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adelphi

# Baseline Study on
# Climate Change Impacts on the Private Sector in Rwanda

This case study has been developed by adelphi commissioned by GIZ global project 'Strengthening the capacity of the private sector to adapt to climate change' on behalf of BMZ.

Date: 21.10.2014

## PREFACE

This document was prepared within the GIZ's global project "Strengthening the capacity of the private sector to adapt to climate change" by GIZ (Hans Joachim Zinnkann) and the German consultancy adelphi (Frederik Eisinger, Christian Kind, Cosima Stahr, and Tamara Tschentscher) between August and October 2014. The main purpose of the document is to provide a starting point for GIZ to develop capacity building activities on climate change adaptation in the private sector in Rwanda by identifying economic sectors that are both particularly relevant for the Rwandan economy and affected by impacts of climate change.

The study constitutes a short synthesis of information on the state of the economy, the current and future climate of Rwanda as well as projected impacts of climatic changes on the economy. Furthermore it encompasses a short overview on initiatives, plans and strategies in Rwanda that are already addressing impacts of climate change.

Findings from a first version of this study were discussed with experts from the Rwandan government, private sector associations, businesses and representatives of the German development cooperation during a fact-finding mission in September 2014. Based on the insights from 20 interviews, the study was updated to provide a sound overview on impacts of climate change on different regions and economic sectors of Rwanda.

The authors thank all experts for their feedback and perspectives.

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# 1 Population and climate in Rwanda

## 1.1 Demographical snapshot

**Table 1: Rwanda's demography**

| | |
|---|---|
| **Population** | 12.3 million (most densely populated country in Sub-Sahara Africa) |
| **Languages** | Official: Kinyarwanda, French, English<br>Spoken: Kinyarwanda only 93.2%; Kinyarwanda and other 6.2%, French and other 0.1%, English and other 0.1% |
| **Religions** | Roman Catholic: 49.5%; Protestant: 39.4%; Muslim: 1.8%; Other: 9.3% |
| **Age Structure** | 0-14 years: 42.1% (male 2,617,472/female 2,575,429)<br>15-24 years: 18.9% (male 1,166,258/female 1,167,934)<br>25-54 years: 32.5% (male 2,010,034/female 1,994,582)<br>55-64 years: 4% (male 229,759/female 267,430)<br>65 years and over: 2.5% (male 125,862/female 182,378) (2014 est.) |
| **Urbanization** | Urban population: 19.1% (2011)<br>Urbanization rate: 4.5% p.a. (2010-15 est.) |

Source: CIA World Factbook, 2014.

## 1.2 Geographical and climatic conditions

Rwanda primarily demonstrates a tropical highland climate with an average daily temperature range of less than 2°C. There are varying temperature levels in different regions because of variations in altitudes (Nations Encyclopaedia). Based on data from 1931-1960, Ruanda demonstrated four broad climatic zones (see figure 1). These are comprised of the (1/red) Kivu-sea climate, (2/violet) mountain climate, (3/green) temperate zone of the central highlands, and (4/orange) East-Rwandan dry and hot lowland zone (Henninger 2012).

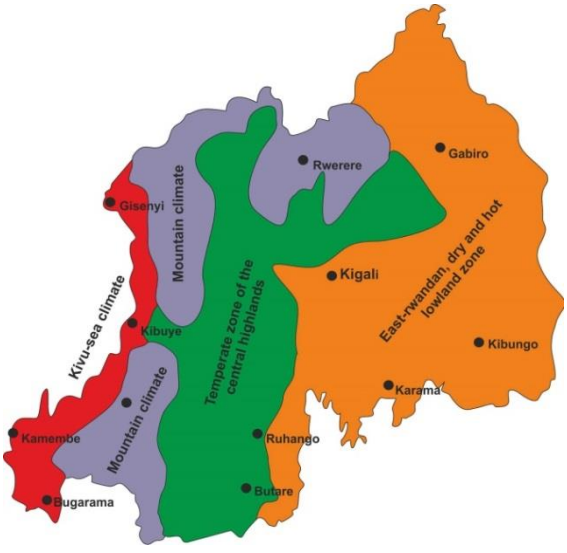



**Figure 1: Climatic zones in Rwanda based on data from 1931-1960 (Henninger, 2012)**

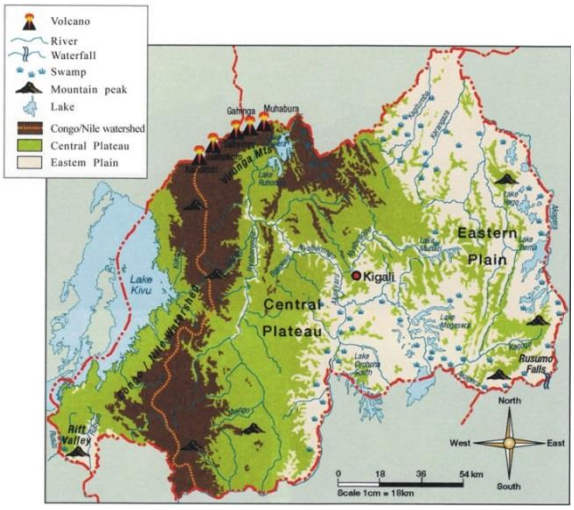



**Figure 2: Rwanda's topography (Henninger, 2012)**

Overall, there are four seasons in Rwanda. The short rainy season occurs between September and November, while the long rainy season stretches from March to May (REMA 2009). The two dry seasons occur between December-February (short) and June-August (long). Annual rainfall ranges from about 900mm in the East and Southeast to more than 1600mm in the Northwest and Southwest (see figure 3). Kigali is located on the central plateau, where the heaviest rainfalls are recorded in the Southwest while the East experiences the least rainfall. In Gisovu in the West (near Kibuye), the average annual rainfall is around 1600mm, while Gabiro in the Northeast receives ca. 780mm and Butare in the South around 1150mm (Nations Encyclopaedia).

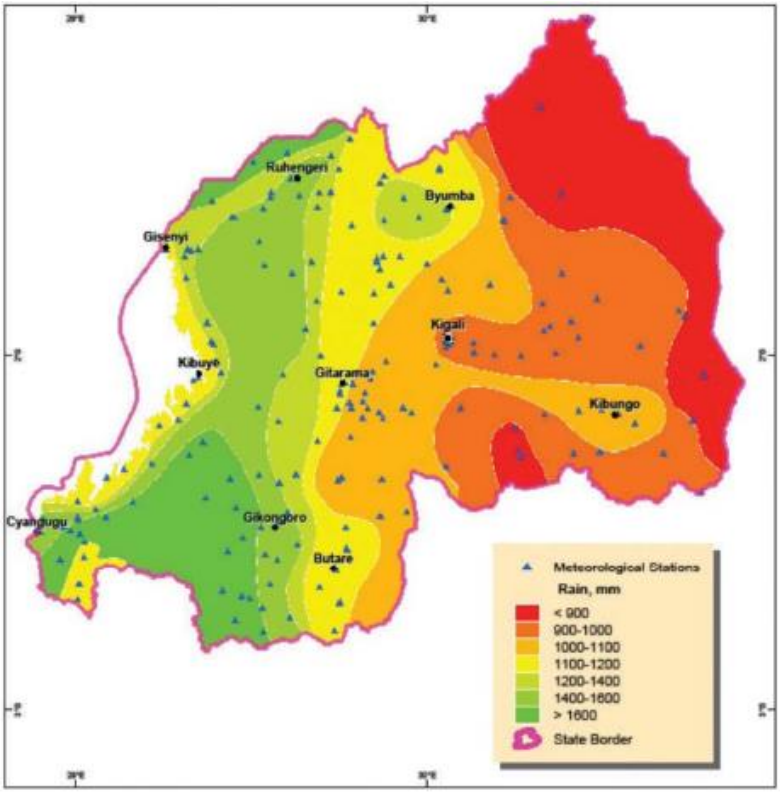



**Figure 3: Distribution of average annual rainfall in mm across Rwanda (Source: SEEE, 2011)**

## 1.3 Recent climate change phenomena and projections for the future

Country-specific climate data for Rwanda is scarce and some studies contradict each other regarding estimates of overall changes in precipitation. Besides temperature recordings, trends of precipitation changes are difficult to observe due to spatial variability and inter-annual rainfall variability. However, the main available observations are summarized in this section while regional changes are described in more detail in section 3.

**Already observable climatic changes**

*Temperature*

The recorded annual average temperatures of four weather stations across Rwanda reveal **a clearly increasing trend of +0.35°C per decade for the period between 1971 and 2010** (MINIRENA, 2011). This is a **larger average temperature increase than the global average** of +0.27°C per decade between 1979 and 2005. A study by the Rwanda Meteorological Centre confirms that the country's temperature has been rising since 1971 (Rwanda Focus, 2012): Minimum temperatures have been increasing by up to 2°C within the past 30 years.

*Precipitation*

Data gathered from 26 weather stations between 1931 and 1990 have not shown any significant trend of changing precipitation patterns. There is a high natural inter-annual variability in rainfall in Rwanda (MINIRENA, 2011). However, the Rwanda Environment Management Authority (REMA) states that some areas of Rwanda have experienced irregular climate patterns that include greater variability in rainfall intensities and frequencies, unusually heavy rains in the North and more severe droughts in the East and South (REMA, 2009). Especially the East has been affected by lack of rainfall: data of REMA (covering 1961-2005) shows that the decade between 1991 and 2001 has been the driest on average

since 1961 (ibid). Overall, REMA estimates that the rainy seasons are becoming shorter but more intense at the same time (ibid).

*Extreme weather events*

According to a study by Didace Musoni (Rwanda Meteorological Center quoted in Rwanda Focus, 2010), heat waves have become more severe and the highest maximum recorded temperature between 2001 and 2010 was as high as 35.4°C compared to 32.8°C in the preceding decade.[1] Developments around weather stations, e.g. converting green spaces to sealed asphalt surfaces might also have contributed to this increase. Heavy rainfalls have been increasing as well. The same study observed that the heaviest 24-hour rain period in Kigali occurred in July 2010 – in the middle of the dry season.

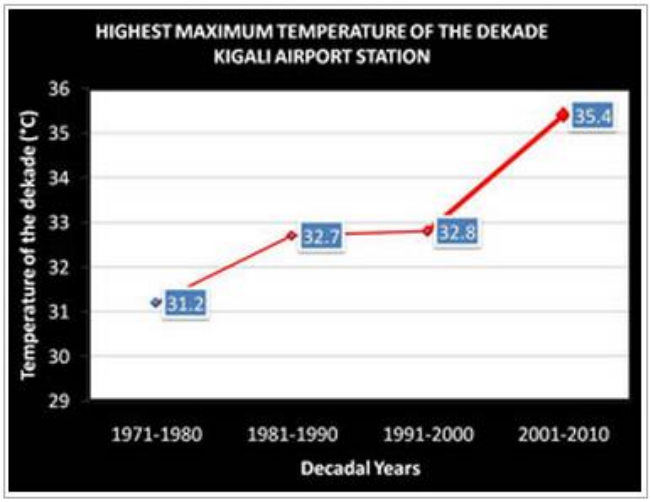



**Figure 4: Highest recorded temperature per decade in Kigali (1971-80 to 2001-2010; Source: Rwanda Focus, 2012)**

Statistics of the Rwanda Ministry of Disaster Management and Refugee Affairs reveal that in 2013, 112 people died of landslides, floods and lightning. Floods and landslides triggered by heavy rains further demolished 3,934 houses in the same year (In2EastAfrica, 2014).[2] Such natural disasters are likely to increase in frequency and intensity when rains become stronger and more erratic.

**General projections on climate change impacts**

Projections estimate that large parts of the country will experience an **increase in precipitation** with **more intense rainfall particularly during rainy seasons**, which will **increase the intensity and frequency of floods and landslides**. In other parts, primarily in the South and Southeast, extended **droughts are expected to become more frequent** (NAPA-Rwanda, 2006; IIED, 2013). Average temperatures are expected to increase up to 2.5°C by 2050 and up to 4°C by 2080, likely resulting in an **expansion of the Malaria virus into regions of higher altitudes** (MINIRENA, 2011; compared to 1990)

Using a regional model (comprising large parts of DRC, Rwanda, Burundi as well as Western Uganda, and the Southern edges of South Sudan and Central African Republic) based on data from the IPCC-AR4, a study by GIZ, the Climate Service Centre (CSC) and the Wageningen University and Research Centre (WUR) projects an **increase in extreme temperatures** in Rwanda. Consequently, the **cold days and cold nights are expected to decrease** by 5-10% (depending on the scenario), and the **number of hot days and hot nights is projected to increase** by 12-58% (hot days) and 31-86% (hot nights, depending on the scenario (CSC, 2013).[3] While this model only projects a moderate increase in overall precipitation, it is expected to become **more erratic with more intense rains**.

