Research report
Niger - Impulsouth project

Assessment of knowledge, capacity needs and gaps, on the issue of assessing impacts, vulnerabilities and risks of climate change in the agriculture sector with an emphasis on gender in Niger.

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ABSTRACT

Niger is highly exposed to the adverse effects of climate change. These effects are mainly reflected in an increase in the irregularity and intensity of rainfall with increasing risks of flooding, drying up of ponds and lakes, decreasing flow of the Niger River and land degradation. These climatic risks have significant socioeconomic consequences, in particular on the country's agricultural production, widespread food insecurity, worsening rural migration and increasing disease. Niger is a semi-arid country with high dependence on rainfed farming systems which makes Niger' agricultural sector vulnerable to the effects of climate change. However, the agricultural sector still dominates the Nigerien economy, it is the main source of income for around 84 percent of the population and contributes at around 40 percent of the country's gross domestic product (GDP). The agricultural population is made of 51.30 % of men and 48.70 % of women. The analysis of the sector from the local scale to the national scale shows significant issues in terms of capacities and knowledge: even if many stakeholders have been identified in the sector, there is insufficient human resource for the different activities. Also, the technical services are not well equipped with instruments, materials and tools for the data collection, data analysis, information production and information dissemination. With regard to the gender issue, women are not well recorded at the technical services and they suffer at the local scale from social discrimination. But, with the intervention of some NGOs and development projects, they start playing an important role in the implementation of new irrigation schemes set under their management. It appears from this study that beside the need of equipment, there are high needs in capacity building in data collection, data analysis and information sharing.

Key words: *Niger, agriculture, climate change, gender, capacity building.*

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1 - INTRODUCTION

Climate change has been a worldwide concern since the 1990s because the warming climate condition is affecting the whole planet (IPCC, 2021). The African continent in general and the Sahelian countries in particular have been highly impacted by the main hazards related to climate change (drought, flood, and heavy winds). The countries like Niger have also shown a high level of vulnerability to climate change with negative consequences on the different sectors of the economy and the society (CNEDD, 2016). Niger is highly exposed to the adverse effects of climate change, which are reflected in agricultural activities, biodiversity, health, infrastructure and water. These effects are mainly reflected in an increase in the irregularity and intensity of rainfall with increasing risks of flooding, drying up of ponds and lakes, decreasing flow of the Niger River and land degradation. These climatic risks can have significant socioeconomic consequences, in particular on the country's agricultural production, widespread food insecurity, worsening rural migration and increasing disease. Niger is a semi-arid country with high dependence on rainfed farming systems, this makes Niger' agricultural sector vulnerable to the effects of climate change. In addition to that, new situations such as security challenges are an aggravating factor of the agricultural sector 's vulnerability to climate change. For instance, during 2021/2022, many farmers have abandoned the farmlands due to the insecurity in Niger. In addition to that, the CO VID-19 situation affects the Niger' agricultural production. Among those most vulnerable to the menaces of climate change are socially marginalised persons such as youth, the elderly, the disabled, and women.

Climate change touches men and women differently which means that it impacts women more than men (Baten et al., 2016; Louis et Mathew, 2020). This is due to the fact that women are highly dependent on natural resources for their livelihoods, as well as low adaptive capacity, high poverty, weak and unequal participation in decision making and other socio-economic and cultural considerations (Goh, 2012; Louis et Mathew, 2020). This is exacerbated by some cultural considerations such as marital status, domestic violence, a lack of access to land and energy, high exposure to some diseases, etc. This is particularly a case of West Africa Sahel where climate change via its manifestations such as droughts, floods, heat, and climate related diseases affects more women than men (Alston, 2015; Rao et al., 2019). For instance, the score of the country's gender inequality index is 0.64 with a ranking of 154th out of 189 in 2020 (UNDP, 2016), thus indicating a strong inequality between men and women in terms of empowerment and economic status in Niger. Inequalities with regard to women concern, in particular, access to education and reproductive health, women's participation in the economy, and in decision-making. For example, in Tillaberi region, there are only 2% of women farmers in hydro-agricultural facilities , showing their marginalization, especially in relation to access to water (Tidjani Alou et al., 2015). In terms of education, it appears that only 18.06% of these women are literate (INS, 2012). Furthermore, Bouchama et al. (2018) reported that women in

Niger experienced high levels of discrimination related to the marriage rights and family code, autonomy, violence and access to resources.

