

## A Status of Food Security in Mauritius in face of Climate Change

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**Abstract:** The intergovernmental panel on climate change (IPCC) has concluded that small island states, low-lying countries and least developed countries are likely to experience some of the most severe impacts of climate change and climate variability. Consequently, these countries will be facing many difficulties to attain the millennium development goals (MDGs). The primary cause is that developing countries lack resources and other capacities to deal with climate related disasters. In addition, the economies of these countries depend on sectors and resources that are very much susceptible to climate change and variability, for instance; agriculture, coastal resources, and water resources. The agricultural sector plays a vital role in lowering the vulnerability of small islands developing states, by ensuring food security, generating income and consequently alleviating poverty. But since the agricultural sector is climate dependent, climate changes may affect the food system in several ways, ranging from direct effects on crop production, to changes in market prices and changes in the supply chain infrastructure. These pressures have led to increasing concerns about achieving food security in small island developing states (SIDS). SIDS are looking for opportunities to diversify their economies, especially the agricultural sector, with much concern on food security and self-reliance. This study was about an evaluation of the current status of the food system in Mauritius, highlighting the thrust areas where stronger focus are required in order to properly address food security in the face of climate change.

**Key Words:** Climate change, food security, island

### 1. INTRODUCTION

Mauritius is a small island isolated from any large land masses and is situated in the southwestern part of the Indian Ocean between latitude 19°58' and 20°32' S and longitude 57°17' and 57°46' E. It is of volcanic origin and covers an area of 1865 km<sup>2</sup>. The island consists of a central plateau surrounded by mountains ranges and plains. Despite being a small island, the climate of Mauritius varies widely from region to region because of its topography. Below the 400 meters on the windward (southeastern) side of the island and below 450 meters on the leeward side, a humid sub-tropical climate prevails (Aquistat, 2005). Above these latitudes, the climate is more temperate but there is no sharp break and the variations in the exposure, altitude and distance from the sea produce a wide range of patterns. The island has two seasons: summer from November to April and winter from May to October. Summer is the rainier and warmer season, during which tropical cyclones occur. The average temperature (Aquistat, 2005) in the summer months varies between 31°C during the day and 22°C at night, while in winter months the average temperature varies between 25°C during the day and 16°C at night. However, departures of the order of 3-4°C from the average values are quite common. Mauritius is considered to be a well-watered island, with an annual average of 2000 mm rainfall. Rainfall varies from 1400 mm on the Eastern Coast to 4000 mm on the Central Plateau and 600 mm on the Western Coast (Hydrological year book, 2005). Its unequal distribution in time and space has led to the formation of various agroclimatic zones.

The agricultural sector in Mauritius is dominated by the sugar plantation industry, which has long been the backbone of the Mauritian economy. Sugar cane was introduced by the Dutch at the end of the 16th century and until 1970 the production of sugar accounted for one-third of the gross national product and more than 90% of the Mauritian exports. For a long time, the sugar industry was the main source of revenue for the Mauritian economy. However, in the late 1970s' the

Mauritian economy underwent major structural changes characterised by the rapid expansion of industrialisation process that concentrated mainly in the Textile production in the Export Processing Zone and the development of tourism. Together with the agricultural sector, these also form the pillars of the Mauritian economy.

## 2. THE AGRICULTURAL SECTOR IN THE MAURITIAN ECONOMY

Agricultural lands in Mauritius represent about 46.4% of the national land mass (Figure 1) or 86 500 ha (CSO, 2006). The agricultural sector is considered to be of significant importance to the Mauritian economy, employing some 7.4% of total working population, about 21,636 people. It is one of the primary source of foreign currencies for the country (CSO, 2006), and has the responsibility of addressing food security and self-sufficiency in certain crops for the population (CSO, 2006). Figure 2 shows the share of agriculture in the economy in the year 2006 (CSO).