*Observations by experts*

In the interviews with experts that were carried out as part of the research for this study, individuals voiced a wide range of observations on recent weather extremes and perceived climate change phenomena. Many statements referred to personal experiences and anecdotal evidence. Interview partners frequently mentioned that weather patterns have been changing, especially with respect to the beginning and end of the rainy seasons. It was often expressed that in general it has become more difficult to predict the weather and that temperature highs have become more extreme. Several experts mentioned that floods after heavy rain events have been happening in areas where in the past

[1] This study is not publically available and hence there is no information on the baseline year.

[2] Figures on these incidents for other years could not be obtained .

[3] These values range across two different scenarios (low emission and high emission) as well as two time horizons each (2036-2065 and 2071-2100) and are compared to the average value from 1961-1990.

there had never been any flooding and that in general rainfall has become more erratic and disastrous.

## 1.4 Key Findings

Regarding the past climate there is clear trend for change in temperature and mixed findings on rainfall.

- Annual average temperature has risen since 1971 by about 1.4°C. Temperature peaks have been rising as well.
- Analysis of average annual rainfall data on a national level does not show any trends, however, REMA reports that there have been unusually heavy rains in the North and more severe droughts in the East and South in the last two decades.

Regarding the future climate the following range of changes are projected.

- Average annual temperatures are projected to increase up to 2.5°C by 2050 and up to 4°C by 2080.
- Most parts of Rwanda are projected to experience an increase in average precipitation with more intense rainfalls particularly in the rainy seasons.
- REMA estimates that the rainy seasons will be shorter and more intense.
- The South and Southeast is expected to have more intense and frequent droughts.

Overall it can be said that while evidence on current and future changes in temperature seems more robust than for precipitation, the publications available seem more concerned with past and future heavy rains (and subsequent impacts like floods and landslides) as well as droughts. The fact that there are observations of REMA on past rain events and independent projections of MINIRENA and the Climate Service Center on more erratic and intense rains for the future gives the impression that this is a relatively reliable trend. Observations of experts in the interviews are in line with the findings on climatic changes in the available literature. Overall, experts seemed more concerned with the impacts of too much or too little rain than with an increase in temperature extremes.

Hence, it seems appropriate to focus a bit more on impacts of precipitation extremes and/or droughts rather than heat issues when developing capacity building activities as planned by GIZ.

# 2 State and prospects of the economy

Rwanda is a relatively resource poor country whose population and economy were severely devastated by the genocide of 1994. Its GDP was halved within a year, 80% of the population was thrown into extreme poverty, the already poorly developed productive infrastructure was destroyed and an entire generation of doctors, public servants, teachers and entrepreneurs was wiped out. In its long-term development strategy *Vision 2020 adopted in 2000*, the Government strives to transform Rwanda from an agricultural low-income country to a knowledge-based, service-oriented middle-income country by 2020 (World Bank, 2014a). This entails achieving an average annual per capita income of USD 900 (in comparison to USD 698 in 2013), reducing poverty to 30% and improving health care to raise the average life expectancy to 55 years (which has already been surpassed with a life expectancy of 59 years in 2013). While currently about 90% of the working population is employed in agriculture, increasingly the share of industry and service sectors in the national economy will need to play a vital part in its development. However, this requires a competitive stock of high skilled labour, infrastructure and financial services (Vision 2020). In order to achieve these long-term goals, the Government of Rwanda has formulated the *Economic Development and Poverty Reduction Strategy (EDPRS 2)* as its medium-term strategy for the period 2013-2018, building on achievements and lessons from the EDPRS 1 (2008-2012). Its highest priority is growth acceleration and poverty reduction through (1) economic transformation, i.a. by increasing investments in priority sectors (2) productivity and youth employment – by i.a. enhancing entrepreneurship and business developments as well as improving skills and attitudes, (3) rural development, i.a. by connecting rural communities to economic opportunity through improved infrastructure and (4) accountable governance.[4]

Rwanda has already made remarkable progress in recent years. Annual real GDP growth was as high as 8.1% on average between 2001 and 2012. The nominal GDP in 2012 totalled USD 7.1 billion (RwF 4,363 billion) and is estimated to grow to USD 8.1 billion (RwF 5,480 billion) in 2014 (GTAI, 2014). Between 2001 and 2011, the poverty rate decreased from 59% to 45% (Wold Bank, 2014). While the majority of the private sector is still largely informal, it will need to play a crucial role in driving further economic growth.[5] Through a number of successfully implemented reforms for improving the business environment including reducing the cost of doing business, tax incentives, and low crime /corruption rates, Rwanda is now ranked as the second easiest place to do business in Sub-Saharan Africa (rank 32) after Mauritius. This ranking gives Rwanda international credit for favourable investment conditions and should help to attract more private investments, both domestic and foreign, and boost industry and service sectors.[6]

More than 90% of Rwanda's workforce is employed in the private sector. Micro, small and medium-sized enterprises (MSMEs) make up 98% of the estimated 123,000 businesses operating in the country and provide 84% of private sector employment.[7] Out of these, only 14,000 firms are registered with the Rwanda Revenue Authority, 40% of which are registered for VAT and only 11% for income taxes. These numbers highlight the dominance of the informal sector compared to the formal private sector. Key impediments to private sector development include the high cost of energy and transport, as well as poor business planning and management skills, particularly in SMEs.

A private sector development strategy was adopted in 2013 within EDPRS 2 to facilitate investment, job creation and growth in the private sector (AEO, 2014).[8] This entails in particular the objectives of (1) strengthening the investment process and pro-actively targeting large foreign investors in priority sectors of the economy, (2) increasing credit (e.g. available capital as loans or investments) to the

[4] The full strategy document can be found at : http://www.minecofin.gov.rw/fileadmin/General/EDPRS_2/EDPRS_2_FINAL1.pdf.

[5] In the manufacturing sector, it was estimated that almost 64 percent of enterprises belonged to the informal sector in 2011 (RDB, 2012).

[6] See Appendix 1 for a figure on distribution of foreign private investment across sectors in 2012.

[7] Family enterprises are a large (separate) component of this Rwandan private sector group. They employ 1-2 people, while businesses with 3-10 employees are classified as micro enterprises.

[8] One lesson from EDPRS was that there was too little focus on the private sector, which plays a crucial role in the country's economic development.

private sector to 30% of GDP by 2017, and (3) strengthening the business environment by reforming regulatory and tax frameworks to spur medium and large enterprise growth. EDPRS 2 further aims to increase productivity in the coffee sector, improve Rwanda's tourism infrastructure, and to pro-actively target export-oriented investment in new and emerging sectors such as business tourism, business process outsourcing (BPO), financial services, and light manufacturing (MINECOFIN, 2012). The strategy also explicitly acknowledges environment and climate change as important cross-cutting issues for economic development and poverty reduction in Rwanda, stating that climate change is likely to "increase damage to infrastructure and property" (MINECOFIN, 2012: 84). The strategy calls for ensuring that climate resilience considerations are built into economic planning and is also expecting the private and financial sector to deliver on this.

## 2.1 Key (non-agricultural) economic sectors and products

Rwanda's industrial sectors are still at an infant stage compared to the many other parts of the world (Economy Watch, 2010; does not include service sectors). Industry only accounted for about 19% of GDP while agriculture made up about 36% and services about 45% in 2013 (AEO, 2014). However, this is an increase of contribution by industry to GDP by an additional 3% compared to 16% in the previous year. Please see the following table for an illustration of GDP contributions of different sectors and their development between 2006 and 2012.

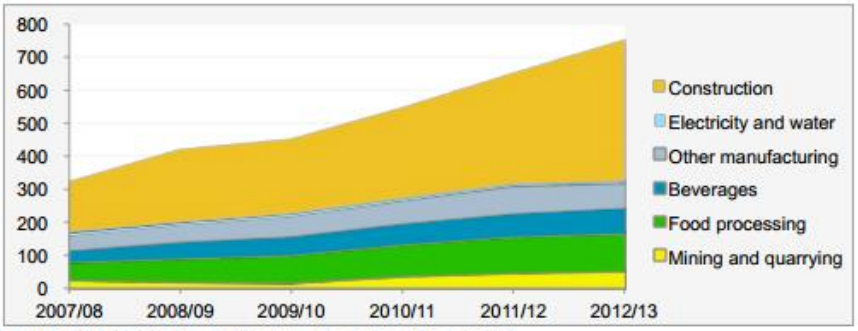
**Table 2: GDP by sectors at current prices (in billion RWF)**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| **Gross Domestic Product** | **1,716** | **2,045** | **2,574** | **2,985** | **3,277** | **3,828** | **4,363** |
| **Agriculture** | **660** | **729** | **834** | **1,012** | **1,058** | **1,223** | **1,438** |
| Food crops | 546 | 619 | 692 | 858 | 891 | 1,040 | 1,232 |
| Export crops | 25 | 18 | 24 | 23 | 28 | 29 | 28 |
| Livestock | 31 | 32 | 41 | 48 | 50 | 56 | 62 |
| Forestry | 52 | 53 | 69 | 73 | 77 | 84 | 101 |
| Fisheries | 6 | 7 | 9 | 10 | 11 | 13 | 15 |
| **Industry** | **236** | **285** | **382** | **431** | **491** | **625** | **695** |
| Mining and quarrying | 11 | 21 | 25 | 16 | 21 | 48 | 39 |
| Manufacturing | 117 | 125 | 159 | 190 | 218 | 252 | 259 |
| Of which: Food | 49 | 49 | 65 | 80 | 92 | 109 | 113 |
| Beverages and tobacco | 28 | 31 | 41 | 56 | 60 | 64 | 74 |
| Textiles and clothing | 8 | 9 | 10 | 10 | 11 | 13 | 13 |
| Wood, paper and printing | 6 | 7 | 8 | 8 | 10 | 9 | 10 |
| Chemicals, rubber, plastics | 7 | 8 | 9 | 9 | 10 | 12 | 14 |
| Non-metallic minerals | 11 | 11 | 14 | 15 | 17 | 21 | 24 |
| Furniture and other | 7 | 9 | 12 | 12 | 17 | 23 | 11 |
| Electricity and water | 3 | 8 | 5 | 6 | 7 | 9 | 10 |
| Construction | 105 | 132 | 193 | 218 | 244 | 317 | 387 |
| **Services** | **720** | **911** | **1,194** | **1,358** | **1,530** | **1,745** | **1,965** |
| Wholesale and retail trade | 192 | 240 | 356 | 385 | 432 | 492 | 564 |
| Hotels and restaurants | 40 | 49 | 58 | 61 | 68 | 72 | 80 |
| Transport, storage, communication | 117 | 145 | 196 | 223 | 256 | 288 | 344 |
| Finance, insurance | 49 | 58 | 64 | 64 | 80 | 109 | 130 |
| Real estate, business services | 113 | 171 | 234 | 282 | 293 | 306 | 337 |
| Public administration | 87 | 97 | 112 | 128 | 151 | 181 | 213 |
| Education | 76 | 95 | 108 | 140 | 165 | 210 | 203 |
| Health | 23 | 30 | 36 | 44 | 51 | 53 | 59 |
| Other personal services | 23 | 27 | 30 | 30 | 33 | 34 | 36 |
| **Adjustments** | **100** | **119** | **164** | **185** | **199** | **236** | **265** |
| Less: Imputed bank service charge | -24 | -31 | -40 | -41 | -50 | -69 | -86 |
| Plus: VAT and other taxes on products | 124 | 151 | 204 | 226 | 249 | 306 | 351 |
| **Growth rate (%)** | **3.3** | **3.3** | **2.9** | **2.9** | **2.9** | **2.9** | **-** |
| **Exchange rate: FRW per US dollar** | **558** | **547** | **547** | **568** | **583** | **600** | **-** |
| **Growth rate (%)** | **0** | **-2** | **0** | **4** | **3** | **3** | **-** |

*Source: NISR (National Account)*

Although growth slowed to 4.6 percent in 2013 from 7.3 percent in 2012, estimates indicate that services and industry were the primary drivers of growth that year. Within the industrial sector, construction demonstrated the steepest growth, particularly since 2009/10 (see figure 5). Besides tea

and coffee[9] (probably found under food processing (16%; RWF 117 billion)), the main industries in Rwanda include small-scale beverages (10%; RWF 76 billion) and small scale manufacturing (e.g. textiles and clothing, chemicals & plastics, non-metallic minerals and wood & paper; 9% RWF 71 billion), furniture, plastic goods, cement, cigarettes and textiles, but most manufacturers primarily target the domestic market (CIA World Factbook, 2014).[10]




***Source**: GDP estimates, National Institute of Statistics (NISR)*

**Figure 5: Nominal GDP by industrial subsector, 2007/08 - 2012/13 (in billion RWF; source: MINICOM, 2013)**

The expansion of services in 2012/13 of about 4% was mainly led by transport and communications, trade, finance and insurance, education and public administration. These account for about 57 percent of the service sector output. Growth in industry of about 11% was mainly driven by mining and construction with increased production and market prices of some key minerals and increased public spending following the resumption of international budget support disbursements in early 2013. Out of the contribution of the industrial sector to annual GDP, construction accounts for about 55%. Sustained growth is expected for key public investments in transport and energy infrastructure (AEO, 2014).