The issue of combating climate change now appears to be a problem of economic and social development. In order to cope with the effects of climate change, in particular by promoting inclusive and resilient economic growth, Niger subscribed to the Paris Global Climate Agreement of 2015. This Agreement aims not only to reduce gas emissions greenhouse effect (mitigation) but above all to strengthen the adaptive capacity of developing countries in the face of the harmful effects of these climate changes. This agreement underlines the need to take measures to make a transition towards a future sustainable and low-carbon economy, creating wealth and decent jobs. Since 2000, several studies have been undertaken on the country to characterize the interactions between the climate components and socio-economic sectors (agriculture, energy, etc.) and to assess the magnitude of the different impacts of climate change in Niger (MESUDD et al., 2020; CNEED, 2014). Since the preparation of the Initial National Communication (CNI) in 2000, many climate scenario development exercises have been conducted by the CNEDD (Conseil National de l'Environnement et du Développement Durable). Niger finalized its first update of the National Determined Contribution (ME/LCD, 2021a) which was submitted to COP26. Furthermore, Niger has ratified all the conventions related to climate change. Since the drought of 1970s, many adaptation strategies have been developed and implemented in Niger in different sectors such as agriculture, water, environment, etc. Some of these strategies include social inclusion with the involvement of women. Some studies have highlighted the effects of climate change on women in Africa (Adzawla et al., 2019; Van Aelst et Holvoet, 2016) and in West Africa Sahel (Alston, 2015) but there is paucity of studies that present the capacities and gaps of the institutions and individuals in the assessment of vulnerabilities of the agricultural sector to climate change.

Thus, despite the important awareness and commitment of the different institutions and stakeholders on the issue of climate change and gender, some gaps and shortcomings remain. This study has explored the effects of climate change on the agricultural sector in Niger with a focus on gender issues . Furthermore, the capacities and gaps in terms of assessing the impacts and vulnerabilities to climate change have been performed at different levels by taking into account the gender aspect.

2 – STUDY SITE

Niger, officially Republic of Niger, is a landlocked western African country with an area of about 1,267,000 km². It is bounded on the northwest by Algeria, on the northeast by Libya, on the east by Chad, on the south by Nigeria and Benin, and on the west by Burkina Faso and Mali. The capital is Niamey.

Niger lies in one of the hottest regions of the world. Temperatures rise from February to May and drop during the "winter" rainy season, rising again somewhat before falling to their annual

minimum averages in December and January. During May (the hottest month), afternoon temperatures are high everywhere, ranging from a low of about 108 °F (42 °C) at Nguigmi on Lake Chad to 113 °F (45°C) at Bilma and Agadez, both in the northern desert. In January, afternoon temperatures average more than 90 °F (mid-30s C) at most stations but at night may drop to freezing level in the desert. The daily range is greater in the desert north than in the south and is also more extreme during the dry season.

Rainfall varies according to location as well as season. The 300 mm/year isohyet (line on a map connecting points having equal rainfall) follows a line from near Tahoua to Gouré, marking the northern limit of nomadic pastoral life. During ethe rainfall sparse vegetation grows. To the extreme south the 30-inch isohyet marks the southern limit of this zone, after which the southern agricultural zone begins. In the course of the same rainy season a most irregular spatial pattern of rainfall may occur, while from one year to another the total amount of rainfall may also vary; in addition, the rainy season itself may arrive early or late, thus jeopardizing crops.

Niger has a population of 24 million people (estimation of 2020 from the National Institution of Statistics). It is the country with the highest total fertility rate (7.6 children each woman). The urban population represents about 16.5% of the population against 83.5% of rural.

The population is extremely young (more than 60% of the population are under 15) and the slight predominance of females (50.3% of women) characterize this predominantly rural population (84% of the population) of Niger (INS, 2020). The Nigerien economy is still dominated by the agricultural sector, which is the main source of income for around 84% of the population and contributes around 36 percent of the country's gross domestic product (GDP) (World Bank, 2018). The agricultural population is made up nationally of 51.30% men and 48.70% women (Ministère de l'Agriculture et de l'Elevage du Niger, 2021). The results report showed that the majority of agricultural households are managed by men, 93.15% against 6.85% of households managed by women (Ministère de l'Agriculture et de l'Elevage du Niger, 2021). According to the results of the Niger 'ministry of agriculture and livestock, 2021, 82.59% of male heads of agricultural households have no level of education against 94.95% in the category of female heads of household. The highest level of education for men is high school (1.02%) and for women it is college (0.54%).