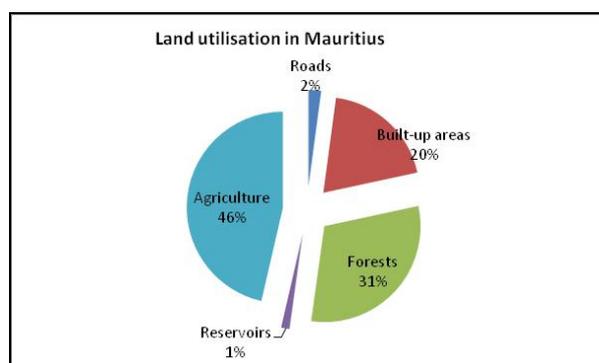


Figure 1: Land utilisation in Mauritius

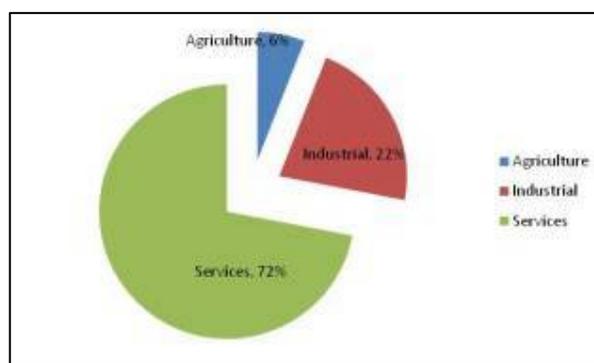


Figure 2: Share of Agriculture

A major part of the island is made up of the reddish tropical latosols which are suitable for cane cultivation as well as crops. In Mauritius, the agricultural crops include sugar cane, tea (green leaves), tobacco, food crops, fruits and flowers (Table 1).

Table 1: Area harvested of agricultural crops (CSO, 2006)

Crops	Area harvested (hectares)
Sugar cane	66,732
Tea	688
Tobacco	287
Food crops	7,207

Recently the sugar industry has started losing its predominant position in the country's economy as a result of falling sugar prices and the end of preferential trade links with the European Union (EU). Mauritius could no longer rely on the safety net of the Sugar Protocol. The foreign exchange derived from the sale of sugar to the EU had so far been adequate to pay for our food imports. With the recent proposal of the EU, there is no certainty of the level of income from sugar, and therefore, food imports are at risk. Mauritius used to spend a large part of the revenue obtained from the export of sugar to import its food requirements, mainly rice, flour, pulses, chicken, beef, onions and milk products. This has made Mauritius to be classified as a Net Food Importing Developing Country (NFIDC) under the World Trade Organization (WTO). However, apart from flour, all the other food items mentioned could be produced partly or even totally in Mauritius. Thus, imports could be reduced and foreign exchange saved. For this reason, the government decided to diversify the agricultural sector to enhance the production of crops and livestock. The government decided that diversification should however not be at the expense of sugarcane.

The government is encouraging departure from sugar cane monoculture through a diversification crop policy. Through the democratisation process, the Government of Mauritius is widening access to lands and has made available 200 acres of agricultural land to be leased out to small planters for agricultural diversification. The government had also offered a number of incentives to farmers to ensure the success of the diversification programme: agricultural credit, i.e. financial loans from bank, subsidy on the price of certain commodities, a guaranteed price was offered for some commodities and facilities were made available to livestock breeders. The food crop sub-sector is meant for local consumption with less than 1% of total production being exported. These exports consist of basically small amounts of vegetables (potatoes, tomatoes, and onions), fruits, tea, or cut flowers. Essential food items such as rice, cereals are currently imported from other countries. The country also produces fish, some of which is exported. Livestock production is limited and meant for local consumption. Mauritius produces enough potatoes and fresh vegetables to meet domestic demand. It can be said that the country is self-sufficient in fresh vegetables except in times of unfavorable climatic conditions (cyclones, drought, and heavy rains). The crops cultivated are beans, peas, potato, maize, groundnut, onion, tomato, cabbage cauliflower, creepers, other vegetables such as beet, bittergourd, brinjal, cabbage, calabash, carrot, chillies, chouchou, cucumber, ginger, garlic, ladies finger, lettuce, maize, manioc, patole, petsai, pipengaille, pumpkin, squash, sweet pepper, sweet potato, voehm among others, and also banana, and pineapple. After nearly 20 years, it can be said that Mauritius has succeeded in a certain measure in its diversification program. Today the country is more than 33% self-sufficient in its food requirements. Mauritius has derived many advantages from its agricultural diversification programs. These advantages are: imports have been reduced and foreign currencies saved, employment has been created, our dependence on sugar has been reduced, the country has become self-sufficient in certain commodities and new crops help to earn additional foreign currencies.

