelope), while the pipeline projects add up to a total of US$479 million (72 percent of total envelope). The distribution per typology for pipeline projects (Figure 8) stays moderately constant over time.

Figure 9 shows that the investment costs of all projects are focused on small scale irrigation development (64 percent) followed by the others category (26 percent), the small/medium scale hydropower development (8 percent), the rehabilitation/modernization of irrigation (2 percent) and lastly the large scale irrigation development (0.4 percent).

Figures 10 and 11 show that on-going investments are concentrated on the development of small scale irrigation schemes (US$135 million, 72 percent) followed by the others category (US$50 million, 27 percent); while the pipeline projects also show investment allocated to small scale hydropower development (US$51 million, 11percent). This shows that Swaziland is changing its focus from solely irrigation projects to a more diversified project portfolio which also includes hydropower projects. This is a step in the right direction; it is nevertheless highly desirable for Swaziland to focus more on hydropower projects. As stated in chapter 1.2, Swaziland is currently importing 77 percent of the energy consumed in this country. Investing more in small/medium scale hydropower development and the rehabilitation/modernization of hydropower plants will thus foster the independence of the Swaziland's energy market.

Figure 9. Cost share per typology –All Projects (%)

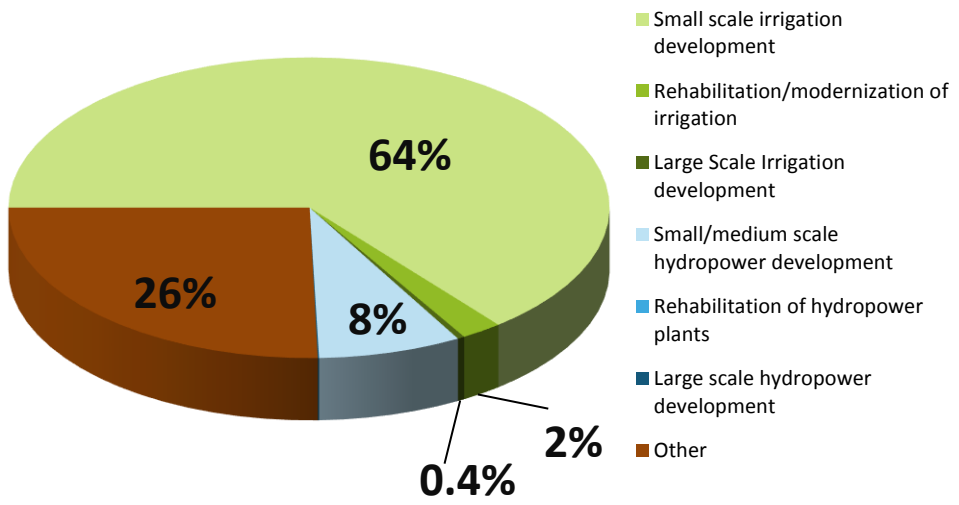


Figure 10. Cost share per typology – On-going Projects (%)

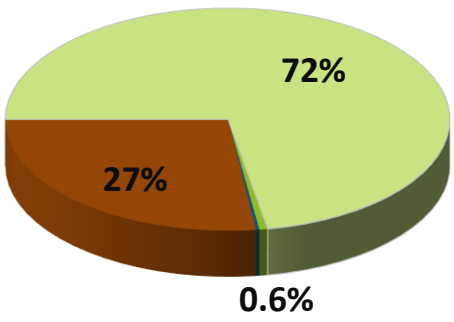
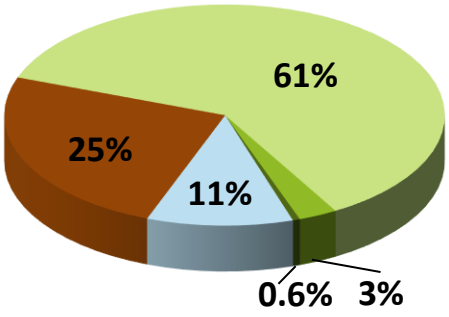


Figure 11.Cost share per typology – Pipeline Projects (%)



Source of funding

The 29 projects in this portfolio are mainly funded by the Government of Swaziland. Figures 12 and 13 show that both the on-going projects and the pipeline projects are primarily funded by the Government of Swaziland (respectively 74percent and 76 percent).

The project portfolio is, besides by the Government of Swaziland, also funded by a number of international donors (10 percent for on-going projects and 24percent for pipeline projects) and private investors (16 percent for on-going projects and 0 percent for pipeline projects). The donors investing in these projects include: the International Fund for Agricultural Development (IFAD), African Development Bank (AfDB), Organization of the Petroleum Exporting Countries (OPEC), Global Environmental Facility (GEF), European Union (EU), World Vision United States of America, World Vision European Union, Common Market for Eastern and Southern Africa (COMESA), USAID and the Finnish Red Cross.

It is worth mentioning that the presence of private donors is always important as a source of financing in order to foster sustainability of funding. A high dependence on public financing entails risks since withdrawal for any reason from financing these projects would mean an almost entire fallback of investment in irrigation and hydropower projects.