According to the Rwanda Industrial Survey 2011, employment in the industrial sector totalled about 33,000 of which 78% are attributed to manufacturing, 16% to construction and 6% to quarrying and mining (MINICOM, 2011). Out of the total industrial output of RWF 625 billion in 2011, manufacturing contributed 40% (RWF 252 billion), construction 51% (RWF 317 billion), and mining and quarrying 8% (RWF 48 billion). The following tables give an overview of employment by company size, industrial sectors and location (MINICOM, 2011).

*Employment by company size in the industrial sector*

Data of employment from different sources (and even within organisations) varies substantially. This is partly a result of the large informal sector and limitations to estimations. While the annual report 2012/13 of the Ministry of Trade and Industry (MINICOM) estimates that 316,000 people are employed in industry overall, i.e. in the formal and informal sector together, the MINICOM Industrial Survey 2011 gives a figure of 33,218 formally employed in the industrial sector (see table 3). Most enterprises are (micro enterprises in the form of) *family businesses* with one to two employees (68%), followed by *micro enterprises* with 3-10 employees (25%). Large industrial companies (>100 employees) employ 46% of workers in the formal sector.

**Table 3: Distribution of employment and number of companies in the industrial sector (2011)**

| Company size | Total Employees | Percentage employed | Number of companies | Percentage of companies |
|---|---|---|---|---|
| Family (1-2 employees) | 4,350 | 13% | 3,229 | 68% |
| Micro (3-10 employees) | 5,131 | 15% | 1,198 | 25% |
| Small (11-30 employees) | 3,038 | 10% | 183 | 4% |
| Medium (31-100 employees) | 5,214 | 16% | 104 | 2% |

[9] As most sources usually refer to tea and coffee as an industry, it is assumed that this includes both cultivation and processing.

[10] Please see Appendix 2 for further information on macroeconomic aggregates and GDP contributions by the different sectors.

| | | | | |
|---|---|---|---|---|
| Large (100+ employees) | 15,485 | 46% | 38 | 1% |
| Total | 33,218 | 100% | 4,752 | 100% |

*Company sizes by industrial sector*

Within the industrial sector, most companies are manufacturers (97%) and are predominantly family and micro enterprises (see table 4).

**Table 4: Company size (by employment) of different industrial sectors (2011)**

| Industry type | ≤ 10 (micro) | > 10 | Total | Percent |
|---|---|---|---|---|
| Mining and Quarrying | 15 | 25 | 40 | 0.8% |
| Manufacturing | 4,347 | 264 | 4,611 | 97% |
| Construction | 65 | 36 | 101 | 2.1% |
| Total | 4,427 | 325 | 4,752 | 100% |

*Number of companies by industrial sector and location*

Most construction companies are located in and around the capital Kigali City (>80%). Mining and quarrying is slightly more prevalent around Kigali, the North and the West. Manufacturing is relatively evenly distributed across regions with a somewhat larger number of companies in the East (see table 5).

**Table 5: Location of companies across key industrial sectors (2011)**

| Sector | Province | | | | | |
|---|---|---|---|---|---|---|
| | Kigali City | Northern | Western | Southern | Eastern | Total |
| Mining and Quarrying | 10 | 10 | 9 | 4 | 7 | 40 |
| Manufacturing | 842 | 873 | 948 | 941 | 1,007 | 4,611 |
| Construction | 84 | 5 | 7 | 3 | 2 | 101 |
| **Total** | **936** | **888** | **964** | **948** | **1,016** | **4,752** |

*Main MSME products in different regions*

In 2011, MINICOM analysed the MSME landscape for the different provinces. The following table summarizes the primary SME products (MINICOM SME, 2011).[11]

**Table 6: SME clusters by province**

| | Kigali City | Northern | Western | Southern | Eastern |
|---|---|---|---|---|---|
| Coffee | x | | x | x | |
| Tea | | | | x | |
| Vegetable oil | x | | | | |
| Rice | | | | | x |
| Maize | | | | | x |
| Irish potatoes | | x | | | |
| Milk | | x | | x | x |
| Yoghurt | | | | x | |
| Cheese | | | | | |
| Tiles | x | | | | |

[11] The source gives a detailed overview of primary products in the individual districts.

| | | | | | |
|---|---|---|---|---|---|
| Bricks | x | x | x | | |
| Fish | | | | | x |
| Fish flour | | | x | | |
| Tailoring | | | x | | x |
| Leather | | | | | x |
| Leather products | | | | | |
| Jewellery | | | | | |
| Baskets | x | | | x | |
| Ceramics | | x | | | |
| Furniture | x | | | x | |
| Casserite | | x | x | | |
| Web design & software | x | | | | |
| Cultural tourism | | | | x | |

*The manufacturing sector in more detail*

**Table 7: Number of companies of different manufacturing sectors in the RDB sample (RDB, 2012)**

| Activity | No. Establishments | % |
|---|---|---|
| Manufacture of food products | 75 | 20.5 |
| Manufacture of beverages | 13 | 3.6 |
| Manufacture of tobacco products | 1 | 0.3 |
| Manufacture of textiles | 25 | 6.8 |
| Manufacturing of wearing apparels | 1 | 0.3 |
| Manufacturing of leather & related products | 12 | 3.3 |
| Manufacturing of wood & products of wood & cork, except furniture; manufacturing of articles of straw & plaiting materials | 28 | 7.7 |
| Manufacture of paper & paper products | 3 | 0.8 |
| Printing and reproduction of recorded materials | 32 | 8.7 |
| Manufacture of chemical & chemical products | 13 | 3.6 |
| Manufacture of rubber and plastic products | 8 | 2.2 |
| Manufacture of other non-metallic mineral products | 22 | 6.0 |
| Manufacture of basic metals | 3 | 0.8 |
| Manufacture of fabricated & metal products except machinery & equipment | 25 | 6.8 |
| Manufacture of computer, electronics and Optical products | 3 | 0.8 |
| Manufacture of electrical equipment | 2 | 0.5 |
| Manufacture of motor vehicles, trailers & semi trailers | 1 | 0.3 |
| Manufacture of other transport equipment | 1 | 0.3 |
| Manufacture of furniture | 31 | 8.5 |
| Other manufacturing | 21 | 5.7 |
| Repair & installation of machinery & equipment | 39 | 10.7 |
| Others | 1 | 0.3 |
| Not stated | 6 | 1.6 |
| **Total** | **366** | **100.0** |

According to the Rwanda Development Board (RDB) Sector Skills Survey 2012, a sample survey of 366 manufacturing companies suggests that the primary manufacturing industries are (1) manufacturing of food products, (2) repair and installation of machinery and equipment, (3) printing and reproduction of recorded materials, (4) manufacture of furniture, and (5) manufacturing of wood & cork products (except furniture). The following table gives an overview of survey results regarding company numbers in different manufacturing sectors.[12]

The beverages and tobacco industry has demonstrated the largest growth between 2006 and 2010. However, the food processing sector has been growing substantially as well and still generates the largest share of revenue in the manufacturing sector (see figure 6).

[12] See Appendix 3 for a selection of new industrial firms starting their operations in 2013

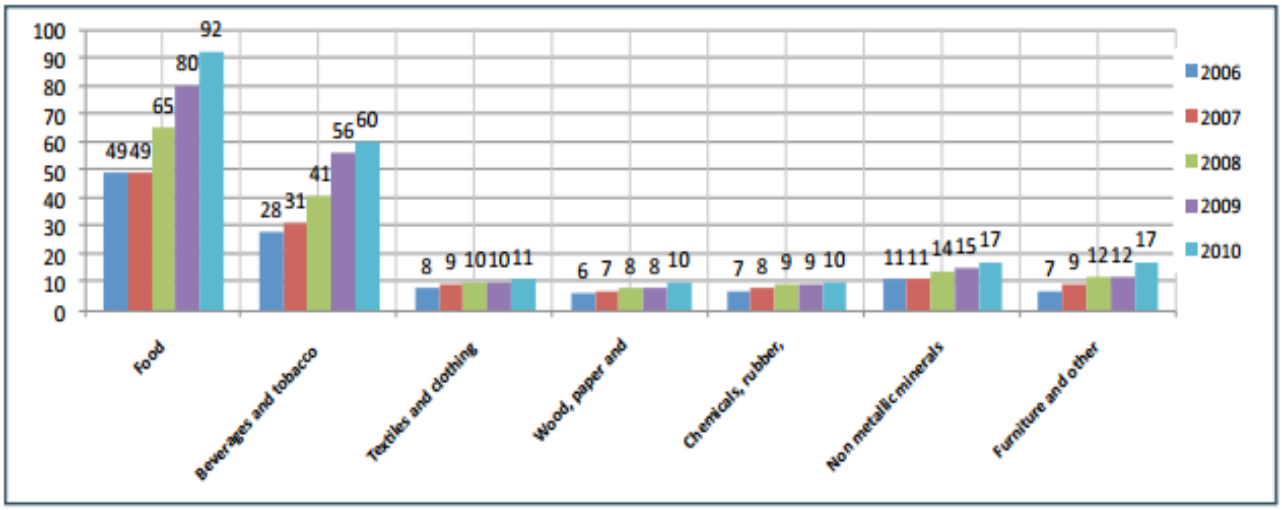
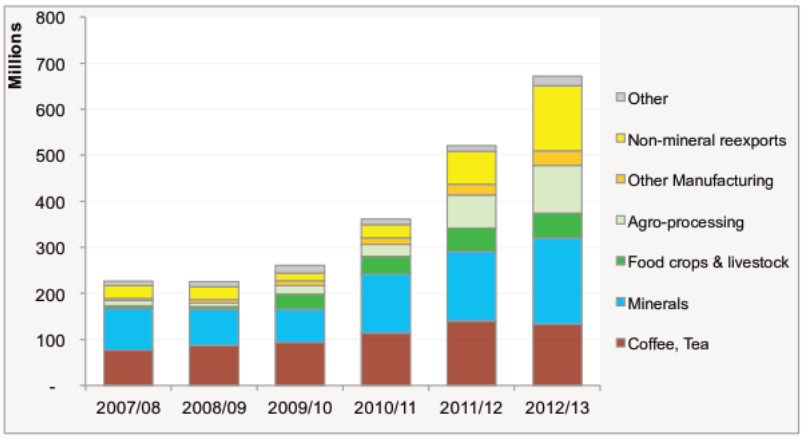



**Figure 6: Industrial output development in the manufacturing sectors 2006-2010 (in billion RWF; Source: MINICOM, 2011)**

*Main export goods*

Exports from the manufacturing sector have been growing substantially between 2009/10 and 2012/13. Earnings from exports increased by about 29% to approximately USD 672 million (RWF 464.3 billion) from 2012 to 2013. Exports of minerals, coffee and tea accounted for 48 percent of total exports in 2012/13. The decrease from 56% in the previous year suggests diversification of exports (MINICOM, 2013). The mining sector is the largest single contributor to export goods in 2012/13 and grew by 24% compared to the previous year. This growth was mainly driven by a doubling of export revenue from coltan due to a price increase of 26% and a subsequent volume expansion of 79%. The substantial growth of re-exports (e.g. iron and steel products, livestock and food crops) was mainly driven by petroleum products.




***Source:*** *National Bank of Rwanda (BNR)*

**Figure 7: Development of exports from the manufacturing sector (source: MINICOM, 2013)**

The main minerals exported by Rwanda are casserite, coltan and wolfram. While export volumes and market prices have demonstrated a generally positive trend in recent years, exports in casserite have almost halved from 2011 to 2012 (see table 8). In 2009, Rwanda was the third largest exporter of coltan after Brazil and Mozambique. However, local production (mining) of coltan is small compared to its exports. Because Rwanda does not tax exports of coltan concentrates, it is a preferred trade route for neighbouring countries with export taxes such as the DRC. According to Rwanda law, imported minerals that are processed in Rwanda with a value increase of at least 30% can be labelled as domestic products, regardless of their origin and legality of their imports (Bleischwitz et al. 2012). Recently, the World Bank identified the mining sector as a potential key driver for economic growth (World Bank 2014b).

**Table 8: Export volumes, export value and percentage of export value change for major mineral exports between 2010 and 2012 (NISR, 2014)[13]**

| Mineral | Volume of Exports (in 1,000 kg) | | | Total value (in 1,000,000 US$) | | | % value change | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2010 | 2011 | 2012 | 2010 / 2011 | 2011 / 2012 |
| **Casserite** | 3,874 | 6,952 | 4,636 | 42.2 | 96.8 | 52.9 | +129% | -47% |
| **Coltan** | 749 | 890 | 1,145 | 18.5 | 38.6 | 56.9 | +109% | +47% |
| **Wolfram** | 843 | 1,006 | 1,750 | 7.1 | 16.0 | 26.3 | +126% | +64% |

*Agricultural products*

The key agricultural products for export are coffee and tea. While the land area for cultivation of coffee and tea has been increasing in recent years, production volumes do not demonstrate a clearly increasing trend (see Appendix 3). This implies varying yield productivity and other – potentially climate-related – influence factors.