Though, Mauritius has attained self-sufficiency in certain number of crops, being a small island, the agricultural sector of the country is however under multiple stresses. Owing to variation of rainfall patterns in time and space, in some zones, agriculture is not possible without irrigation. In addition, the island being volcanic and relatively young, in many places, especially in the North, West and South-East, the soil is rocky, that is, basaltic rocks are present in the surface and as well as the sub-surface. Consequently, derocking is necessary and is a constraint to the agricultural mechanisation and irrigation. Furthermore, fertile land is becoming an increasingly severe constraint to food crop production in Mauritius. The 1994 Master Plan for Agriculture estimated that 300–350 ha of land was being removed from agriculture annually to cater for residential and commercial developments. Also, rotational land from sugar estates is becoming less available to food crop growers. In addition, the main climatic threat, which affects agriculture, in particular is the occurrence of cyclones, which significantly damage or even eradicate harvests. Invasion of alien species threatens remaining endemic biodiversity and the current management system for terrestrial and marine park protection is still inadequate. Lagoons have been depleted through overfishing and must be protected through concerted efforts in order to revive fishing potential and protect the natural resource base. Further, while in the sugar sector an insurance scheme is fully functional, a pilot insurance scheme for the food crop sector has only recently been started with only one crop being covered namely carrots. The scheme will be replicated to other crops upon the successful performance of the insurance scheme. Agricultural production is also restricted due to losses in harvested agriculture which include handling damage, insect, fungal, vertebrate pests, diseases and spoilage. Lack of cold storage facilities and access to processing technologies and equipment have until recently prevented from the proper utilisation of increased production of vegetables and fruits. In addition to the already prevailing threats in the agricultural sector, climate change is likely to bring about its own problems.

Global warming and increased frequency of extreme weather events will increase the vulnerability of the farming/planters community. The impact of climate change and variability will cause a change in the cropping pattern for some crops from lowlands to higher altitude. Besides, the cropping calendars, flowering and productivity of some vegetables and fruits will also be affected.

Crop cycle may shorten leading a decrease in yields. Production can also be affected by more frequent and severe droughts as well as cyclones and heavy rains. Coastal land may be affected by more frequent storm surge thus destroying crops and affecting soil quality and productivity. Warmer temperature and milder winters will lead to an increase incidence of pest and diseases.

### 3. CLIMATE CHANGE

For the purpose of this study, the definition proposed by the United Nations Framework Convention on Climate Change UNFCCC has been adopted. According to the UNFCCC climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere that is in addition to natural climate variability observed over comparable time periods. Scientists believe that there is some linkage between global warming and changes in the composition of the atmosphere (Buchholz, 1987). These changes in the atmosphere are due to increase in the levels of several greenhouse gases such as carbon dioxide, nitrous oxides, methane and several compounds of chlorofluorocarbons. The definition of global warming holds that these gases form a shield around the earth that prevents the heat of the sun (infrared waves) from escaping into the atmosphere. A global increase of a few degrees Celsius over the next 50 or 100 years would raise the sea levels by between 0.2 and 1.5 meters as a result of the thermal expansion of the oceans and the melting of glaciers. Low-lying coastal areas would be flooded and people would have to either erect sea walls or move to another location. Such climatic change would also mean hot, dry summers for many parts of the world. According to the IPCC, these hot spells would become more frequent and more severe. There could be a decline in the agricultural productivity causing hardships for some people. Another change would be an increase in extreme events such as sudden rainfall that have increasingly replaced consistent patterns of annual rainfall. These heavy downpours can every damaging, destroying crops and triggering violent floods.

In short, five factors related to climate change can be identified: (1) the rise in temperature; (2) changes in the precipitation patterns; (3) the rise of sea levels; (4) increased incidence of extreme weather events; and (5) increase of greenhouse gases in the atmosphere, of which carbon dioxide is the most prominent.

### 4. GOVERNMENT'S STRATEGY TO ADDRESS FOOD SECURITY

The United Nations Food and Agricultural Organisation's (FAO) latest estimates for the period 2000 to 2002 show that 852 million of people were undernourished (FAO, 2005). An overwhelming majority of these hungry people is found in the developing countries (815 million), while in transition and developed countries, 28 million and 9 million people respectively, are caloric deficient (FAO, 2005). Globally, the world food supply is vulnerable to threats such as overpopulation, poverty, higher food prices, climate change, and loss of agricultural land to overuse and urban development, rising oil prices that drive up the costs of transporting food, food safety issues such as food-borne pathogens, and lack of political will to address food security concerns. Consequently, food security has become one of the targets of the Millennium Development Goals and it is widely considered as a useful measure for evaluating the progress of a country in terms of well being because although technological advances have modernised the production and distribution of food, hunger and malnutrition still threaten the health and well-being of millions of people around the world. According to the United Nations Food and Agricultural Organisation (FAO), *"Food security" means that food is available at all times; that all persons have means of access to it; that is nutritionally adequate in terms of quantity, quality and variety; and that it is acceptable within the given culture. Only when all these conditions are in place can a population be considered "food secure."*