Figure 12. Investment cost per source of financing (%)

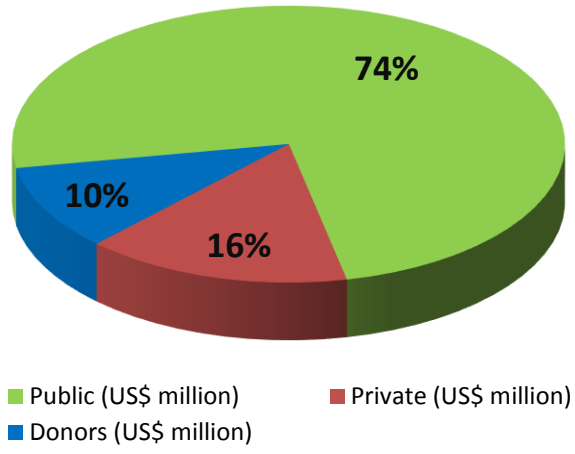
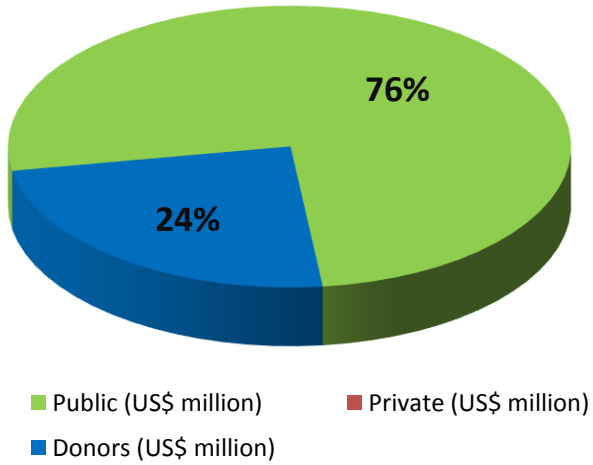


Figure 13. Investment cost per source of financing (%)



Hectares to develop or rehabilitate

The 29 projects of this investment portfolio will bring changes to about 31 697 hectares by 2025 of which 9 938 hectares will be developed or rehabilitated through on-going projects and 21,759 through pipeline projects (Figure 14). Of these projects approximately 23 243 hectares

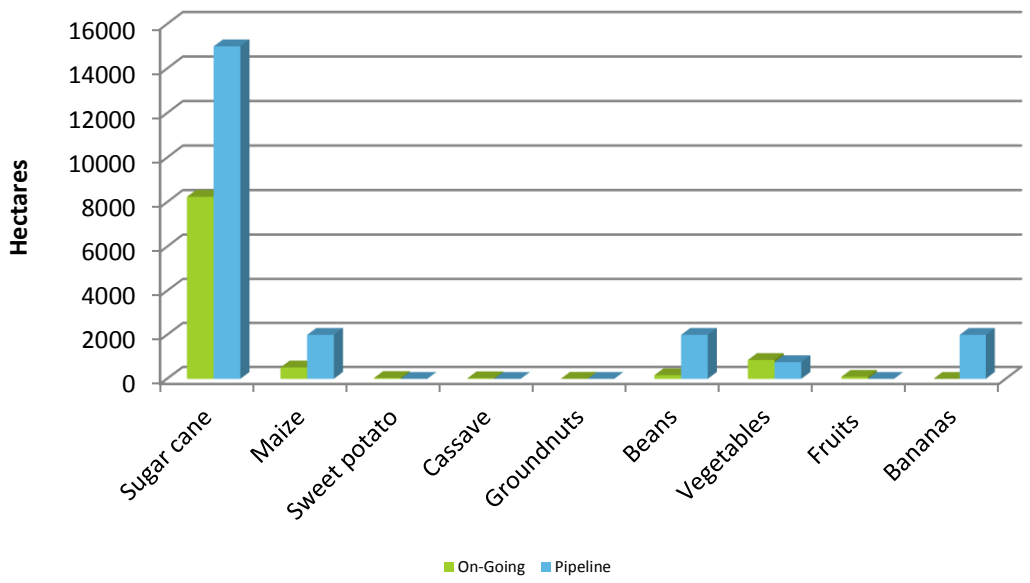
(73.3 percent of total number of hectares to be developed/rehabilitated) will be used for the cultivation of sugarcane; 2 516 hectares (8 percent of total number of hectares to be developed/rehabilitated) will be used for cultivation of maize; 2 165 hectares will be used for the cultivation of beans; 2 000 hectares will be used for the cultivation of bananas and; 1 616 hectares will be allocated to the cultivation of uncategorized vegetables (Figure 14). The remaining 157 hectares will be used for the cultivation of all other crop types displayed in Figure 14 with an average of 20 hectares per crop.