Of the key food security crops, rice portrays the highest market price with RWF 719 per kg in 2012. This is followed by Sorghum (RWF 346 per kg) and beans (RWF 324 per kg). Production volumes are displayed in the following table.[14]

**Table 9: Annual crop production (in tons)**

| | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| **Total crops** | **8,234,188** | **9,254,763** | **10,139,259** | **11,212,264** | **11,703,817** |
| **Cereals (céréales)** | **461,163** | **615,059** | **738,080** | **848,658** | **871,725** |
| Sorghum (sorgho) | 144,418 | 174,553 | 161,229 | 151,754 | 138,695 |
| Maize (maïs) | 166,853 | 286,946 | 432,404 | 525,679 | 573,038 |
| Wheat (blé) | 67,869 | 72,479 | 77,193 | 90,684 | 75,913 |
| Paddy (riz) | 82,025 | 81,081 | 67,253 | 80,541 | 84,079 |
| **Pulses (légumineuses)** | **392,305** | **431,139** | **436,954** | **421,257** | **489,595** |
| Beans (haricot) | 308,563 | 327,728 | 327,497 | 331,166 | 432,857 |
| Groundnuts (arachide) | 11,122 | 15,353 | 14,369 | 14,756 | 11,638 |
| Soya (soya) | 50,931 | 54,203 | 57,089 | 37,426 | 18,544 |
| Peas (petit pois) | 21,689 | 33,855 | 37,999 | 37,909 | 26,556 |
| **Roots & tubers** | **3,815,126** | **4,264,961** | **5,192,652** | **5,783,263** | **6,189,937** |
| Irish potatoes (pomme de terre) | 1,161,943 | 1,289,623 | 1,789,404 | 2,171,517 | 2,337,706 |
| Sweet potatoes (potates douces) | 826,440 | 803,228 | 840,072 | 845,099 | 1,005,305 |
| Taro (colocase) | 144,919 | 152,369 | 185,964 | 187,248 | 130,505 |
| Cassava (manioc) | 1,681,823 | 2,019,741 | 2,377,213 | 2,579,399 | 2,716,421 |
| **Bananas** | **2,603,949** | **2,993,482** | **2,749,152** | **3,036,273** | **3,219,466** |
| Vegetables & fruits (maraîchéres & fruitiéres) | 961,645 | 950,122 | 1,022,421 | 1,122,814 | 933,094 |

*Sources: MINAGRI*

*Tourism*

Revenue from hotels and restaurants doubled between 2006 and 2012 from RWF 40 billion to RWF 80 billion. According to the Ministry of Finance and Development Planning, tourism is also one of the existing "export-oriented priority sectors" of the EDPRS 2 with many plans to improve the infrastructure not only for leisure tourists and but also for business tourists, looking at establishing Kigali as premium spot for conventions and industry fairs in Africa.

[13] These are approximated values for illustration.

[14] Crop price details and further information on agricultural products can be found in Appendix 3.

## 2.2 Projections of the national economic development

Projections estimate that growth in 2014 would increase again from 4.6 in 2013 to around 7% and to 7.4% in 2015 (AEO, 2014). Most recent estimates are a bit more conservative: the World Bank is forecasting an economic growth rate of 5.7% for 2014 and 6.6% for 2015 (World Bank 2014).

One strategy of the government to boost industry and service sector is by embedding domestic firms into global value chains (GVCs) and thereby promoting export growth and diversification (AfDB, 2014). Several industries such as export of coffee, tea, and minerals; food processing; Business Process Outsourcing (BPO); ICT; dairy and beverages could offer linkages to connect national value chains to GVCs. Current value chain activities are primarily upstream and focus on the supply of primary and intermediate inputs to export markets. However, if the Rwandan economy is to move further downstream in GVCs, which will be important for its continued strong economic development, it will also be affected by local climate change impacts on suppliers in other countries. Especially when serving international markets, delays in the supply chain may compromise relations with trading partners and customers and hence reduce potential profits.[15]

Rwanda's GDP growth projections emphasise the importance of increased capital spending for strategic government investments, investments to increase agricultural productivity, sustained industrial growth and a continuing recovery of the service sector. Moreover, through less public borrowing from the domestic financial sector and improved donor aid flow stability, private sector credits could substantially increase. In order to support the private sector's role in GDP growth, it will be crucial to address supply constraints and infrastructure bottlenecks, especially in transport and energy as well as to improve the quality of domestic raw materials.

Embedding climate change adaptation into business strategies helps to build resilience in enterprises, which will be essential for future profitability of operations and sustainable growth. While the private sector is affected by climate and weather events and changes thereof, it in turn also affects communities and the environment. In order to sustain future operations, negative impacts on resource availability, the environment and communities need to be minimised. Furthermore, new market opportunities can arise from needs to adapt to climate change across sectors. These may materialise in form of new products because of a changing climate and subsequently evolving consumer needs and preferences, or from enhanced reputation by demonstrating corporate social responsibility and a future oriented business strategy, among others.

## 2.3 Initiatives for Private Sector Development

The Rwandan government has recognised the importance of the private sector for the development of the economy and has started or supported numerous initiatives to strengthen SMEs.

**Private Sector Environment**

The Rwandan government has enacted an SME development policy in 2010. The major aim of the policy is to create an enabling environment for the growth and development of SMEs in Rwanda[16]. Several institutions and their programmes and policies are part of this enabling environment.

The **Rwanda Development Board (RDB)** coordinates all areas relevant for the Rwandan private sector. Services to companies include investment and export support, business registration, environmental and tax advice, free trade zone and IT development and cluster specific programmes. The RDB is the main agency responsible for the implementation of the SME Development Policy.

The **Ministry of Trade and Industry (MINICOM)** is the main actor responsible for creating an environment conducive to economy growth and the development of the private sector. A Single Project

[15] Chapter 14 *Business Enterprises and Foreign Trade* (p 187ff.) of the Statistical Year Book 2013 by the National Institute of Statistics of Rwanda (NISR, 2014) offers numerous tables containing information on primary trade partners, both for imports and exports. These may be useful in order to assess which climate impacts in other coutries and regions would affect Rwanda's private sector when moving further downstream in GVCs.

[16] http://www.smeportal.gov.rw/IMG/pdf/sme_business_guide-final.2-4.pdf

Implementing Unit (SPIU) has been established in 2011 and coordinates all project-related work of the ministry. This work includes the development and implementation of projects with partners such as the World Bank, African Development Bank, or the International Fund for Agricultural Development (IFAD). Projects implemented by the SPIU include the Rural Small/Micro Enterprises Promotion Project Phase (PPPMER-II), the Competitiveness and Enterprise Development Project (CEDP) and the Rwanda Investment Climate Project (RICP).

The **Private Sector Federation (PSF)** is a member-based business organisation. Founded in 1999 it replaced the former Chamber of Commerce and Industry. It is an umbrella organisation that comprises nine professional chambers, e.g. chambers for tourism, industry, women entrepreneurs or agriculture. The PSF provides training to its members, advocates their interests vis-à-vis the political actors and offers services such as business plan competitions. Through its Business Development Service Centres PSF offers consultancy services on market access, supply chains, technology and product development or access to finance to its members. PSF is cooperating with GIZ in a number of initiatives, e.g. EcoEmploi.

The **Rwanda Development Bank (BDR)** provides direct financing to SMEs and cooperatives. Additional activities are refinancing to microfinance institutions, equity financing and equipment leasing through funds.

The **Business Development Fund** is a company that manages funds from different ministries. It offers credit guarantees, loans, and business advisory services. The fund is a subsidiary of BDR.

The **Rwanda Business Development Centre** has been founded by the Regent University Center for Entrepreneurship (RCE) and the International Christian Chamber of Commerce (ICCC). It supports SME development and offers training, mentoring, consulting services, and access to a broad network of business-relevant stakeholders.

The **Rwanda Cooperative Agency (RCA)** supports the development of Rwandan cooperatives. Cooperatives are similar to SMEs but have a different legal status.

**Policy Initiatives**

The **SME Development Policy** (Ministry of Trade and Industry, 2010) has five objectives.

- Objective 1: Promote a Culture of Entrepreneurship among Rwandans; several programmes such as a Business Plan Competition implemented by PSF or the Technical, Vocational Education and Training by the Workforce Development Authority are initiatives aimed at achieving this objective.
- Objective 2: Facilitate SMEs Access to Business Development Services; The Business Development Service Center as well as trade fairs organised by the PSF are initiatives targeting this objective.
- Objective 3: Put in Place Mechanisms for SMEs to Access Appropriate Business Financing; special credit lines and guarantee funds available to SMEs through the DBR as well as the National Bank of Rwanda.
- Objective 4: Simplify the Fiscal and Regulatory Framework for SMEs Growth; a new tax regime for SMEs has been implemented in 2012 and reforms have been enacted which have made it easier for businesses to be established, deal with construction permits, register property, and trade across borders.
- Objective 5: Develop an Appropriate Institutional Framework for SMEs Development; as a result the role of the Development Bank of Rwanda and the Rwanda Development Board in the support of SME sector development has been strengthened.

The **National Industrial Policy** (Ministry of Trade and Industry, 2011) has three objectives:

- Objective 1: *Increase Domestic Production for Local Consumption;* includes export diversification and expanding production of industries in which it currently imports (e.g. palm and vegetable oils, soaps, manufactured fertilizers, cement, electrical equipment, pharmaceuticals, and metal parts, among others).

- Objective 2*: Improve Rwanda's Export Competitiveness;* escaping the 'commodity trap' by diversifying its exports (from currently primarily tea and coffee, tourism and minerals) into targeted products and services, innovating, increasing productivity, and serving higher margin / niche markets and hence moving further downstream in GVCs.
- Objective 3: *Create an Enabling Environment for Rwanda's Industrialization;* primarily investing in infrastructure (e.g. energy, roads) and human resource (skill) development, increasing access to finance, facilitating trade, strengthening the regulatory environment, ensuring access to industrial inputs and raw materials as well as promoting environmental sustainability and technology research and innovation.

## 2.4 Key findings

Rwanda's industry is at an infant stage, consisting of many informal small enterprises but growing very fast. The main impediments to industry growth and economic transformation as perceived by the government are unmet energy demand, limit and over-concentrated exports, low FDI, weak logistic system, urbanisation pressures and limited availability of long-term savings and credit. Particularly relevant for the envisioned capacity building activities by GIZ are the following findings:

- According to the statistics, there are only 38 companies (around 1% of all companies) that have more than 100 employees. Micro, small and medium-sized enterprises (MSMEs) make up the rest of the estimated 123,000 businesses operating in the country and provide 84% of private sector employment.
- The private sector is largely informal: Out of the estimated 123,000 businesses, only 14,000 firms are registered with the Rwanda Revenue Authority.
- The construction sector has been growing very fast, making up around half the GDP of the whole industry. Other sectors with positive economic dynamics include mining, tourism, agro-processing especially cultivation of coffee and tea.
- While the land area for cultivation of coffee and tea has been increasing in recent years, production volumes do not demonstrate a clearly increasing trend which implies varying yield productivity that could be connected to climate-related factors.
- The Eastern province that is projected to see more droughts hosts SME clusters that are mainly agricultural i.e. dependent on rain (rice, maize, milk).

The findings offer some implications for developing capacity building activities for the private sector.