Figure 1: Map of Niger republic (https://www.britannica.com/place/Niger)

3 – OBJETIVES OF THE STUDY

The capacity and knowledge gaps assessment are defined as the difference between the "desired capacity and knowledge" and the "existing capacity and knowledge" at the institutions and at the individual level. Thus, the purpose of this study is to evaluate the needs and gaps related to the evaluation of the impacts of climate change on the agricultural sector with a focus on gender issues . More specifically it is to:

i. Assess the knowledge capacity, gaps and needs in climate change impacts assessment on agricultural systems in Niger at different levels (individual, institutional, systemic) and areas (institutional, legislative, human resources, etc.);
ii. Determine gender consideration in climate change impacts and vulnerabilities assessment, and identification of barriers related to gender inequality;
iii. Formulate some recommendations and share the results with some stakeholders through workshops and group discussions.

4 – CONCEPTUAL AND THEORETICAL FRAMEWORK

This study considered the capacity building framework developed by UNFCC (Figure 2). The evaluation of gabs and needs concerned the three levels (individual, institutional and systemic) in Niger for the agriculture sector. The main stakeholders at each level were identified and the characterization of the different interactions which helped to define relevant actions that could bring changes toward a sustainable impact on the global system.

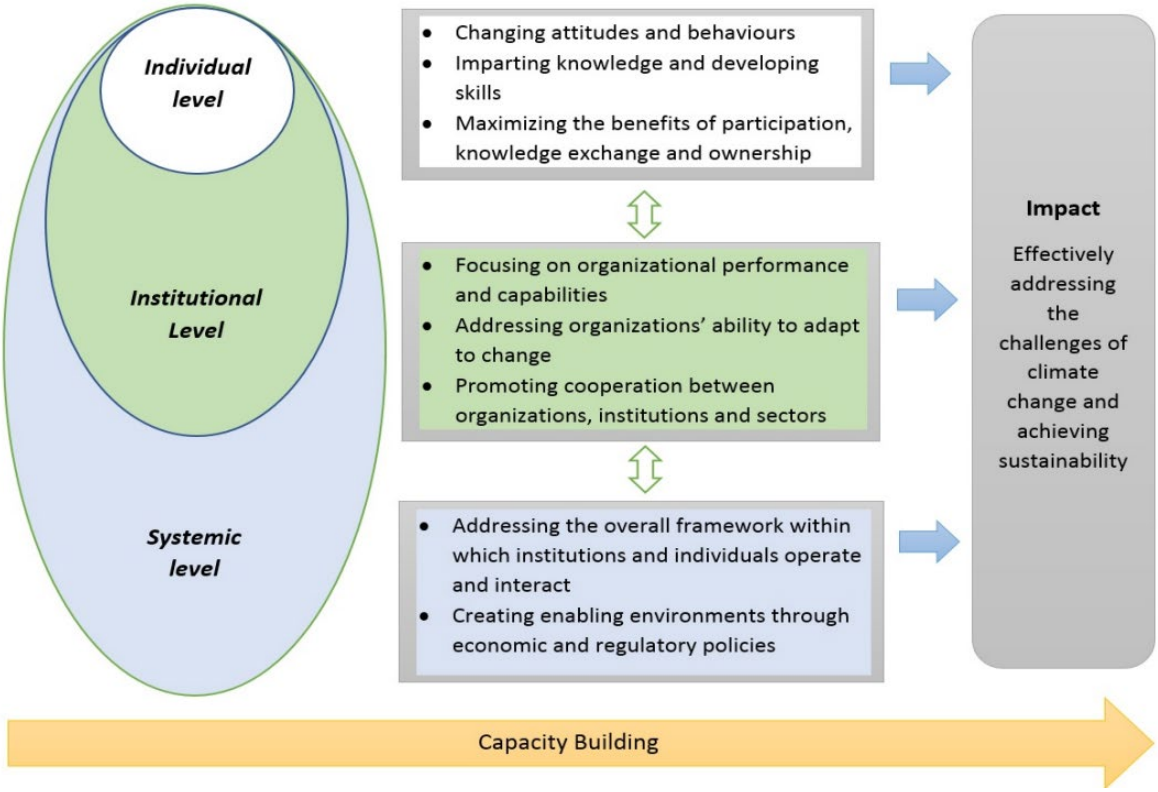

Figure 2: Capacity Building Framework and levels in the UNFCCC. (UNFCCC, 2021)

5 – METHODOLOGY

The study was carried out in different steps. The first step consisted in stakeholders mapping on climate change actors at the three levels (individual, institutional, systemic). The l iterature review was also conducted in order to evaluate the advancement made in Niger in the agriculture sector with regard to climate change adaptation. The literature review considered gender dimension in climate change issues related to the implementation of development projects and programs in the agricultural sector. A survey with some questionnaires was carried out across the three levels in order to evaluate the capacity, weaknesses and needs of

the different stakeholders and institutions in the evaluation of impacts of climate change on the agricultural sector with an emphasis on gender dimension. Furthermore, some workshops and discussion groups were organised during the survey. This study used both qualitative and quantitative research methods (focus group discussions and key informant interviews) to explore the consideration of gender dimension in the agricultural sector in Niger. The surveys and group discussions considered the main areas (policy, legislation, institutional framework, human resources , etc.) for the identification of knowledge and capacity gaps and needs.