The government being fully aware about the stiff competition of sugar on the EU market and the significant boost required to the other agricultural products in terms of growth rate and exports, has come up the Non-Sugar Sector Strategic Plan (NSSSP) 2003 – 2007 which was a five-year strategic plan for the non-sugar agricultural sector meant to stir up sustainable development in agricultural diversification and shape a new technological era for agriculture in Mauritius. The government comes up with another document of Strategic Options in Crop Diversification and Livestock Sector 2007-2015 which proposes a programme for non-sugar agriculture and it takes into account government policy to promote access to agricultural land, agribusiness and good agricultural practice, improving food quality and safety, reducing dependency on import, promoting export and ensuring food security.

The government also recognised that our country is vulnerable because of low self-sufficiency in food; and therefore it is imperative to build resilience in Mauritius through food security. Hence, as part of the budgetary measures 2008-2009, the government has provided a five pronged-strategy for food self-sufficiency, which are as follows:

- Boosting up investment in agriculture by providing facilities through various policies to attain self-sufficiency;
- Exploiting opportunity of Cross Border Initiative (CBI) set by the FAO with Madagascar, Mozambique, Tanzania and other countries to increase production for domestic consumption as well as for regional markets;
- Encouraging surpluses in food production for export as to capture maximum gains that can benefit local consumers and farmers by generating more income;
- Seeking the support of regional blocs and development partners and promote joint ventures with countries including China and India;
- Sensitisation campaigns to promote healthy eating through the promotion of island food thus reducing dependency on rice and flour.

To achieve these strategies, a Food Security Fund of 1 billion rupees has been provided to finance these actions.

## **5. DATA COLLECTION & ANALYSIS**

A survey was carried out with key stakeholders in the field of agriculture so as to assess whether Mauritius was indeed addressing food security in the face of climate change. A questionnaire was firstly designed and then distributed to relevant departments. In many cases the questionnaire was filled together with the respondent and informal interview was carried out at the same time. A number of pertinent issues were noted both during the informal interview and while analysing the filled in questionnaires.

### ***5.1 Awareness on climate change, food security and impacts of climate change on food security***

It could be noted that the stakeholders were fully aware about climate change, food security and the impacts of climate change on food security. These topics were not new to them, though the extent to which they understood these topics were yet to be analysed. When asked about the likely impacts climate would have in the agricultural sector, the answer was quite confusing (Figure 3). The response of the interviewee to this question indicated that the interviewee did not fully understand the issue of climate change and its likely impact.

All stakeholders (100%) agreed on the fact that the Government of Mauritius is addressing the issue of food security. According to them, the Government has mentioned a Food Security Fund in the budget 2008-2009 and moreover, it has put in place lots of incentives for small planters, for instance: training of growers to improve agricultural activities; mobilizing human resources,

technology and financial resources to produce more food; partnership with countries in the region (Madagascar, Mozambique, Tanzania); control of pest and diseases; incentives on loan and land release of sugar cane land to grow food crops; and extension of irrigation in the North of Mauritius. However, all the stakeholders (100%) also agreed that the strategies and policies taken are not enough to combat the impacts of climate change on food security.