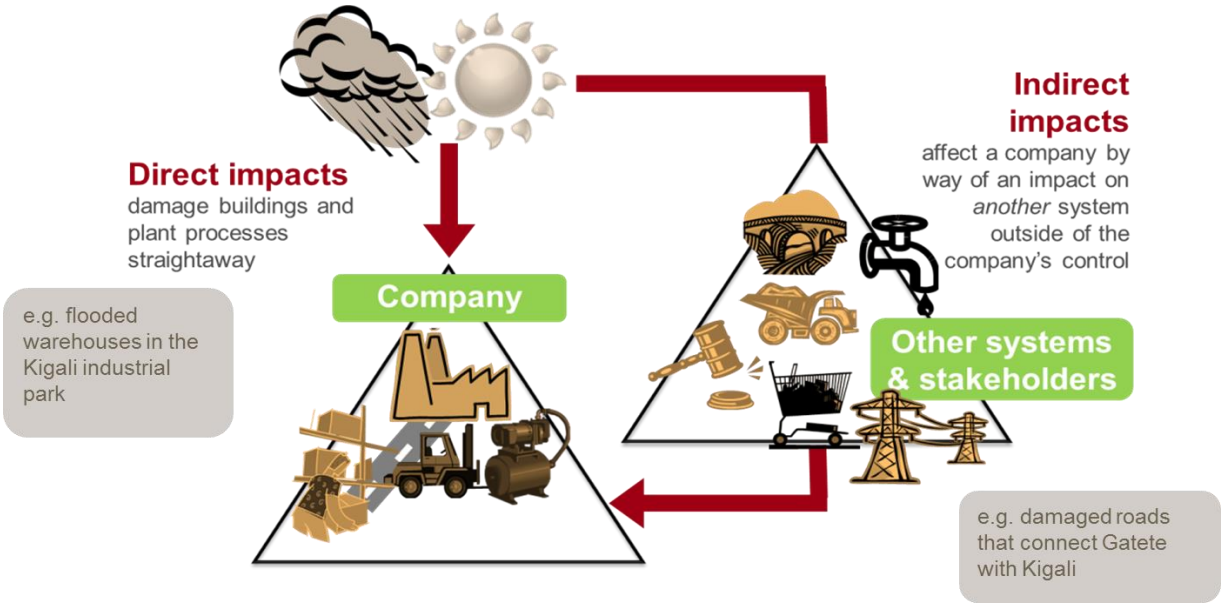
- In the EDPRS 2, the government encourages investments in the agro-processing sector and expresses the intention to support a large-scale tea expansion programme (see EDPRS 2). Against this background, capacity building on climate change impacts for agro-processing especially tea companies could be of great interest – to contribute to making the planned expansions resilient to climate change.
- The EDPRS 2 offers a number of interesting entry points, even if many of the envisioned activities might not have started yet. The strategy sketches out activities for supporting private sector investments into agro-processing, for strengthening entrepreneurship skills among young people, transforming the logistics systems, accelerating access to road infrastructure, overhauling Rwanda's mining sector through new regulations, expanding tea production, capacity building and research for increasing productivity in the coffee sector, positioning Rwanda as an attractive financial service centre in the region, establishing a Centre of Excellence on green urbanisation, initiating a pilot green city, starting an Environment and Climate Change Innovation Centre, enhancing irrigation in rural areas.
- Reaching the vast majority of businesses in Rwanda will require excellent networks as the bulk of companies are rather small and informal.
- When targeting companies with more than 100 employees the choice of companies is very limited. Hence there might be a risk of not finding a critical mass that could be required for capacity building activities. At the same time, some of the interviewed experts advised that, if they are interested, larger companies who depend on inputs of small informal businesses (e.g. tea companies who buy tea from cooperatives or small farmers) could be powerful multipliers for reaching out to MSMEs.

# 3 Climate change impacts on economic sectors

## 3.1 Overview on vulnerability of relevant economic sectors and outreach potential (of project activities)

Climate change can directly and indirectly affect a company. Direct impacts through e.g. heat, floods, landslides, water shortages etc. include damage to facilities, interruption of production processes and impacts on employees' health and safety. On the other hand, indirect impacts are effects on the systems that a company relies on, such as supplier networks, markets and government regulation. While the exposure and sensitivity to climatic conditions as well as the adaptive capacities vary between sectors and companies, some general conclusions can be drawn for Rwanda.

**Figure 8: Direct and indirect impacts (adelphi)**




Due to their current importance for the Rwandan economy and their vulnerability to climatic changes, the economic sectors agriculture (90% of working population employed there), processing of tea and coffee (major export struggling with productivity issues), tourism (priority growth sector) and mining and quarrying (important for exports) are of particular interest for capacity building on adaptation to climate change.

*Agriculture and agro-processing*

With more than 90% of Rwanda's population employed in the precipitation dependent agriculture sector and further 5% in the food and beverages industry, the livelihoods of almost the entire (domestic) population depend on local climatic conditions. Changes in precipitation and temperatures can substantially affect crop yields and consequently impact the domestic food and beverage industry as well as exports. This can be considered a serious issue since efficient irrigation techniques are not very wide-spread especially in the more rural areas of Rwanda. Maize, the cereal with the largest production volume in Rwanda is particularly vulnerable to water stress and heat changes. Even an average temperature increase of 1°C can severely damage the maize yield of a season. Consequently, the suitability of maize as a crop is projected to decrease. Similarly, coffee is extremely sensitive to changes in temperature (temperatures above 25°C reduce photosynthesis), water supply and humidity level. Additionally, higher temperatures increase the risk of new parasites and pests that

thrive in this warmer climate (MINIRENA, 2011). This is both relevant for crops, as well as for livestock. Out of the primary diseases affecting livestock, the most climate sensitive are likely ticks (e.g. ectoparasites), tick-borne diseases and trypanosomosis. In the interview series, experts reported that companies, who are processing agricultural products, e.g. processing fruit into juice, have experienced shortages of production inputs (e.g. containers or labels for their products) after landslides had blocked important transport routes to their facilities for several days. This also resulted in problems for transporting the final products to customers in Kigali. Furthermore it was pointed out that the increasing unpredictability of rainfall patterns has increased the risk for the drying out of seedlings when planting new crops or plants.

*Coffee and tea*

As coffee beans are generally sun dried, more erratic precipitation patterns and specifically rains in the harvesting season can impact the drying process. Furthermore, heavier rains can cause landslides in the mountainous terrain – where coffee and tea are usually grown – which can damage roads and cause delays in the movement of cherries to coffee harvesting stations or tea leads to processing plants after harvesting.

The quality of the coffee is highly sensitive to these delays as the coffee beans need to be processed quickly once harvested. Farmers have already been experiencing that the June-August dry season is lengthening, which causes a delay in the flowering of coffee. Weaker rains in March have similarly been prolonging the ripening process of the coffee cherries. Shortening harvesting periods cause higher peaks in production than the processing capacity allows, letting part of it go to waste because of delays. Coffee premiums can hence only be realized if the post-farm processing system demonstrates an adequate level of adaptive capacity in a changing climate (Ngabitsinze et al. 2011). Furthermore, according to the Fifth Assessment Report by the IPCC WGII, highland Arabica coffee-producing areas are at risk to see an increase in the coffee berry borer (Hypothenemus hampei) through warming temperatures. This may consequently pose a serious threat to coffee producers.

Tea is less sensitive to temperature increases than coffee but especially older varieties of tea bushes are very sensitive to droughts. Experts interviewed reported that while larger tea companies, who often own tea tree nurseries, usually have the means to replant dried up bushes, many small farmers cannot afford to replant tea bushes if they have dried up. Processing tea requires a number of energy-intense drying procedures. This can lead to business risks connected with climate change: the high heat in some parts of the production facilities can become more unbearable if temperature extremes increase which can lead to lower productivity among the workforce or health problems. The availability and/or costs of energy sources that are required for powering the drying processes might also be affected by climate change: the electricity grid can be disrupted by extreme weather events which many companies address by installing generator. But given the scarcity of fossil fuels, the price of diesel (for powering generator) is likely to increase further. When using wood for powering machinery it should be considered that growth rates of firewood (e.g. eucalyptus) might also be affected by changing climatic conditions.

*General manufacturing*

Companies from the manufacturing sector make up 97% of the industry of Rwanda. While there are very few pieces of information in publicly available reports on impacts of climate change in the manufacturing sector, discussions with experts from industry associations and from companies imply that that this sector is affected by extreme weather in different ways. Businesses have experienced floods on their premises during heavy rainfalls. In most cases serious damages could be avoided but stored materials were damaged beyond repair and cleaning efforts, especially when mud slides happened as well, took days. Similarly to impacts described in the coffee and tea sector, manufacturing companies have also been affected by damages to roads and electricity infrastructure. Lack of water for production processes or impacts of heat on production process has not been reported in the interviews. Interrupted deliveries of essential production inputs from suppliers abroad due to extreme weather events were not mentioned either.

*Tourism*

Having grown in revenues from RWF 40 billion in 2006 to around RWF 80 billion in 2012 (figures refer to hotels and restaurants) tourism is a major economic sector in Rwanda's economy and Rwanda's

largest earner of foreign exchange. To sustain the viability of this sector, conservation of biodiversity hotspots and provision of adequate climate resilient infrastructure is vital for the country's economic development (SEI, 2009). Nyungwe forest in the Southwest is home to the mountain gorillas that attract a substantial share of tourism every year. Similarly, chimpanzees are found in the Gishwati forest, located in the Northwest of the country (IIED, 2013). The mountainous areas are often difficult to reach and particularly vulnerable to landslides, due to the expected increase in precipitation. Furthermore, higher temperatures and precipitation could reduce viable habitat and allow the spread of diseases. Protecting these unique and endangered species and habitats as well as climate-proofing transportation, buildings and emergency infrastructure is crucial for the sustained income from tourism.

*Mining and quarrying*

The major climate risk to the mining and quarrying sector is increased precipitation and more erratic rainfall potentially resulting in stronger and more frequent floods and landslides. While these climate phenomena impact production volumes by damaging sites and their infrastructure, they also compromise health and safety of workers. A large part of mining in Rwanda is informal and located in the North and West of the country, which is particularly prone to these natural disasters because of their wet climate and mountainous topography. However, experts commenting on the vulnerability of the sector mentioned that mining as a sector currently has a very strong dynamic and many technical and regulatory issues to struggle with, making it a very complex sector to engage with.

General issues affecting the economy exacerbated by climate change

*High electricity prices compared to regional average*

Due to an inadequate energy infrastructure, Rwanda's electricity prices of USD 0.22/kWh are more than twice as high as the regional average of USD 0.10 to-0.12/kWh. This bottleneck substantially reduces competitiveness of domestic production and hence limits the opportunities for inclusion in GVCs (AEO, 2014). Climate change impacts and more stringent regulations on electricity regulation are likely to further inflate local energy prices. Hydropower contributes about 50 percent to electricity generation, making the power sector and electricity intensive sectors dependent on grid-power vulnerable to changes in precipitation and evaporation (MINIRENA, 2011). Floods through increased rainfall cause soil erosion and siltation that can damage dams and droughts reduce the generating capacity of hydroelectric dams.

## 3.2 Assessment of affected regions

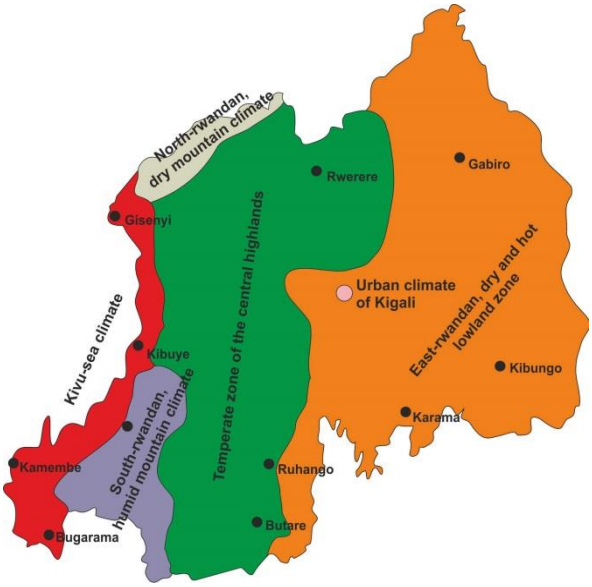



**Figure 9: Climatic zones in Rwanda based on data from 1996-2011** (Source: Henninger, 2012)

**Climatic zones**

Data gathered between 1996 and 2011 suggests that the previous four-part climate zone scheme has shifted to a six-part climatic map (see figure 8). Accordingly, the dry and hot lowland climate of the East has expanded further west in central Rwanda. Part of the Northern mountain climate has shifted towards the temperate zone of the central highlands and further west has developed a new climatic zone, the North-Rwandan dry mountain climate, suggesting that it became drier. The mountain climate zone in the South has become more humid, on the other hand. The Kivu-sea climate in the West does not seem to have recorded substantial changes.

**Disease occurrence**

With rising average temperatures, diseases are likely to spread to new areas that were previously not affected. There are seven vector-borne diseases affecting human health in Rwanda. Out of

these, malaria, tick bite fever and bilharzia/schistosomiasis are the most likely to be affected by climate change (MINIRENA, 2011). This may even affect health of the human population in such areas more strongly, as gene pools have not previously been exposed to these diseases and hence have likely not yet developed any resistance.

**Extreme weather events and natural disasters**

Overall, the districts most prone to disaster include Rubavu, Musanze and Burera in the North, Karongi and Nyamasheke in the West, Gasabo in central Rwanda, and Kirehe in the South-East (In2EastAfrica, 2014). However, most of Rwanda is vulnerable to natural disasters that are exacerbated through climatic changes such as droughts, floods and landslides, predominantly. The Ministry of Disaster management and Refugee Affairs (MIDIMAR) developed the following overview map:[17]

Natural disasters often have detrimental impacts on affected communities. Particularly in poor areas, construction of buildings and their location often are not able to withstand such natural forces. Livelihoods are easily destroyed when flooding and landslides damage fields, storages, machines, infrastructure, and buildings, for example, as well as droughts killing livestock. Due to its diverse topography, different districts in Rwanda are exposed to a different set of risks.