The methodology followed the framework presented on figure 3, from the identification of needs to the formulation of some recommendations to strengthen capacities at the three levels.

Figure 3: Operationalization of the capacity and knowledge gap and needs assessment

6 – MAIN FINDINGS OF THE STUDY

6.1 Main characteristics of the agriculture sector and climate change

From an agro-ecological point of view, Niger is made up with several distinct agrarian systems (pastoral in the north, transitional in the centre, eastern plains, western plateaus, valley systems, oases, hydro-agricultural and peri-urban areas), characterized by their own specificities in terms

of constraints and potentialities. Figure 4 presents the 17 agrarian zones which are distinguished according to the climatic, biophysical and ecological characteristics of the environment. These agrarian zones correspond to particular forms of environmental development, and have as well specific constraints to be taken into account for the development of climate-smart agricultural systems. In this respect, this zoning constitutes a reference for the development of regional action plans for adaptation to climate change.

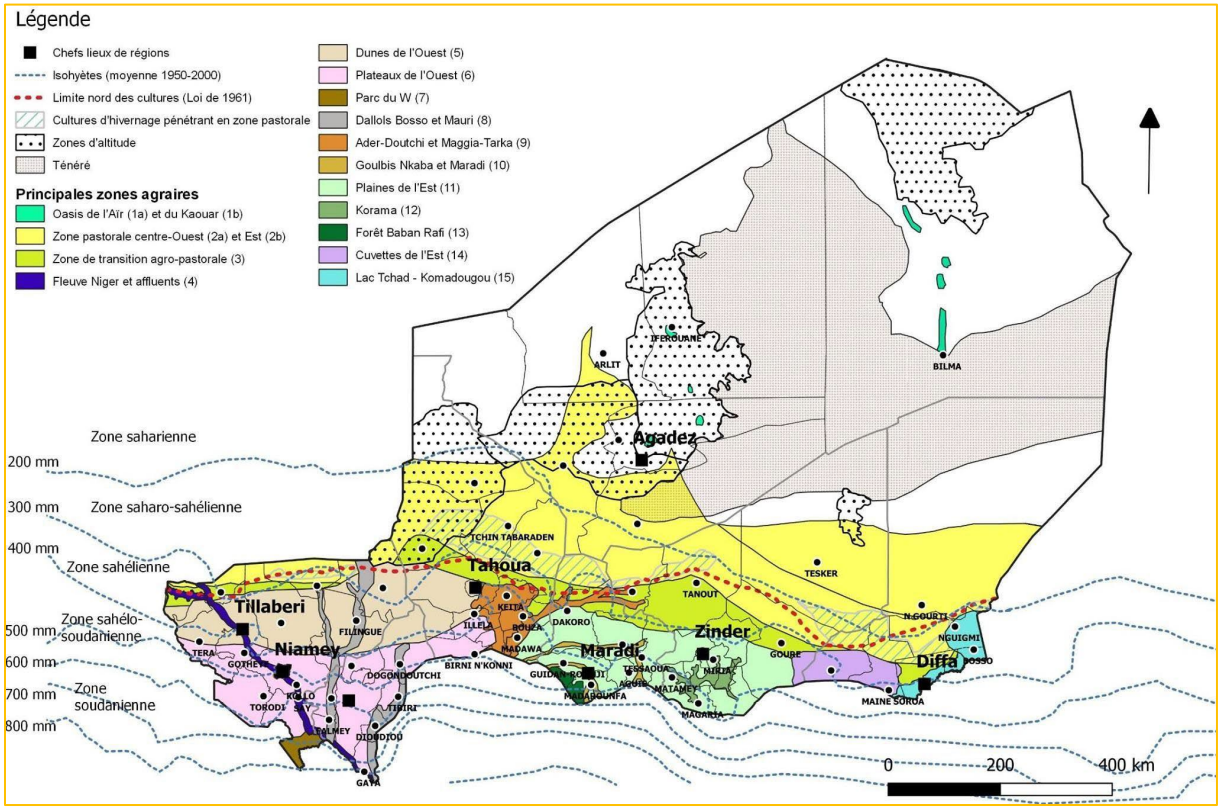

Figure 4: Agro-ecological zones in Niger

6-1.1Agricultural potentialities

The analysis of Niger's agricultural potential focuses on the produced capital made up of land and irrigation water resources and the agro-technical capital represented by the material and human resources used by the agricultural sector as well as the sum of knowledge and agricultural practices used. Land is the main productive capital on which Niger's economy is based (MEDD, 2016). About 15 million hectares of land (13% of the country's area) is suitable for agriculture. Only 7 million are used (AFD, 2020). However, this productive capital is strongly affected by the development of erosion (water and wind) to the point where the valleys, the watercourses and even the dune lands are affected by silting up (CNEDD, 2006). Erosion control is therefore a basic element for soil and water conservation and good fertility management.

Moreover, despite the aridity of its climate, Niger has significant water resources. The potential is estimated at 30 billion m^3/year for surface water; and 2.5 billion m^3/year for the renewable underground resource. Approximately 20% of this volume is currently exploited, and more than

2,000 billion m^3 of fossil water (Ministry of Hydraulics, 2015). Niger has 15.9 million hectares of agricultural land, or 11% of the country's total area. The potential of irrigable land amounts to 270,000 ha, or about 2% of the cultivable area. In 2014, the cultivated area was estimated at 15,927,192 hectares (AFD, 2020), including 107,000 ha in irrigated systems. The irrigated areas supervised by the National Office for Hydro-Agricultural Developments represent 14,000 ha, of which 6,800 ha are exploited with total water control and 1,900 ha are exploited in polyculture.

Small-scale irrigation is practiced on 93,000 ha (including off-season perimeters) and controlled flooding is practiced on 5,300 ha. Arable land is mainly used for rainfed crops with yields of less than 500 kg/ha (National Institute of Statistics of Niger, 2012). Constraints in groundwater development arise from their high depths, insufficient flow rates in places and the low success rate of boreholes in particular hydrogeological zones (basement zones), resulting in a high cost of exploitation and infrastructure maintenance (Ministry of Hydraulics, 2015).