LUSIP Phase II (2015-2022) will develop 11 000 hectares of irrigated land and will be located at the Lubombo region, linking the St. Philips canal from the Main Canal South extending to the Nsoko development area. The Komati Downstream Development Project (KDDP) will generate 5 796 hectares of irrigated land and is located at Tshaneni in the northeast of Swaziland where it drains from the Maguga Dam. Other relevant irrigation projects are the Ethemba Downstream Irrigation development project, the Nsilingane Dam project, LUSIP Phase I and the Ethemba Downstream Irrigation Development project.

Figure 14 shows that the number of hectares to be developed or rehabilitated is too low to foster food security. The focus of the cropping pattern is changing even more from staple crops to cash crops, i.e. from maize to sugar cane. Chapter 1.2 already mentioned that 41 500 hectares of the total irrigated land in Swaziland of 49 843 hectares is allocated for the cultivation of sugar cane while undernourishment in Swaziland was 31 percent in 2010 (FAO, 2010). An increase in the diversity of cropping pattern towards food self-sufficiency is thus favorable for Swaziland.

The vegetables and fruits category of Figure 14 are aggregated categories due to limited data availability. The vegetables category comprises green pepper, potato, cabbage, onion, garlic, green mealies, butternut squash, carrot, beetroot, lettuce, spinach, baby marrow, baby cabbage, baby corn, green beans, cauliflower, baby broccoli, green patty pan, baby gem, mange tout peas, and sugar snap peas. The fruits category includes banana, papaya, mango, peach, plum, nectarine, apple, litchi, granadilla, avocado, tomato and lemon.

Figure 14. Hectares to be developed/rehabilitated per crop



Internal Rate of Return

The Financial Diagnostic tool also allows calculating the Internal Rate of Return (IRR), i.e. the interest rate received for an investment consisting of payments (negative values) and income (positive values) that occur at regular periods. The IRR is closely related to the net present value: the rate of return calculated by IRR is the interest rate corresponding to a zero net present value. The calculation of an IRR evaluates the desirability of a project; in theory, all projects with an IRR that exceeds the cost of capital should be undertaken.

It is assumed that cash flows occur at regular annual intervals. All succeeding payments are discounted based on a 365-day year. An iterative process has been applied for calculating the IRR: starting with a pre-imposed guess, the function cycles through the calculation until the result is accurate within 0.00001 percent. It is also assumed that a project will "lead value" for a defined period (40 years) after the first year of implementation. Such restrictive assumption is dictated by simplicity in calculation and by the fact that detailed information on the life-time of each project was not fully available. Moreover, revenues only occur after the completion of the project and no variation is allowed over the years, as such variation would depend on infrastructural and managerial conditions that are project specific variables and could be generalized in a tool only including stochastic variability (leaving limited data availability out of consideration).

The IRR can be calculated for both agriculture projects, provided that at least the figures for the total areas to be developed are available, and for hydropower projects when the total megawatts to be generated are available. The calculation of the IRR for hydropower projects is

straightforward and univocal, but for agricultural project it strongly depends on the type of crop planted, its yield and the net returns (which can vary significantly each year) that can be derived. Although 9 of the 29 projects reported in the portfolio have not yet entered into operation; for only 1 out of 29 projects the cropping patterns are unknown.

The widely available cropping patterns (known for 28 out of 29 projects) allow this analysis to account for the exact planned hectares and corresponding prices/costs/yields when calculating the IRR. However, since the number of hectares per project ranges from a minimum of 1 hectare to a maximum of 11 000 hectares, it was decided to calculate the IRR in Table 20 using a weighted average with the number of hectares as weighting.

Although a planned cropping pattern is not a guarantee for the future to become reality; the calculation of the IRR assumes that the planned cropping pattern will be adopted.

The results of the analysis, as reported in Table 20, show that agriculture projects yield, on average, a positive IRR. There are no on-going hydropower projects; only one pipeline hydropower project with a negative IRR of -16 percent. This negative IRR is explained by the recent revision of the Ethemba Dam Construction project which changed its focus from merely hydropower (12MW) to a combination of hydropower (3MW) and irrigation (2500 hectares). In the case of agriculture, on-going projects would, on average, yield a positive IRR that ranges between 701 percent and -7 percent (Figure 15) with an average of 86 percent while the pipeline projects appear to perform less profitable, yielding rate of returns between 18 percent and -0.2 percent with an average of 7 percent (Figure 16).

Table 20. Weighted average Internal Rate of return (number of hectares as weight)

	Hydropower	Agriculture
On-going	N/A	21.43%
Pipeline	-16% (only one observation)	24.24%

It can also be noticed that, for on-going projects, half of the projects exhibit an IRR higher than 50 percent (Figure 15), while for the pipeline projects, 60 percent of the projects have an IRR higher than 5 percent (Figure 17). Similarly, looking at the upper queue of the on-going projects distribution, 28 percent of the projects exhibit a very high IRR above 100. The most evident outlier of the on-going projects is the Mdzimba Producers Multi-Purpose Cooperative Society (Ltd) project with an IRR of 701 percent. This small-scale irrigation project generates 270 hectares of irrigated land for 27 farmers and is recognized by a low investment cost (US$ 46 900) which explains the high IRR when calculating the profitability with a time span of 40 years.