*Floods and landslides*: Due to its mountainous topography and high annual precipitation in large parts of the country, Rwanda is vulnerable to floods and landslides. The North-Western areas of Nyabihu, Gicumbi, Rubavu, Musanze, Burera, Gakenke, Rutsiro, and Ngororero, as well as Nyamagabe, Kamonyi, and Bugesera in the South and South-East are the most affected areas.[18] Triggering factors such as deforestation, inappropriate farming and poor housing techniques as well as changing precipitation patterns due to climate change exacerbate the vulnerability of these areas (MIDIMAR, 2012). The flood in 2007 caused the largest economic damage among the natural disasters recorded between 1980 and 2010.

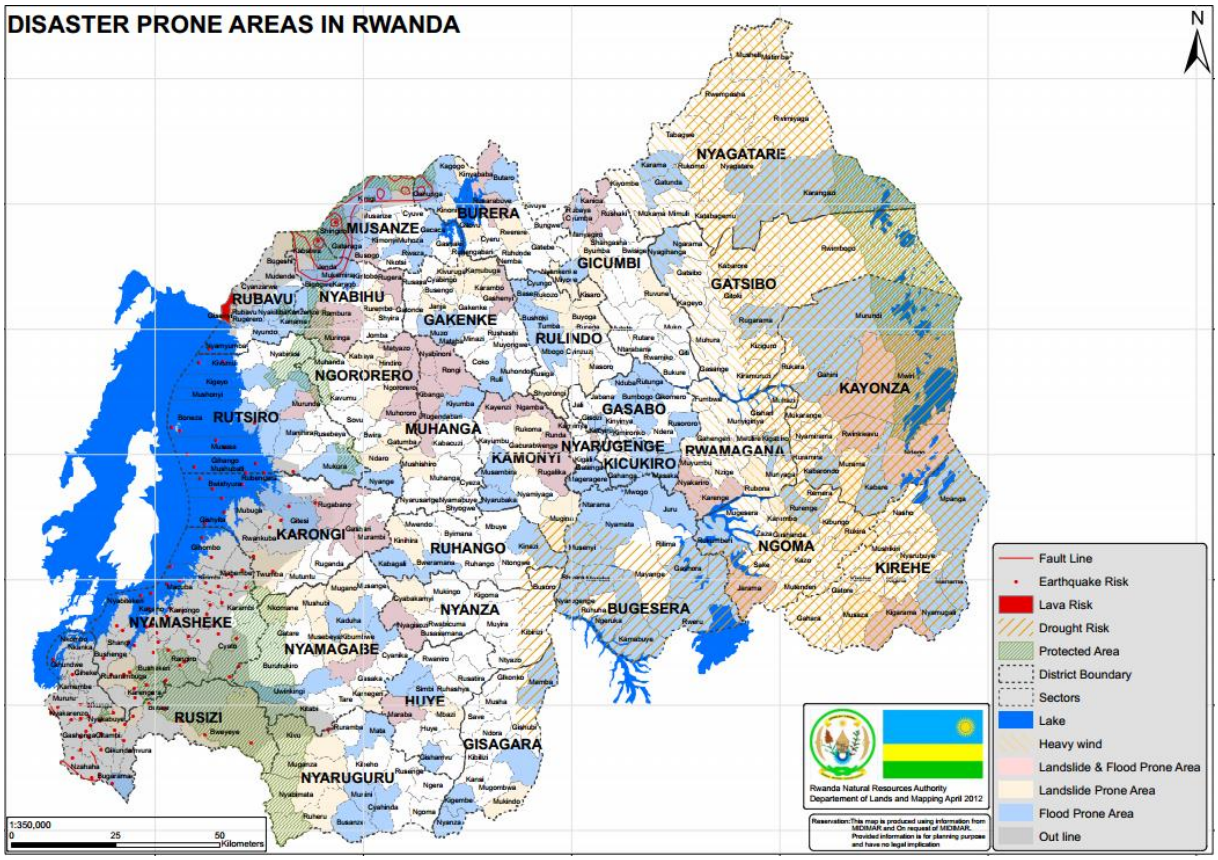



**Figure 10: Overview map of disaster prone areas in Rwanda (source: MIDIMAR).**

[17] The map can be found and enlarged at : http://midimar.gov.rw/uploads/tx_download/All_Disasters_map_in_Rwanda_01.pdf.

[18] See Appendix 4 for a map of flood and landslide prone areas in Rwanda.

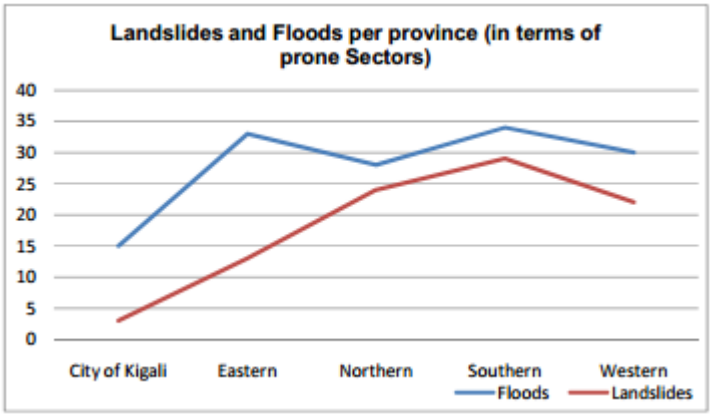



Figure 11: Floods and landslides per province (Source MIDIMAR, 2012)

| Province | Floods | Landslides |
|---|---|---|
| City of Kigali | 15 | 3 |
| Eastern | 33 | 13 |
| Northern | 28 | 24 |
| Southern | 34 | 29 |
| Western | 30 | 22 |

Table 10: Floods and landslides by province

*Droughts*: The drought in 2003 affected the largest number of people to that date (1,000,000 people affected; 890,000 in 1999, and 420,000 in 1984). Overall, droughts affected the most people when compared to other natural disasters (PreventionWeb, 2010). Mostly the Eastern provinces are at risk of droughts (ReliefWeb, 2009).[19] As the Eastern province is heavily agriculture based, droughts pose a serious risk to its local economy and the private sector.

## 3.3 Implications for industries and regions

As illustrated in the previous sections, Rwanda faces a number of challenges regarding local climatic changes, vulnerability to natural disasters as well as economic development and infrastructure enhancement. The following figure gives an overview of the current primary products of MSMEs in the different provinces, potential future products (based on MINICOM, 2011) as well as major natural disasters most common to occur in the respective province and likely to be exacerbated by climate change.

[19] See Appendix 4 for a map of drought prone areas in Rwanda.

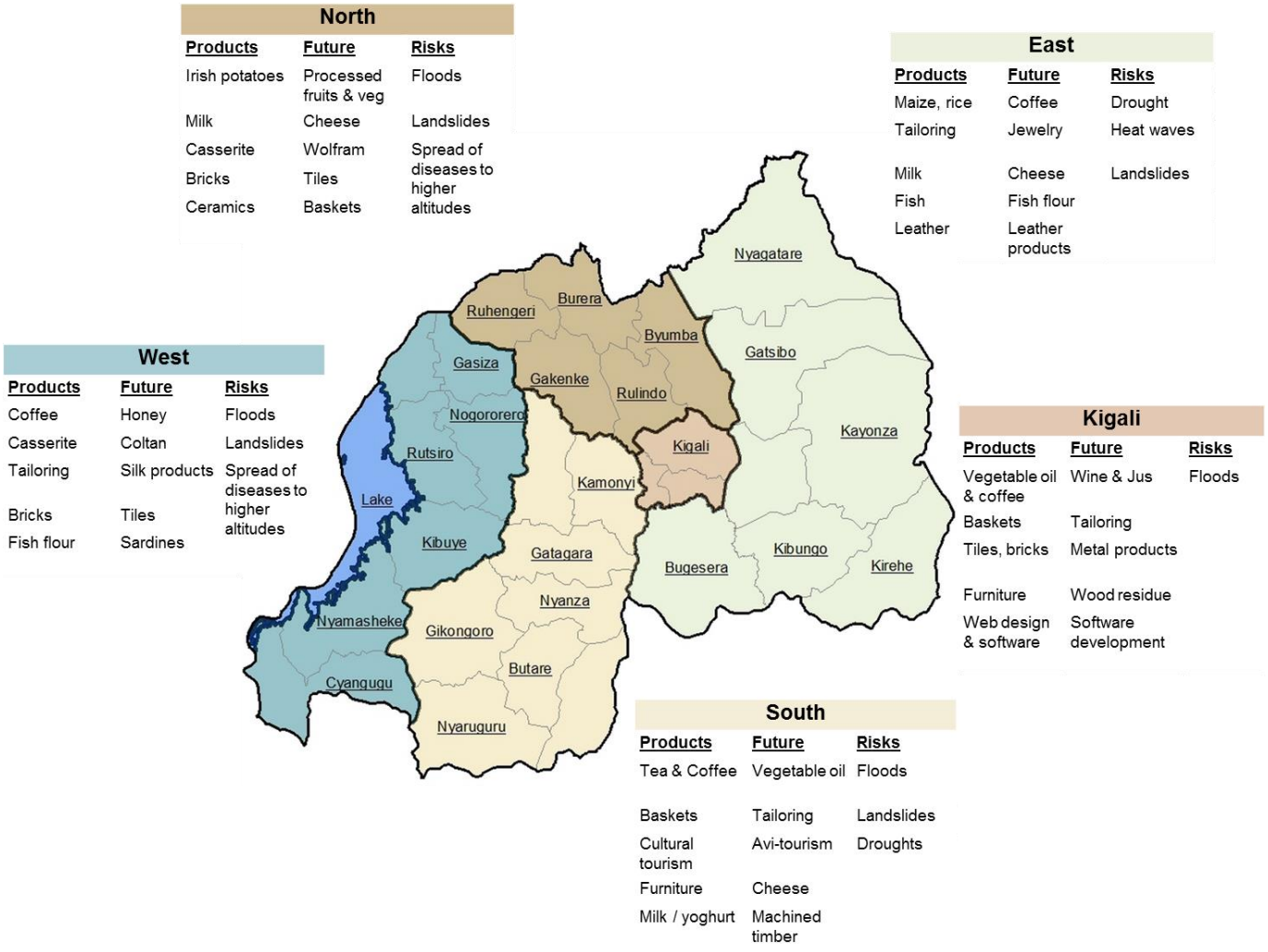



**Figure 12: Current primary MSME sector products, potential future products, and risks of natural disasters exacerbated by climate change in the different provinces**

The following assumptions can be inferred for the five provinces based on the literature review and the information gathered. However, these need to be verified and potentially adapted through local assessments and interviews.

*Kigali Province*

Rwanda's capital Kigali City and the surrounding districts are the centre of commerce in Rwanda. The main economic sectors in which MSMEs operate are cultivation and processing production of coffee, vegetable oil, construction materials such as tiles and bricks, and furniture, handicraft in form of baskets as well as web design and software services. One of the primary climate risk in this province are floods, which can damage materials and production facilities, compromise workers health and safety as well as destroy electronic equipment and data storage. Gasabo is actually one of the most flood-prone districts in the country. The MINICOM predicts that this province has strong potential of producing higher value goods such as wine and juice and metal products as well as move further downstream in value chains by expanding tailoring and developing software (MINICOM SME, 2011). The increasing risk of flooding through a changing climate could substantially impact such new companies without adequate adaptive capacity of facilities, equipment and processes.

*Southern Province*

The Southern province faces the risk of increased floods and droughts throughout and to a lesser extent with respect to droughts in the South-east. Primary products of the MSME sector are tea and coffee, baskets, furniture as well as fresh milk and yoghurt. Cultural tourism is another major source of

income. The Nyungwe forest that is home to one of the country's main attractions – the mountain gorillas – is situated in the South-west and extends into the Western province. Climate change impacts are likely to increase the intensity and frequency of natural disasters, which would cause more delays in production chains and may decrease tourism to affected regions because of safety concerns and damaged infrastructure, e.g. road blocks after landslides triggered by heavy rain.

Other sectors likely to offer new market opportunities to MSMEs are expected to include production of vegetable oils and cheese, avi-tourism (i.e. bird-watching), tailoring and machined timber. As landslides pose a major risk to many regions of this province, an expansion of the timber industry may increase deforestation and erosion and landslides with it if not managed adequately.

*Western Province*

The Western province with its hilly topography, high precipitation, Lake Kivu and Nyungwe forest in its Southern part has a plethora of economic opportunities. Currently, the predominant sectors of MSMEs are coffee, mining (primarily casserite), tailoring and the production of bricks and fish flour. The region in the North of the Western province is expected to experience decreasing average annual precipitation (Henninger, 2012), which may negatively impact the coffee industry. Rubavu district in the same region as well as Karongi and Nyamasheke further south belong to the most disaster prone areas in Rwanda.