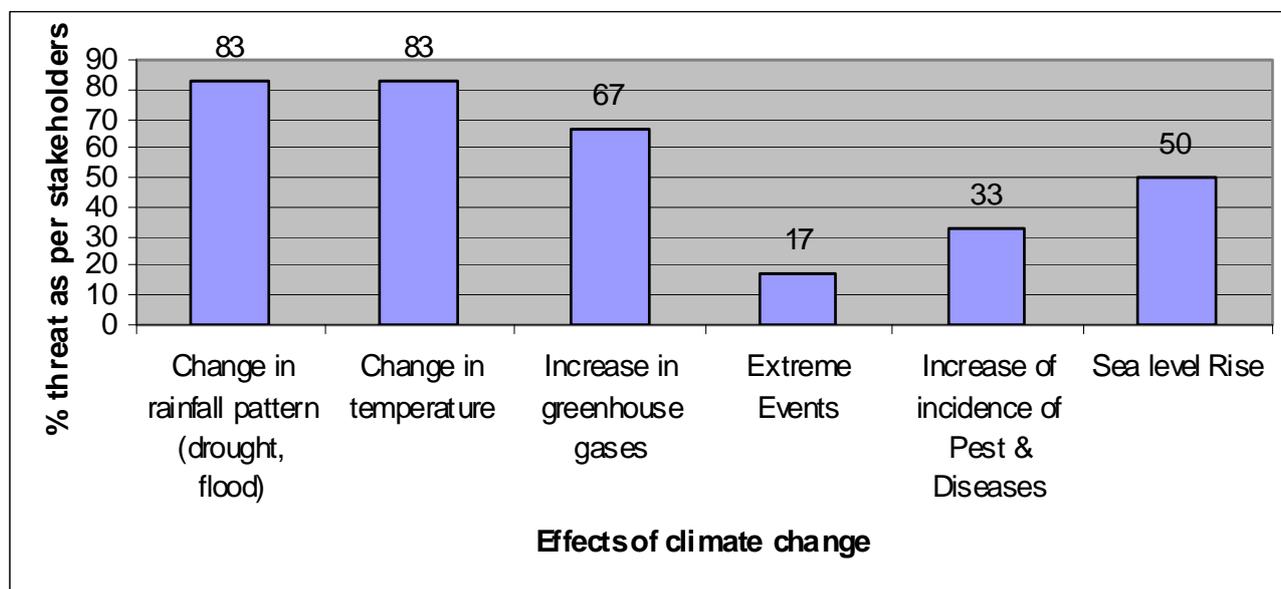


Figure 3: Effects of climate change as per stakeholders

## 5.2 Existing strategies and policies in Mauritius for food security

It has been found that stakeholders are not clearly aware about the nature of the existing strategies and policies as far as concern food security. The tables (2-5) show the percentage of stakeholders which has the same opinion on the strategies and policies implemented in Mauritius.

Table 2: Impacts of Temperature

Description	%agreed
Development of high temperature resistant crop varieties	50
Altering timing and location of crop activities	50
Facilitating shifts in cropping patterns to better suit the altered climate	50
Cropping Calendar	50
Seasonal changes and sowing dates	50
Integrated Crop Management	100

Table 3: Availability of Water

Description	%agreed
Promoting water conservation	50
Rainwater harvesting	17
Improved irrigation system (drip irrigation)	67
Wider use of technologies to use water more effectively where rainfall decreases	67
Promotion of organic farming which is more resistant to drought and also reduce the risk of flood	50
Managing water to prevent water logging, erosion where rainfall increases	33
Promotion of crop which are resistant to drought	50
Promotion of crop which are salt resistant due to salt water intrusion	0
Promotion of agricultural drought management	33

Table 4: Occurrence of Pests &amp; Diseases

Description	%agreed
Development and use of varieties of species resistant to pests and diseases	67
Integrated Pest Management	100
Sueveillance, eradication and management programmes for pest and diseases	33
A sound quarantine system supported by scientific methods	50
Replacement of crops which are vulnerable to diseases	0
Distribution of equipment to prevent and combat pests	0
Weed management practices	17
Chemical control	17
Promotion of biological control as a safer pest control	50
Production and multiplication of seeds	1
Strategic grain reserves	17
Food storage techniques	33

Table 5: Potential measures

Description	%agreed
Agricultural diversification	67
Crop diversification	67
Avoiding mono culture and encouraging farmers to plant a variety of resistant crops	50
Early warning systems	50
Use of climate information in planning	33
Use of climate forecasting to reduce climate risk	17
Disaster management and contingency response plans	17
Preserve existing biodiversity of existing crops	50
Training to inform farmers on agricultural adaptation to climate change, for example sustainable agriculture (adapted planting schedules and tillage practices, etc)	50
Land issues including redistribution and management as part of an integrated agricultural development	33
Crop insurance schemes	50

### 5.3 Training on food security

The Food and Agricultural Organisation (FAO) is one among other international organisation which has implemented many programmes related to food security to enhance national capacity of a nation. The information gathered from the stakeholders revealed that stakeholders are once again not equally aware about which programmes offered by the FAO is implemented in Mauritius. Table 6 shows the percentage of stakeholders which has the same opinion on the programme implemented in Mauritius.