Figure 15. IRR - On-going projects

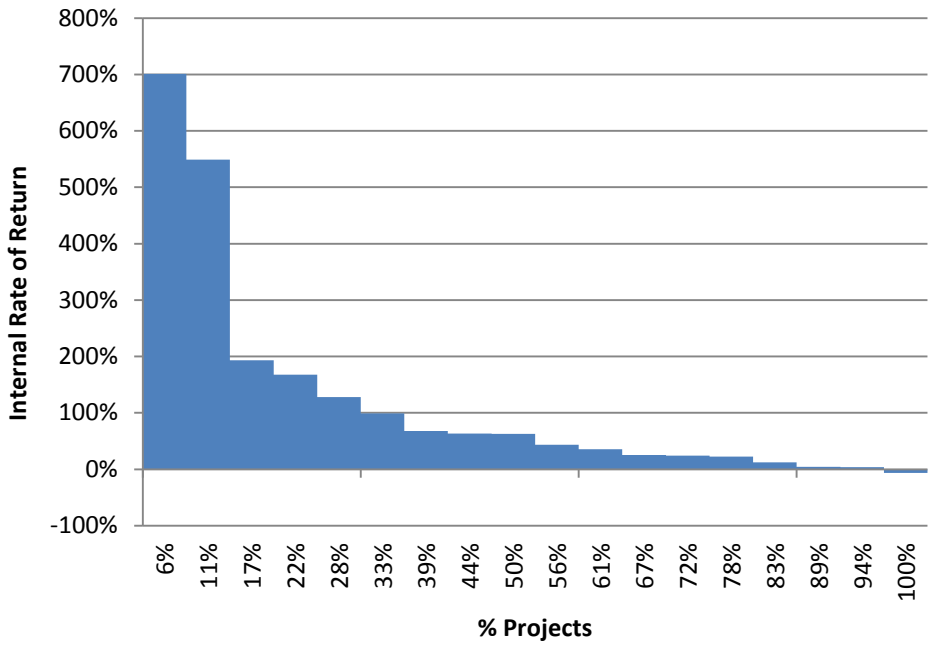
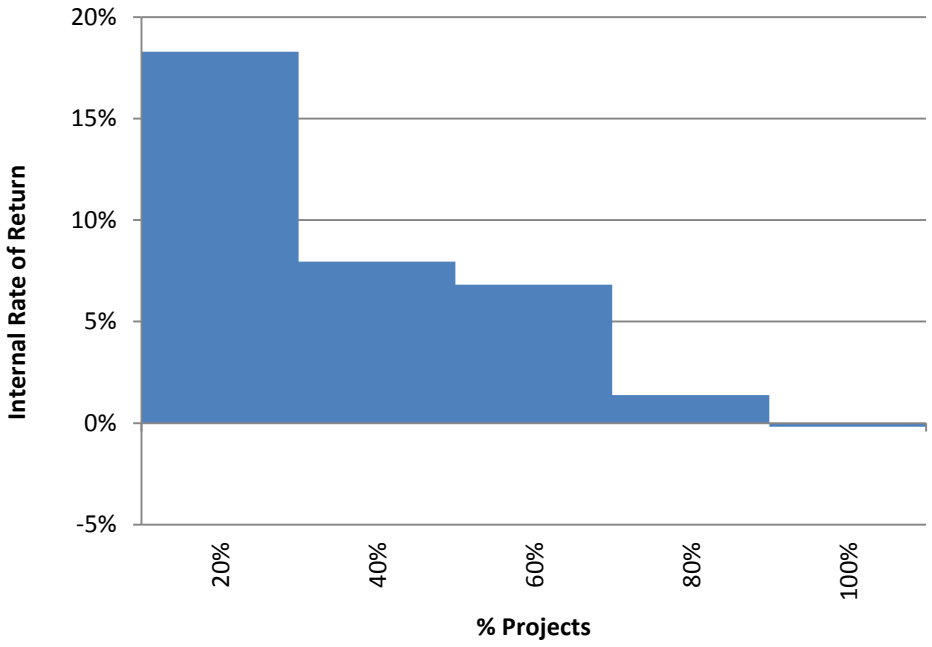


Figure 16. IRR - Pipeline projects



4 CONCLUSIONS

Based on the information and analysis presented in this report, the following can be concluded:

a) The government of Swaziland is planning to invest more in small scale irrigation as opposed to large scale irrigation schemes, with US$427.2 million investment for the former and US$2.5 million for the latter. This is in line with the planned paradigm shift from current dry-land subsistence farming to irrigated, commercial but small scale agriculture adopted by the country. His Majesty's Government Programme of Action (MGPA) (2013 – 2018) plans a broader access to water for irrigation purposes which will benefit agriculture. Approximately 31 697 hectares is expected to be equipped for irrigation in the country by 2025 and thereby transforming the farming systems which are currently predominantly subsistence-based and rain-fed to irrigated, commercial agriculture;