As mentioned earlier, part of the Nyungwe forest with its mountain gorillas is situated in the South of the Western province. The study conducted by Henninger (2012) suggested that this area has become more humid in the past few decades. With rising average temperatures and increases in average annual precipitation, there is a significant risk of vector borne diseases spreading to higher altitudes. Affecting humans and also potentially wildlife, this may hamper the development of the tourism sector. At the same time, the tourism industry needs to minimise its impacts on the environment and communities, conserving habitats and ecosystems, as well as improving livelihoods of local communities in order to ensure sustainable tourism for the future.

MINICOM estimates that sectors with the greatest future opportunities for MSMEs include honey production, manufacture of silk products and tiles, increased mining of coltan, and sardine aquaculture. Climate risks such as floods (predominantly in the North) and landslides (in mountainous areas), which are likely to increase in frequency and intensity, can damage such production sites, equipment, mines and infrastructure, increasing costs and causing delays in production processes.

*Northern Province*

The current MSME landscape in the Northern province primarily focuses on cultivation of Irish potatoes, fresh milk production, casserite mining and manufacture of bricks and ceramics. Two districts in this province, namely Muzanze and Burera, belong to the most disaster prone in Rwanda. Primarily floods and landslides occur in this area and may be exacerbated in a changing climate. Another climate risk is the potential spreading of vector borne diseases to higher altitudes with increasing average temperatures.

Potential new market opportunities for MSMEs in this province could be processing of fruits and vegetables, cheese production, wolfram mining, manufacturing of tiles and handicraft like traditional baskets. As in the other provinces, new private companies and sectors have the opportunity to incorporate climate change adaptation into their practices and processes in order to develop long-term strategies in a changing climate.

*Eastern Province*

The Kirehe district in the south-east of this province belongs to the most disaster prone districts in Rwanda. In most of the Eastern province drought is a severe risk. At the same time, most areas are also prone to floods and landslides, which can be exacerbated by the sudden shift from a long dry period to sudden, heavy rains that the soil cannot adequately absorb. As droughts are expected to become more severe in the Eastern Province and rainfall generally more erratic through climate change, intensity and frequency of floods and landslides may also increase. Bugesera in the South is already particularly flood-prone.

Currently, the economy of the Eastern province is largely agriculture based with the cultivation of maize and rice, and the production of fresh milk, fish and leather among the primary activities in the

MSME landscape. Varieties of maize and rice currently used are quite sensitive to higher temperatures and water stress, which may decrease already low yield productivities in a changing climate. Similarly, livestock and fish ponds are often severely affected by droughts, impacting the production of milk, fish and leather.

As MINICOM expects the local economy to move into products further up in the value chain, such as cheese, fish flour and leather products, new companies in these sectors should anticipate potential future climate impacts and incorporate adaptation into their business operations early on. Similarly, future revenues from expanding coffee cultivation are at risk as coffee is highly sensitive to high temperatures and heat waves are expected to become more frequent and longer in duration.

## 3.4 Key findings

The pieces of information gathered on impacts on different economic sectors holds a number of implications when designing capacity building activities.

- Since the government is in the process of enlarging the capacities for tea cultivation and processing and the since there is a high vulnerability to climate change for tea plantations, this sector might constitute an interesting entry point.
- As there are ongoing capacity buildings for coffee growers and staff in coffee washing stations and given there is high vulnerability to climate change for coffee plantations, this sector might constitute an interesting entry point.
- Agriculture is undeniably a field that is of high relevance for the Rwandan economy and people and will be strongly affected by climate change impacts. Since the capacity building will have to focus on businesses rather than on farmers, targeting the agro-processing sector seems to be imperative as this sector is affected both by the risks relevant to agriculture as well as the risks that are affecting the general manufacturing sector. Agro-processing companies could also provide a promising outreach to the communities and cooperatives that they are connected with.
- General manufacturing as a key part of the Rwandan industry would be an interesting focus for capacity building activities as well, given the economic importance and multiple direct and indirect impacts.
- The mining sector has some vulnerabilities and will be overhauled with a new legal framework in the near future, hence it could constitute an interesting entry point for the GIZ project. However, as mentioned above, the strong dynamics and looming regulations can make the environment for and in which the capacity building activities are implemented difficult to navigate.
- As tourism is of economic importance, was selected as a priority growth sector by the government of Rwanda, will be transformed by future governmental plans (establishing a “tourist circuit”, a road networks that makes it easy to visit all major sights on a circular route) and is vulnerable to climate change in different ways, e.g. damages to road infrastructure or loss of biodiversity due to climatic changes), it could be a suitable entry point for capacity building activities as well. However, the tourism sector is very fragmented into small companies with very short planning horizons.
- A cross-cutting issue for many of the entry points mentioned in this chapter and further above is the transport and logistic sector and road infrastructure. All this is needed for transporting commodities destined for export, connecting farmers in rural areas to local markets or for tourists to get around in the country. With numerous landslides that were blocking roads in past years and the ambitious plans in the EDPRS 2 for transforming Rwanda’s logistics system, the cross-cutting issue of infrastructure for business could also be a potential entry point for this project. However, identifying partners and creating ownership for capacity building processes might be more challenging in this case – since unlike with industrial sectors there is not a dedicated business association dealing with infrastructure issues.
- While regions are affected differently by climatic changes, experts advised that given the small size of Rwanda, logistics or geography do not require focussing capacity building activities on one region. Starting the development of capacity building activities with particular economic sectors in mind will be more promising then starting by focussing on a particular region.

# 4 Climate change adaptation in Rwanda

This chapter provides an overview on national initiatives, publications and actors concerned with climate change adaptation that could be relevant to connect with before or during developing and implementing capacity building activities on adaptation for the private sector.

## 4.1 Initiatives, publications and organisations

In 2005, the Government of Rwanda (GoR) published a "National Communication" (NATCOM) to report on the status of climatic changes and their impacts in Rwanda. This was down in line with requirements for least developed countries under the United Nations Framework Convention on Climate Change. As a first step in planning adaptation activities, the GoR drafted a "National Adaptation Programme of Action" (NAPA) in 2006, building on the NATCOM and stressing the fact that agriculture is the most vulnerable sector in the country, requesting support for expanding irrigation schemes and increasing capacities for innovative irrigation and farming techniques.

The **Rwanda Environmental Management Authority (REMA)** was mandated by the GoR to manage all activities of the Rwandan state with regard to the climate change impacts and adaptation. In the "Rwanda State of Environment and Outlook Report" 2009, REMA published a chapter on "Climate Change and Natural Disaster", discussing recent natural disasters and how they could be connected to climate change. Floods and landslides were singled out as disasters with high damage potentials that could become more severe and frequent in the future.

In 2010, the GoR published a new NAPA that contains a more detailed vulnerability assessment of different sectors, again touching on agriculture as the most vulnerable one. The document contains very concrete proposals for adaptation actions, two of which received funding for implementation under the NAPA-process: the establishment of an early warning system for a wide range of disasters and a project on the restoration of ecosystems.

In the following year, the GoR integrated the issues of economic development, climate change mitigation and adaptation in the "Green Growth and Climate Resilience Strategy – National Strategy on Climate Change and Low Carbon Development" (2011). The strategy includes inputs from many ministries, sets a framework and establishes priority actions to coordinate the work of different governmental bodies. In the realms of climate resilience and adaptation it calls for irrigation infrastructure, robust road networks, the establishment of a Centre for Climate Knowledge for Development and fostering agroforestry.

In 2012, the Unit of Research and Public Awareness within the **Ministry of Disaster Management and Refugee Affairs (MIDIMAR)** published a report on "Disaster High Risk Zone on Floods and Landslides" in which key terms for disaster risk management are defined and a methodology for mapping out different risks at varying scales is suggested. Some maps on floods and landslides were developed for this report (see appendix 4). In the same year, the implementation of the **National Climate Fund FONERWA**, located at REMA, was begun. The fund provides grants and loans for mitigation and adaptation activities and is directed at companies as well as regional and local governments. While many businesses had submitted proposals for receiving funding so far no business proposal has made it to the final funding stage, for a variety of reasons. Partly to also raise awareness for the opportunities FONERWA offers, REMA and the Private Sector Federation conducted an awareness raising tour in 30 districts, engaging with representatives of business associations on the issue of climate change.

A key strategy for development in Rwanda that has high relevance was touched upon above already: the Economic Development and Poverty Reduction Strategy 2013 – 2018 (EDPRS 2), "Shaping our Development". It proposes many new measures in different fields but also picks up measures and ideas from earlier strategies and frames them in very distinct desired outcomes that are aimed to be realised by 2018, e.g. the establishment of an Environment and Climate Change Innovation Centre that is foreseen to cooperate with FONERWA and will support the private sector. Meanwhile, the

**Rwandan Meteorological Agency** has begun to widen its network of weather stations across Rwanda, aiming at improving their forecasts and engaging more with potentials users of their data – to learn about their needs and increase their understanding of what the Agency can offer to them. MIDIMAR has also become more active in distributing information: they have established a distaste committee network which collects information on recent disasters and the damages they have done and then distributes said information via SMS to members of the network.

The range of activities shows that the awareness for climate change within national bodies is relatively high and that the development of structures for dealing with climate change impacts has been on the national agenda for more than ten years now. There is a strong strategic framework and a unique fund in place to support adaptation activities. The envisioned capacity building activities could benefit from connecting with these initiatives which could create synergies for everyone involved. For a number of reasons, climate change impacts on the private sector have so far only been touched upon within the margins of the initiatives mentioned above – the planned capacity building activities by GIZ could contribute to building awareness and knowledge on this important issue.

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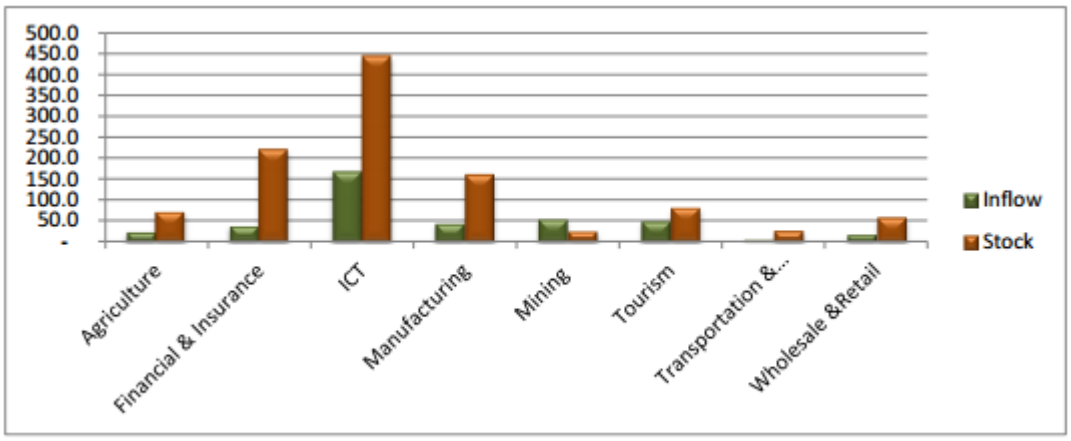
# 6 Appendix

## 6.1 Appendix 1

**Figure 13: Foreign private investment inflows and stocks by sector (in US$ million) in 2012 (Source: NBR, 2012)**




***Source:*** *Foreign Private investment 2012*

## 6.2 Appendix 2

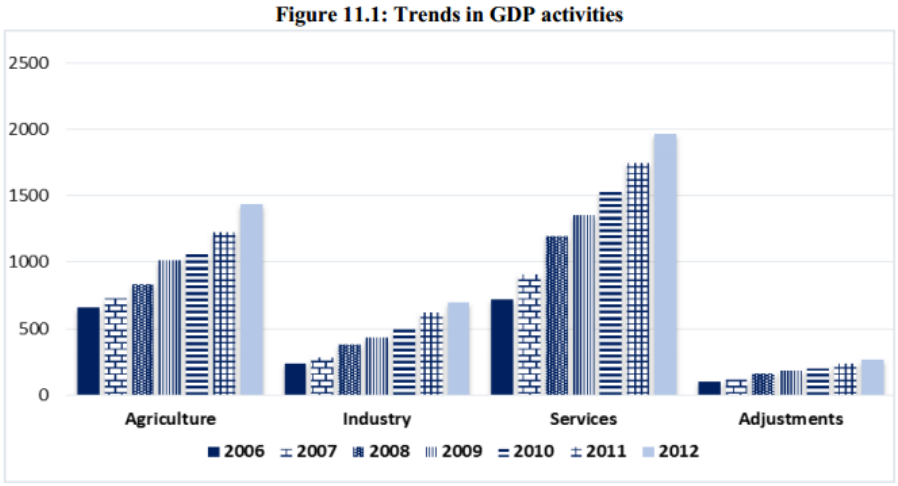
**Table 11: Macro-economic aggregates and GDP contributions by the different sectors (Source: NISR, 2014)**