Table 6: Training possibilities in the field of agriculture

Description	% agreed
The FAO Trust Fund for Food security and Food Safety	17
Regional Programme for Food Security in the Pacific Islands	17
Treaty on Plant Genetic Resources for Food and Agriculture	33
FAO's Global Early Warning and Information Systems	17
Rapid Agricultural Disaster Assessment Routine (RADAR)	0
Food Security Information for Action Programme	17

Eight three per cent (83%) of the stakeholders agree that there are qualified staffs who have been assigned the responsibility for food security in Mauritius, on the other hand, the remaining 17% claim that there are not enough qualified staffs to deal with food security. In addition, all stakeholders (100%) the same mind that nutritional education and skills training programme are important for enhancing food security in Mauritius and they also specify that training and education are very important to promote local production and consumption. From the views gathered from the

stakeholders, all stakeholders (100%) felt there is no institutions in Mauritius offering course related to food security.

All stakeholders (100%) are fully aware about the help given by the FAO on training of food security; however, only 14% of the stakeholders are aware about other international organisations which give training on food security. The international organisations cited are: AVRDC (World Vegetable Centre); IAEA; and BVRC (Beijing Vegetable Research Centre).

#### ***5.4 Education on food security***

Data gathered on this part of the questionnaire was mainly through the informal interview as the interrogated stakeholders have diverse perceptions on this particular issue.

According to the respondents, people of Mauritius are very well aware that Mauritius is classified as a Net Food Import Developing Countries and that due to the globalization process changes in lifestyle and food habits in Mauritius there have been a reduction in the consumption of traditional foods, with an increase in consumption of “fast foods” and increased dependence on food imports and as a result, diseases such as obesity, diabetes and heart disease are on the rise in Mauritius. Yet, the local populations prefer imported foods, believing them to be more nutritious and also because of their higher social status.

According to the stakeholders’ opinion, this may be due to the fact that there are not enough sensitization campaign and education about the nutritious value of traditional foods. All stakeholders share the same opinion, on the fact that local populations must be re-educated about food habits and sustainable food security.

#### ***5.5 Priorities to enhance Agro-processing***

All the stakeholders agree on the fact that agro-processing is another important step to enhance food security in face of adverse climatic factors; however, there are numerous factors which hinder this particular sector. Different stakeholders have different views on the factors that hinder this sector, as can be seen in Table 7.

*Table 7: Factors influencing the success behind Agro-processing*

<b>Description</b>	<b>%agreed</b>
Land scarcity which obstructs large scale production	83
High cost associated with imported raw materials as primary input	67
High cost of labour	83
Adverse climatic factors	17
Varieties and quality of local products do not suit requirement of agro-processing industry	83

Stakeholders also comment that people are reluctant to start a business because of the high cost associated with the technology for processing and that there are also poor marketing strategies and not enough re-grouping among growers to voice out their difficulties.

#### ***5.6 Analysis of data obtained from the Central Statistic Office***

In the year 1999, the island experienced its most severe drought. Crop production consequently decreased during that year. For the purpose of this study it was considered worth analysing the relations between crop production, rainfall and use of fertilizers. The SPSS programme was used to find out whether a correlation exists between; food crop production and the amount of rainfall it

receives; food crop production and temperature; and food crop production and amount of fertilisers used.

Bivariate Correlation Analysis was used to generate the Pearson's correlation coefficient which estimates the linear relationship between data. The Pearson product-moment correlation coefficient, denoted by  $r$ , is a common measure of the degree of linear relationship between two variables. It ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables, whereas a correlation of -1 means that there is a perfect negative linear relationship (inverse relationship) between variables and on the other hand, a correlation of 0 means that there is no linear relationship between the two variables. Table 8 summarises the interpretation of a correlation coefficient.

*Table 8: Interpretation of correlation coefficient*

<b>Correlation</b>	<b>Negative</b>	<b>Positive</b>
<b>Small</b>	-0.3 to -0.1	0.1 to 0.3
<b>Medium</b>	-0.5 to -0.3	0.3 to 0.5
<b>Large</b>	-1.0 to -0.5	0.5 to 1.0

In addition, the two-tailed test of significance also was carried out. The significance level indicates whether or not the correlation between the variables is real or simply occurred by chance. The lower the significance level, the stronger the evidence that the null hypothesis can be rejected. Usually significance level less than 0.05 allow us to confirm rejection of the null hypothesis.

Table 9 shows the output file from SPSS software for the correlation and significance test between the crop production, temperature, rainfall and fertilizer.