b) The major projects in irrigation and hydropower will take place in the long term (until 2025). This highlights the importance of long-term strategic investment in the country envisaged in NDS, which guides the country's long-term socio-economic development and gives direction for the development of key economic sectors including agriculture. However, the overall level of long term planning is still insufficient, especially for the on-going projects. The pipeline project show a more favourable distribution of investment cost over time scales, which shows that Swaziland is heading the right direction of investment sustainability in irrigation and hydropower projects;

c) Public sources of funding are predominant in the Swaziland investment envelope; the country thus seems to neglect the potential role of the private sector (i.e. small farmers as well as more commercial ones). However, this analysis calculated that the on-going projects on average deliver an IRR of 21.43 percent while the pipeline projects generate an IRR of 24.24 percent, such research might foster the appetite to invest by the private sector;

d) Planned irrigation projects significantly target the cultivation of sugar cane; this has already been Swaziland's aim for the last decades which resulted in 84 percent of currently irrigated land to be allocated for the cultivation of sugar cane (AQAUSTAT, 2012). The cultivation of this cash crop can alleviate poverty and foster trade. On the opposite side, Swaziland only produces around two thirds of its maize requirements and roughly half of its total food staple needs (including rice) because they are mainly produced by the subsistence sub-sector on SNL. This gap in supply of maize production (main staple crop) has already caused a 45 percent food price increase since 1998, which has further eroded the purchasing power of poor households, and reduced their access to food (CASP, 2005). The planned construction of 15 medium scale dams, which are capable of irrigating more than 750 hectares of staple crops, is therefore one step in the right direction but Swaziland's cropping patterns have to be diversified to foster food security and self-sufficiency;

e) Investment/expenditure in operation and maintenance (O&M) of irrigation schemes has not been specified in the list of projects in the portfolio of Swaziland. Nonetheless, it is important that Swaziland takes into consideration the importance of O&M for the correct functioning and performance of irrigation systems;

f) The project portfolio reflects all the pipeline projects proposed under the SNAIP (2015 – 2025) which is expected to initiate implementation in 2015. This means that the country is relatively late in embracing the idea of NAIP compared with countries like Kenya and Nigeria that have both on-going and pipeline projects reflected in their respective NAIP;

g) Irrigation planning is mainly focused on irrigation development, overlooking possible country needs in the rehabilitation and modernization of schemes.

h) During the validation workshop the need for monetary evaluations was discussed. Projects should, after implementation once fully operational, be assessed on profitability.

i) During the validation workshop in Swaziland the government representatives also discussed the need for water accounting and charging. Without water charging there is no need to enhance the water efficiency, especially for sugar cultivation which is water-intensive this would make a difference. A side-effect will be to reduce the monoculture in Swaziland. This will reduce the economic risks for the agricultural sector in Swaziland and will foster an equal distribution of benefits since sugar cultivation is mainly run by five big corporations.

j) Another outcome of the validation workshop is that the lack of medium- and long-term planning in investment does not affect the continuity of investment since most short-term projects are protracted.

ANNEX 1. PROJECT PORTFOLIO

Table 1.1. ON-GOING PROJECTS

#	Project title	Funding Partners	Time Scale	Total Budget (million Currency)	Description
1	Komati Downstream Development Project(KDDP)	Government of Swaziland, AfDB and EU	2002-2015	SZL1012 (US$111)	The KDDP is located at Tshaneni in the north eastern part of the country. It provides water for the irrigation of crops and rearing of livestock for the surrounding communities. The project has developed about 5206 hectares, for sugarcane and other crops production. The source of water is the Maguga Dam. Typology: Small scale irrigation development (70%) and others (30%)
2	Lower Usuthu Smallholder Irrigation Project (LUSIP) Phase 1	Government of Swaziland, IFAD,OPEC and GEF	2004-2016	SZL3472 (US$563)	Located at the Lowveld of Swaziland and areas around Siphofaneni. Known as LUSIP Phase 1, the project aims to reduce poverty levels by transforming the local economy from subsistence farming to sustainable, irrigated, commercial agriculture. This phase of development has been developed to the extent that it delivers water to 3 357 hectares of irrigated land. The source of water is the Lubovane Dam. Typology: Small scale irrigation development (70%) and others (30%)
3	Mdzimba Producers Multi-Purpose Cooperative Society (Ltd)	Government of Swaziland	2014-2015	SZL0.5 (US$0.047)	The project is located in the middle-veld part of the country. It provides irrigation infrastructure to 27 farmers at the Malkerns area for vegetable and livestock production. When completed it will provide water to about 270ha for irrigation. Typology: Small scale irrigation development (65%) and others (35%)