**Table 11.1.1: Macro-economic aggregates**

| **Goss Domestic Product (RwF billions)** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|
| **GDP at current prices** | **2,574** | **2,985** | **3,277** | **3,828** | **4,363** |
| Growth rate (%) | 26 | 16 | 10 | 17 | 14 |
| **GDP at constant 2006 prices** | **2,060** | **2,184** | **2,349** | **2,540** | **2,734** |
| Growth rate (%) | 11.50 | 6.00 | 7.60 | 8.60 | 8.00 |
| **Implicit GDP deflator** | **125** | **137** | **139** | **151** | **160** |
| Growth rate (%) | 13.00 | 9.00 | 2.00 | 7.00 | 5.90 |
| **GDP per head (in '000 RwF)** | **262** | **295** | **315** | **357** | **395** |
| **GDP per head (in current US dollars)** | **479** | **519** | **540** | **595** | **644** |
| **Proportion of GDP** | | | | | |
| **Total final consumption expenditure** | - | - | - | - | - |
| Government (%) | 15 | 15 | 16 | 15 | 15 |
| Private includes changes in stock (%) | 78 | 83 | 83 | 83 | 82 |
| Gross capital formation (%) | 23 | 22 | 21 | 21 | 23 |
| Resource balance (%) | -16 | -19 | -20 | -19 | -20 |
| Value added by | | | | | |
| Agriculture (%) | 32 | 34 | 32 | 32 | 33 |
| Industry (%) | 15 | 14 | 15 | 16 | 16 |
| Services (%) | 46 | 45 | 47 | 46 | 45 |
| Adjustments (%) | 6 | 6 | 6 | 6 | 6 |
| **National income and expenditure (FWR billions)** | | | | | |
| **Gross Domestic Product at current prices** | **2,574** | **2,985** | **3,277** | **3,828** | **4,363** |
| Factor income from abroad, net | -19 | -21 | -27 | -33 | -45 |
| **Gross National Income** | **2,555** | **2,964** | **3,250** | **3,795** | 4,318 |
| Current transfers, net | 244 | 298 | 330 | 450 | 331 |
| **Gross National Disposable Income** | **2,799** | **3,262** | **3,581** | **4,245** | **4,646** |
| Less Final consumption expenditure | -2,395 | -2,918 | -3,237 | -3,740 | -4,225 |
| **Gross National Saving** | **404** | **344** | **344** | **505** | 425 |
| Less Gross capital formation | -585 | -644 | -688 | -818 | -997 |
| **Net lending to the rest of the world** | **-181** | **-300** | **-344** | **-313** | **-572** |
| **Memorandum items** | | | | | |
| **Total population (millions)** | **9.80** | **10.10** | **10.40** | **10.70** | **11.00** |
| **Growth rate (%)** | **2.90** | **2.90** | **2.90** | **2.90** | **2.90** |
| **Exchange rate: FRW per US dollar** | **547** | **568** | **583** | **600** | **614** |
| **Growth rate (%)** | **0** | **4** | **3** | **3** | **2** |

*Source: NISR (National Account)*

Figure 14: Trends in GDP activities




## 6.3 Appendix 3

Table 12: Selected new industrial firms starting operations 2012/13 (Source: MINICOM, 2013)

| Industry name | Product | Location |
|---|---|---|
| Kinazi Cassava Factory | Cassava flour | Ruhango |
| Pure Vegetable Oil | Cooking Oil | Kamonyi |
| Mount Meru Soyco | Cooking Oil | Kayonza |
| Blessed Dairy | Dairy products | Gicumbi |
| AGROPHARM | Insecticide | Musanze |
| Alpha Choice Rwanda | Fish processing | KSEZ |
| Mayenge Rice Mill | Rice | Bugesera |
| Gatsibo Rice Mill | Rice | Gatsibo |
| Kirehe Rice Mill | Rice | Kirehe |
| Mukunguri Rice Mill | Rice | Kamonyi |
| Ruhango Rice Milling | Rice | Ruhango |
| Mushubi Tea Factory | Tea | Nyamagabe |
| Gatare tea factory | Tea | Nyamasheke |
| Rutsiro tea factory | Tea | Rutsiro |
| Karongi tea factory | Tea | Karongi |
| Mulindi tea factory | Tea | Gicumbi |
| Shagasha tea factory | Tea | Nyamasheke |
| Mibirizi Coffee and Food Stuffs Ltd | Coffee | Nyarugenge |
| Dormans Coffee Ltd | Coffee | Kicukiro |
| East Africa Granite industries | Construction materials | Nyagatare |
| Premier Medical Rwanda Ltd. | Pharmaceuticals | Gicumbi |

Table 13: Average market prices for key food security crops (RWF / kg) (Source: MINAGRI)

| Crop | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| **Rice** | 579 | 622 | 571 | 652 | 719 |
| **Cassava (Flour)** | 146 | 182 | 242 | 160 | 201 |
| **Banana** | 86 | 108 | 111 | 133 | 133 |
| **Sweet potato** | 60 | 93 | 86 | 107 | 129 |
| **Irish Potato** | 113 | 136 | 131 | 135 | 186 |
| **Maize** | 199 | 232 | 183 | 227 | 252 |
| **Sorghum** | 212 | 247 | 227 | 238 | 346 |
| **Beans** | 313 | 276 | 292 | 306 | 324 |

*Source: MINAGRI*

**Table 14: Land area under cultivation for major cash crops (in 1,000 hectares) (Source: NAEB)**

| Years | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Coffee | 29.00 | 31.32 | 32.71 | 35.10 | 41.76 |
| Tea | 12.50 | 12.58 | 13.55 | 15.10 | 15.38 |
| Sugar cane | 3.60 | 3.60 | 3.70 | - | - |

*Source: NAEB*

**Table 15: Production of major cash crops (in tons) (Source: NAEB)**

| Years | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Coffee | 21,283 | 15,941 | 19,319 | 16,372 | 19,955 |
| Tea | 19,965 | 20,535 | 22,248 | 24,066 | 22,502 |
| Sugar cane | 63,001 | 100,663 | 115,304 | - | - |

*Source: NAEB*

**Table 16: Volumes of fisheries for selected areas (in tons) (Source: RAB)**

| | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Ruhengeri | 244.00 | 220.00 | 482.00 | 166.00 | 717.00 |
| Rwamagana | 3,316.00 | 1,377.00 | 658.00 | 1,058.00 | 1,438.00 |
| Kivu | 8,121.00 | 9,848.00 | 10,601.00 | 10,438.00 | 15,333.00 |
| Other zones | 0.00 | 0.00 | 0.00 | - | 1,857.00 |
| **Total** | **11,682.00** | **11,445.00** | **11,741.00** | **11,662.00** | **19,344.00** |

*Source: RAB/ Animal Resource Extension*

**Table 17: Livestock products (in tons) (Source: RAB)**

| Product | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Milk | 257,480 | 334,727 | 401,672 | 442,337 | 503,130 |
| Meat | 69,637 | 65,863 | 79,035 | 73,633 | 76,830 |
| Fish | 12,594 | 14,104 | 16,924 | 15,526 | 19,345 |
| Eggs | 2,327 | 3,268 | 3,921 | 5,736 | 6,324 |
| Honey | 1,654 | 2,684 | 3,221 | 3,221 | 3,785 |
| Hides & skin | 4,496 | 4,098 | 5,327 | 4,017 | 3,814 |

*Source: RAB/ Animal Resource Extension*

**Table 18: Development of Hotel and room numbers between 2009 and 2012 across districts (Source: RDB, 2014)**

| DISTRICT | Number of Hotels | | | | Number of Rooms | | | |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2009 | 2010 | 2011 | 2012 |
| Bugesera | 1 | 1 | 1 | 1 | 52 | 52 | 52 | 52 |
| Burera | 1 | 1 | 1 | 1 | 9 | 9 | 9 | 9 |
| Gasabo | 28 | 32 | 81 | 83 | 670 | 746 | 1695 | 1734 |
| Gicumbi | 5 | 5 | 5 | 5 | 74 | 74 | 74 | 74 |
| Huye | 16 | 19 | 19 | 19 | 379 | 450 | 450 | 450 |
| Karongi | 5 | 5 | 5 | 6 | 198 | 198 | 198 | 238 |
| Kayonza | 1 | 3 | 3 | 5 | 60 | 73 | 73 | 87 |
| Kicukiro | 9 | 11 | 41 | 42 | 176 | 220 | 447 | 477 |
| Kirehe | 1 | 1 | 1 | 3 | 9 | 9 | 9 | 27 |
| Muhanga | 17 | 18 | 18 | 18 | 291 | 308 | 308 | 308 |
| Musanze | 17 | 22 | 48 | 51 | 362 | 535 | 760 | 821 |
| Ngoma | | 5 | 5 | 5 | | 73 | 73 | 73 |
| Nyagatare | 4 | 4 | 4 | 5 | 100 | 100 | 100 | 125 |
| Nyamagabe | 5 | 6 | 6 | 6 | 87 | 97 | 97 | 97 |
| Nyamasheke | | 1 | 1 | 1 | | 24 | 24 | 24 |
| Nyanza | 3 | 3 | 3 | 3 | 45 | 45 | 45 | 45 |
| Nyarugenge | 35 | 40 | 44 | 47 | 855 | 1016 | 1076 | 1149 |
| Rubavu | 25 | 28 | 59 | 59 | 316 | 410 | 735 | 735 |
| Ruhango | 2 | 2 | 2 | 2 | 16 | 16 | 16 | 16 |
| Rusizi | 10 | 10 | 10 | 10 | 196 | 196 | 196 | 196 |
| Rwamagana | 3 | 3 | 3 | 3 | 63 | 63 | 63 | 63 |
| **Rwanda (Total)** | **188** | **220** | **360** | **375** | **3,958** | **4,714** | **6,500** | **6,800** |

*Source: RDB*

## 6.4 Appendix 4

Figure 15: Flood and Landslide Risk Location in Rwanda (Source: MIDIMAR, 2012)

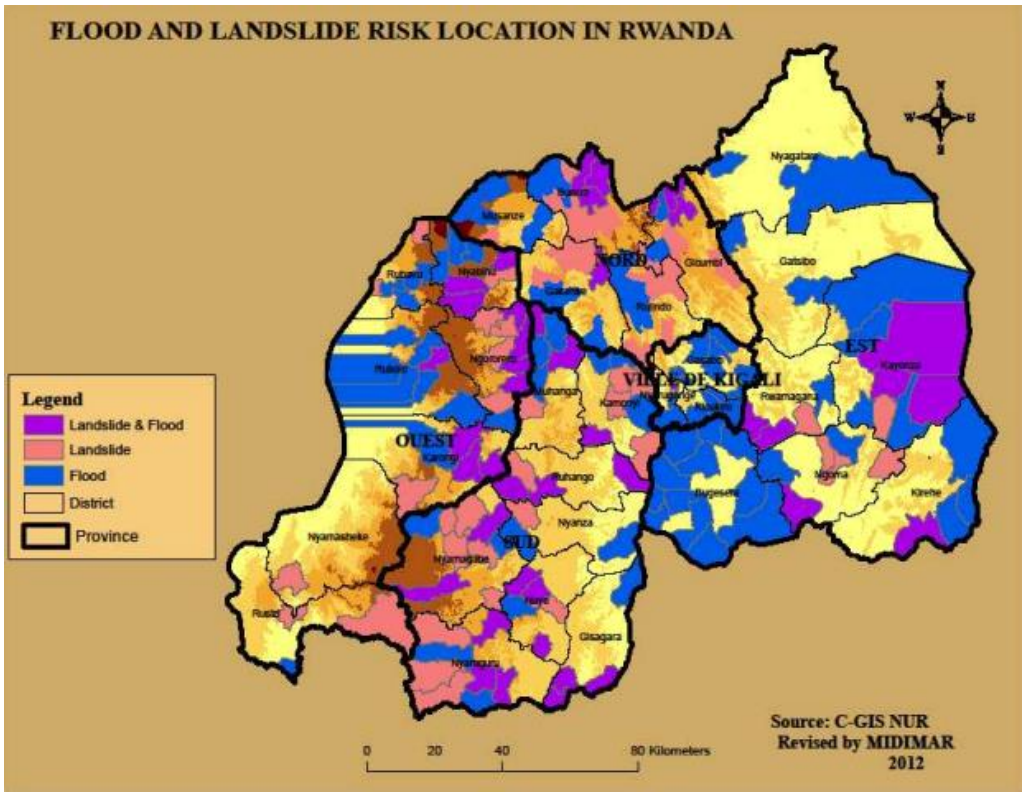



Figure 16: Drought Analysis (Source: WFP-VAM, 2009)