*Table 9: Correlation between crop production, temperature, rainfall and fertiliser*

		<b>CROP</b>	<b>TEMP</b>	<b>RAINFALL</b>	<b>FERT</b>
<b>CROP</b>	Pearson Correlation	1.000	-.393	.291	.640
	Sig. (2-tailed)	.	.296	.448	.064
	N	9	9	9	9
<b>TEMP</b>	Pearson Correlation	-.393	1.000	-.493	-.227
	Sig. (2-tailed)	.296	.	.177	.557
	N	9	9	9	9
<b>RAINFALL</b>	Pearson Correlation	.291	-.493	1.000	.385
	Sig. (2-tailed)	.448	.177	.	.306
	N	9	9	9	9
<b>FERT</b>	Pearson Correlation	.640	-.227	.385	1.000
	Sig. (2-tailed)	.064	.557	.306	.
	N	9	9	9	9

From the above table, it is observed that the Pearson coefficient between the two variables rainfall and food crop production is 0.291, which shows a small positive relationship, on the other hand, the significance level is very high: (0.448), which means that the null hypothesis is confirmed, statistically it can be deduced that correlation between crop production and rainfall is not significant and there is not linear relationship between the two variables. It is also observed that there is no positive correlation between temperature and food crop production.

But however, it is worth mentioning that there is a high correlation coefficient: (0.64) is observed between crop production and use of fertilizers the table above. The significance level also between the two variables is the least compared to the other tabulated values. This shows that fertilisers is consumed a lot for food crop production, which can have adverse effects on the environment including groundwater pollution

## 6. DISCUSSION

Observations made during the survey revealed that climate change, food security and the impacts of climate change on food security are still like a “buzz” word for most of the stakeholders. Though all the stakeholders claim that they have knowledge on climate change, food security and the impacts of climate change on food security, but from the data gathered, it does not seem that these issues are very well clear to them. Analysis of stakeholders’ questionnaire reveals that stakeholders were confused on the greatest threat of climate change impacts on Mauritius. It has been noted that different stakeholders have different views on this particular issue, and this shows that for most of them the notion on this matter is not clear to them. This is in line with a report disclosed by the UNFCCC (2005) which states that most SIDS have not been able to undertake an in-depth, nationwide climate change impact and vulnerability assessment in an integrated manner. Consequently, without such national assessments as a sound basis for designing and planning adaptation policies, strategies and programmes, decisions on adaptation will be very difficult (UNFCCC, 2005). On the other hand, it should also be noted that from the open questions which disclose stakeholders’ personal views, most of them are very well aware about the incentives that the Government of Mauritius has put in place to growers.

Analysis of the responses of the stakeholders on the existing strategies and policies again revealed that the latter are not clear to them. It has been noted once more that different stakeholders have different views on the strategies and policies are implemented in Mauritius. However, it should be also be mentioned that from the informal interview done, it has been unveiled that stakeholders are confused with the strategies concerning sugar and food crop production but while questioning, it was observed that since sugar cane was monocrop for a long time, most of the strategies and policies were geared towards this sector.

This finding revealed that sugar can production was for a very long time, dominating the national agricultural policy so far in Mauritius, only recently crop diversification has become a burning issue for the agricultural policy. This is of real fact as can be seen from the draft for consultation by the Ministry of Agro Industry and Fisheries which proposes a programme of action on the non sugar agricultural sector for the period 2007-2015. However, due to the accelerated rate of climate change impacts, the strategic options proposed by the above ministry should become the top most priority of the national agricultural policy and should be geared towards sustainable development goals.

Once more, the findings of this research confirmed that stakeholders are not very well aware about the impacts of climate change on food security in Mauritius, as can be seen from the data analysed that stakeholders are once again not equally aware about which programmes offered by the FAO is implemented in Mauritius. Conversely, FAO and its assistance provided to SIDS should be very well recognized by the stakeholders as the FAO is one among other international organisation which has implemented many programmes related to food security to enhance national capacity of a nation. The FAO recognised that SIDS are the most vulnerable one to climate change impacts, and in response to this, FAO assists the SIDS in developing their capacities in agriculture, forestry and fisheries (FAO, 1999).

Incomplete awareness on these issues can be explained by the lack of communication between stakeholders because though the latter are not aware about all the strategies and policies implemented, it has been noticed that different stakeholders pin out different facilities provided to enhance agricultural diversification and production. A coordinating body to deal with all these issues of food security dimensions is missing.