4	Earth Dam Construction Project	Government of Swaziland	2014-2018	SZL1.84 (US$0.17)	This project is located in the low rainfall areas. It targets to provide water for irrigation to about 1 hectare of land for vegetable production once a dam has been constructed. The project set out a target that at least each year, 5 medium sized earth dams should be constructed with one dam irrigating about 1 hectare. Typology: Small scale irrigation development (30%) and others (70%)
5	Climate Smart Agriculture Project	Government of Swaziland and COMESA	2014-2015	SZL4.005 (US$0.38)	This project is located among areas such as Mpatheni Nhletjeni and Nkhungwini that have farming schemes. It was designed to rehabilitate pack and farm houses to upscale vegetable and to convert existing or primitive irrigation system over 52 hectares. Typology: Rehabilitation and modernization of irrigation scheme (47%) and others (53%)
6	Water and Irrigation Development Project at Sigangeni ,Mpuluzi and Gege	Government of Swaziland	2010-2016	SZL147.5 (US$20.9)	This project is an initiative by the government of Swaziland for harnessing water for irrigation development and other farming activities at Sigangeni, Mpuluzi, Gege, Ngcoseni, Maseyisini and Nyamane. This project involves the construction of medium sized earth dams and downstream irrigation development. The main objective of this project is to deliver water for irrigation to about 205 hectares. Typology: Small scale irrigation development (90%) and others (10%)
7	SADP Dam Rehabilitation and SADP DAM Rehabilitation and Construction	European Union	2012-2014	Euro1.1 (US$1.4)	This project involves the rehabilitation of three earth dams and construction of an earth dam, weir and borehole for irrigation development on all sites. This project involves the rehabilitation of three earth dams and construction of an earth dam, weir and borehole for irrigation development on all sites. Typology: Rehabilitation and modernization of irrigation schemes (100%)

8	SADP Food and Nutrition Garden	EU	2013-2014	Euro0.141(US$0.19)	This project assists households with 7m x 7m garden materials including a 5000L water harvest tank for irrigation. This project supports about 800 needy households to provide water for the irrigation of to about 3.92 hectares combined. Typology: Small scale irrigation development (100%)
9	Purchase of Heavy Plant and Earth Dam Construction Equipment	Government of Swaziland and Taiwan	2009-2015	SZL259.6 (US$34)	This project involves the purchase of heavy plant material which is used for the construction of small and medium earth dams for the purpose of irrigation development among local communities in Swaziland. The construction of these dams is located among high to medium rainfall areas in the country. Typology: Small scale irrigation development (100%)
10	Madwaleni Community Irrigation Scheme	World Vision USA and EU	2014-2015	Euro0.0064 (US$0.0078)	This project is located at Maseyisini in the Shiselweni region. The project provides water for irrigation development which is meant for commercial vegetable production. This project is meant to deliver water to about 1 ha of irrigated land from a perennial stream. Typology: Small scale irrigation development (100%)
11	Simemeni Garden Scheme	World Vision USA and EU	2014-2015	Euro 0.0064 (US$0.0078)	The project is located at Mahlalini area in the Shiselweni region. It aims to provide water to improve the quality and market linkage for irrigated crops covering 10 ha. Typology: Small scale irrigation development (40%) and others (60%)
12	Mphilo Isachubeka	World Vision USA and EU	2014-2015	Euro 0.0075 (US$0.009)	This is a commercial vegetable production project located at Maseyisini area in the Shiselweni region. This project provides water for irrigation development by

	Irrigation Scheme				modernizing the current irrigation system to a sprinkler type over 0.6 hectare. Typology: Rehabilitation and modernization of irrigation scheme (100%)
13	Mbukwane Garden Scheme	World Vision USA	2014-2015	Euro 0.0045 (US$0.0055)	This project is located at Mbukwane in the Shiselweni region. It provides water tanks for the irrigation of 3.25 hectares of land suitable for commercial vegetable production. Typology: Small scale irrigation development (100%)
14	Letindze Garden Scheme	World Vision Australia	2014-2015	US$0.05	This project is located in the Ngudzeni and Nokwane in the Shiselweni region. It aims to provide irrigation water for commercial vegetable production over 24 hectares through an electric irrigation system from a perennial stream. Typology: Small scale irrigation development (100%)
15	Masibini Garden Scheme	World Vision USA	2014-2015	Euro 0.0075 (US$0.009)	This project is located at Maseyisini area in the Shiselweni region. The project aims to upgrade the existing irrigation system to a sprinkler type to provide for the irrigation of 3 hectares of commercial vegetable production. Typology: Rehabilitation and modernization of irrigation scheme (100%)
16	Khethokuhle Garden Scheme	World Vision Germany and EU	2011-2015	US$ 0.0147	This project is located at Matsanjeni area in the Shiselweni region. This project provides water for irrigation development for fruits and commercial vegetable production over 8 hectares. Typology: Small scale irrigation development (100%)

17	Integrated Food Security and Livelihoods	Finnish Red Cross	2014-2015	SZL5.0 (US$0.47)	The project is located in Mpofu, Nyakatfo,and Zinyane communities under Mhlangatane constituency in the northern Hhohho region. The project has identified 415 households for backyard gardening and 40 volunteers that support the gardens. The project is expected to improve availability and accessibility to food at household level, improve nutritional practices and to strengthen Red Cross in programming and operations. The project aims to achieve this by supporting households with agricultural inputs such as drums for water harvesting. Typology: Small scale irrigation development (6%) and others (94%)
18	Adapting National and Transboundary Water Resources Management in Swaziland to Manage the Expected Impacts of Climate Change	GEF	2014-2015	US$0.45	This project is located at KaBhudla, Luve, Ntjanini, Matsanjeni and Mbelebeleni. The goal of this project is to ensure that the management of Swaziland`s water resource is adapted to take into consideration the anticipated impacts of climate change. The project focuses on adaptation measures in communities and these focus on improving access to water in rural communities using two methods, namely; piloting improved land use practices that increase rates of water infiltration into soils, and introducing rain water harvesting techniques. Such measures will have the long term effect of recharging ground water levels and increasing surface water flow in rivers and streams during the dry season as well as providing communities with improved access to water for both irrigation and drinking purposes. Typology: Small scale irrigation development (41%) Rehabilitation and modernization of irrigation scheme (48%) and others (11%)
19	Mitigation of Negative Impacts of	USAID	2012 - 2014	SZL6.5 (US$0.75)	IRD is working with farmers from 15 community vegetable gardens averaging 2 ha serving over 950 households in the target geographical area (15 tinkhundla in

	Climate Change in Swaziland				the Lowveld of Swaziland: Somthongo, Matsanjeni, Sigwe, Lubuli, Mpolonjeni, Hosea, Ngudzeni, Sithobela, Nkilongo, Hlane, Shiselweni 1, Dvokodveni, Mkhiweni, Mandlangempisi and Mahlangatene) to increase their vegetable production under small scale irrigationschemes supported by technical support and limited provision of agricultural inputs. Typology: 100 % Small scale irrigation development
20	Mini-Micro Hydropower study and pilot projects	Government of Swaziland	2007-2015	SZL31.55 (US$4.39)	This project is located in the LUSIP areas. Intended to determine the hydropower potential for the Lubovane dam. This project purposes to inform investors about the potential hydropower to be generated as well as how to generate electricity. Typology: Large scale hydropower project (100%)