Some stakeholders comment that the existing policies and strategies are suited at micro level for domestic production, but are not enough to enhance food security and to be self-sufficient in future. Therefore, new policies and strategies should be taken into consideration to ensure food security and self-sufficiency at national level. For example, stakeholders argue on a very important issue which is the land scarce resources. They reveal that land policy is unclear and that land resources which are very important in agriculture are being misused. In addition, stakeholders also point out that land degradation on Mauritius is caused by three main factors: deforestation, unsustainable

agriculture and recurring wildfires on mountain slopes. They argue that land resources are becoming scarcer in Mauritius thus rendering the agriculture sector vulnerable. They added that sustaining agriculture on cleared mountains reserves is problematic because of the steep slopes and on the other hand, flat land are being used for construction purposes because of the various facilities. It is very important to revise the land use policy and develop strategies to identify all suitable land for agricultural purposes.

Stakeholders also disclose that sensitisation campaign is another important aspect to promote food security; nevertheless, campaign on food security is not enough. They argue that media (newspaper, television, radio, etc) play a vital role to communicate important issues to various stakeholders and the public at large and also to promote healthy eating. Another important issue raised by stakeholders is about the eating habit which is noticed to have change in Mauritius during the last decades. The most important commodity in Mauritian diet is the rice and bread as compared to long time back; people were relying on sweet potato, manioc among others as their staple food. Food represents 26.5% of the total household consumption expenditure in 2006 (CSO, 2007). As stated before, Mauritius is net food importing country which means that the staple food such as rice, wheat, maize, pulses are imported. But since, Mauritius is highly vulnerable to various global prices fluctuations and global climatic shocks; this might lead to food insecurity in the future. Hence, the stakeholders comment that it is very important to re-educate our population on these issues and also good eating habits and new methods of food preparation by eating less rice and consequently, relying on traditional food like sweet potato, manioc among others. Stakeholders also mention that agro-processing is a very important step to enhance food security, but due to the high cost associated with imported raw material as primary input, some local food are more expensive than imported ones. Hence, strategies should be taken to produce local food at competing prices.

Analysis of the data from the central statistic office indicates that there is small relationship between rainfall and food crop production, however, though small relationship, the agricultural sector is the biggest user of water and hence measures can be taken to optimize the use of water in this particular sector. In addition, the high relationship between use of fertilisers and food crop production has to be taken into consideration due to the high risk of groundwater pollution; expansion of organic farming should be taken into consideration to avoid adverse effects on the environment.

## 7. CONCLUSION & RECOMMENDATION

Throughout the last few years, the agricultural diversification from sugar to non-sugar sector has resulted in a significant number of initiatives, which in turn have provided useful incentives for growers. Currently strategies (adaptation measures) that take into consideration climate change scenarios need to be included in the national agricultural policy. Strategies and policies that trigger interest, enthusiasm, concern and curiosity of stakeholders of the agricultural sector are also needed to ensure food security.

Indeed, this study has revealed that the notion of climate change, food security and impacts of food security in Mauritius is not clear among stakeholders due to a lack of communication. This may also be due to the lack of local expert in the field of agriculture and climate change. The current stakeholders approach is not addressing the most fundamental issue for food security. Food security is an issue that cannot be addressed in isolation from other sectors, as the agricultural sector is one among other sectors of the economy which ensures employment and food security for the country. However, it has been observed that there are fragmentation in the agricultural sector and therefore, it can be concluded that this current approach does not seem suitable for ensuring adequate action to tackle food security issues in this uncertain future. It has also been observed that there are not enough collaboration with international organisations and hence not adequate training so as to make stakeholders have a clear vision on these issues and how it can be tackle, keeping in mind environmental sustainability.

In the light of the findings, the following recommendations are suggested which are components that can be included in the national agricultural policy. Though, some measures already exist, it is recommended that they are reinforced to ensure food security and food self-sufficiency in this uncertain future.

- A coordinating body to address all issues of food security thus preventing fragmentation within the agricultural sector and other sectors and also to facilitate communication among stakeholders.
- Develop indicators to assess the effectiveness of existing policies at macro level
- Revise the existing land use policy
- Re-education on good eating habits and new methods of preparation.
- Sensitising students (future generation) about backyard gardening.
- Efficient use of media to communicate about food security and food self-sufficiency.
- Expansion of organic farming to reduce the use of fertilisers.
- Precision farming.
- Strategic Grain Reserves

Existing policies and strategies for promoting the non-sugar sector are yielding positive returns in this field, but these policies may not be adequate to address the pressing issues linked to climate change and its impacts in the field of agriculture. So there is a need to review the policies to make them more focus in the face of climate change.

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