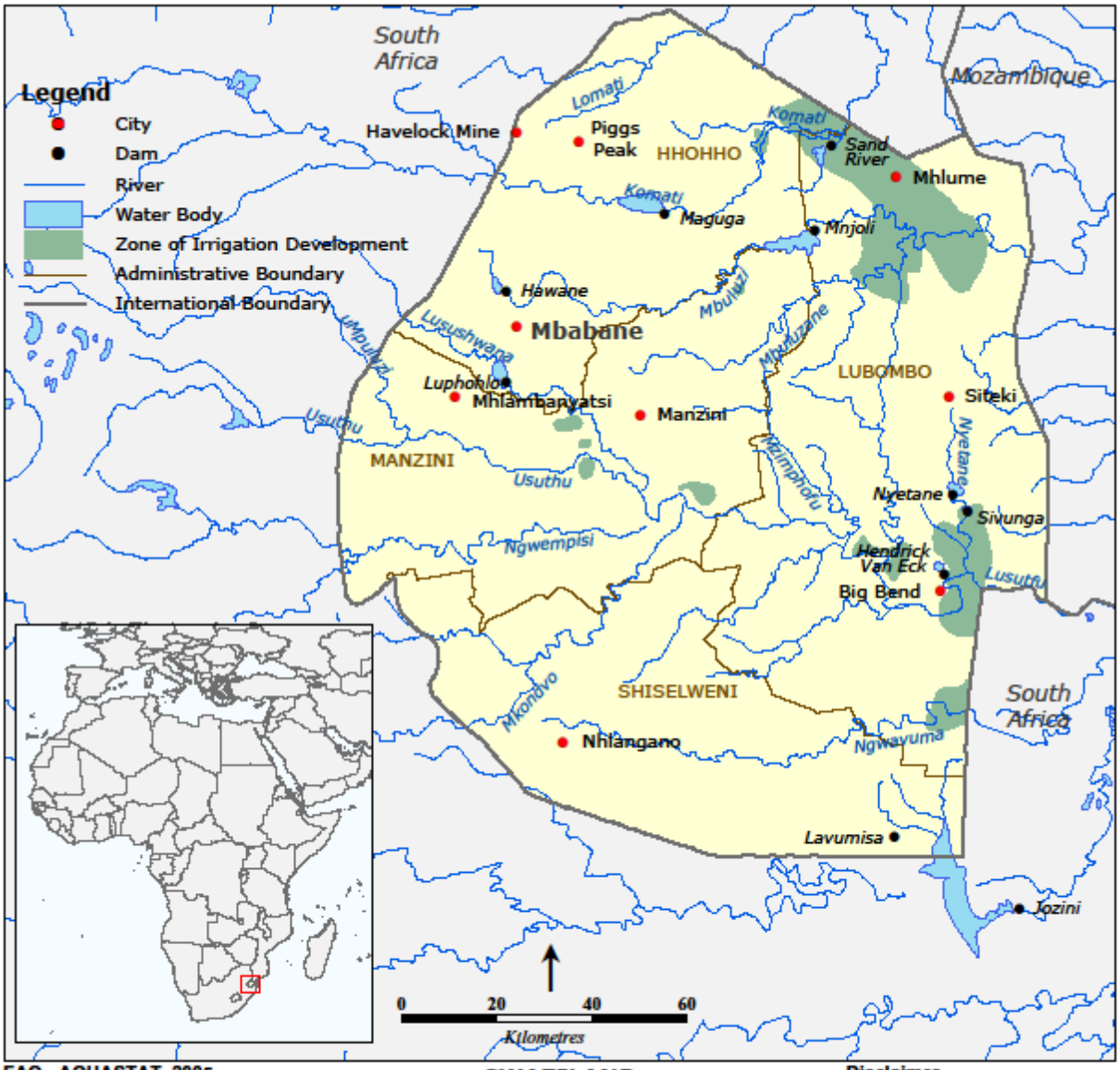
Table 1.2. PIPELINE PROJECTS

#	Project title	Funding Partners	Time Scale	Total Budget (Million Currency)	Description
1	Lower Usuthu Smallholder Irrigation Project (LUSIP) Phase II	Government of Swaziland and Development Partners	2015-2022	SZL2 100.00 (US$200.5)	The LUSIP Phase 2 is an extension of LUSIP Phase 1 covering areas that were not catered for in the development of the region. Located at the Lubombo region, the project will link at the point of departure of the St. Philips canal from the Main Canal South extending to Nsoko development area. The project is expected to deliver irrigation water to about 11 000 hectares. Typology: Small scale irrigation development (70%) and other (30%)
2	Ethemba Downstream Irrigation development	Government of Swaziland	2016-2025	US$150.00	This project will be located at the Mkhondvo river basin. It involves new irrigation development for about 4 500ha. The project aims to help subsistence farmers in the poor communities downstream of the dam to undertake commercial farming so as to improve their livelihoods and to supply domestic water to the Hlatikhulu town and nearby communities. Typology: Small scale irrigation development (80%) and others (20%)
3	Ngwempisi Hydropower project (pre-feasibility study)	Government of Swaziland and AfDB	2015-2016	US$ 0.51	This is a pre-feasibility study to determine how much hydropower can be harnessed from the Ngwempisi river. The project will be located along the Ngwempisi river in Mankaye. Typology: Small and medium scale hydropower development (100%)

4	Feasibility Studies for Nsilingane Dam	Government of Swaziland	2021-2023	US$3.60	This project will be located in the northern part of the country in the Komati river basin. It is envisaged that the project will avail about 797 million cubic meters of water, which will be enough to provide water for the irrigation of about 5 500 hectares as well as providing water for the generation of hydro-energy. Typology: Large scale irrigation development (70%), and small and medium scale hydropower (30%)
5	Medium Scale Earth Dams	Government of Swaziland	2016-2025	US$15.20	This project involves the construction of medium scale dams to increase irrigation water availability in the high and upper middle-veld agro-ecological zones. This component is targeting to construct 15 medium scale dams with a combined capacity to irrigate more than 750 hectares of non-sugar crops. Typology: Small scale irrigation development (75%) and others (25%)
6	Small Earth Dams	Government of Swaziland	2016-2025	US$4.50	This project intends to construct small earth dams to provide livestock, drinking water and downstream gardening in the dry regions of the country. It is targeted that 45 small earth dams will be provided in nine constituencies each having five dams from which one earth dam is expected to provide water to irrigate 1 hectare of land per constituency for vegetable production. Typology: Small scale irrigation development (30%) and others (70%)

7	Rooftop Water Harvesting	Government of Swaziland	2016-2025	US$8.0	This is a countrywide project that will provide water harvesting material and train communities on roof top water harvesting techniques to supplement domestic water needs and development of food and nutrition gardens. The projects targets to harvest about 5000 liters of water per needy household in order to improve their food nutrition status. Typology: Small scale irrigation development (50%) and others (50%)
8	Construction and Rehabilitation of Irrigation Schemes	Government of Swaziland	2016-2025	US$15.20	This project is targeting the development of downstream irrigation infrastructure in the areas where new dams will be constructed and rehabilitating dilapidated irrigation schemes. The target is to provide land equipped with irrigation infrastructure in excess of 1 000 hectares excluding areas irrigated by large-scale dams. This is expected to benefit 1 000 households. Typology: Rehabilitation and modernization of irrigation scheme (90%) and others (10%)
9	Ethema Dam Constructrion	Government of Swaziland	2016-2025	US$200.00	A 368 million cubic meters reservoir which will be located at the Mkhondvo river basin. It involves the actual construction of a dam that will provide water for irrigation, sanitation and hydropower generation. This dam has the potential to generate about 3MW of hydropower and develop 2 500 hectares of irrigated land. Typology: Small scale irrigation development (45%), Small-medium –scale hydropower (31%) and others (24%)

ANNEX 2: MAP OF WATER CONTROL IN SWAZILAND



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