6-1.2 Impacts of climate change on the sector

Located in the Sahel, Niger is in an area already experiencing the consequences of global warming (IPCC, 2007). In fact, studies show a downward trend in rainfall over the past few decades (PANA, 2006), as well as an upward trend in minimum and maximum temperatures and often a later start to the rainy season (ME/SU, 2009). This will not be without consequences for rain-fed agriculture, and food security in general. Extreme phenomena already observed are mainly floods, droughts, sand and/or dust storms, extreme temperatures and violent winds (PANA, 2006). This leads to physical degradation of productive capital (water, soil, vegetation). Studies have thus shown a drop in isohyets of about 150 mm on the Niger between the so-called wet period (1950-1970) and the so-called dry period (1970-1990). This decrease in rainfall has led to a drop in surface runoff, groundwater recharge and the degradation of plant cover. Other harmful effects are also listed, such as: water stress due to heat, the effect of crops during flowering, the loss of young plantations, the proliferation of climate-sensitive diseases, the regression of certain plant populations and animals, the appearance of insects, the reduction of arable land, floods, the degradation of structures and social conflicts.

Indeed, climate variability and change are major constraints for the development of Niger, insofar as they have a direct impact on food security. Over the past forty years, the country has experienced seven droughts which have had an undeniable impact on natural resources and agro-pastoral production, in particular the degradation of the environment and plant cover, the acceleration of desertification and silting. The consequences of this development are dramatic, particularly with regard to food security with frequent food shortages leading to a massive rural exodus of young people.

In addition, global warming has led to a reduction in the potential for agricultural production and areas suitable for agriculture. Indeed, the declines are recorded for the areas of arable land, for the agricultural biological diversity, for the length of cropping seasons and for the yield per hectare, which would have negative consequences on food security and accentuate malnutrition. For all crops, regardless of soil type and climate scenario, the observed trend in yields is generally downward by 2100 due to the increase in temperature. Yields of crops such as millet

and sorghum will drop by more than 10% in the event of a temperature increase of +2°C and insignificant variations in precipitation over the future horizons (2021-2050, 2051-2075, and 2076-2100). A rise of +3°C will lead to a drop in agricultural yields of around 15 to 25%. In poor sandy soil conditions, yields will generally be below the 1971-2000 average in most localities in Niger; this downward trend in yields and the amplitude of variation of the latter being much more marked with the dry scenario. The cultivation of sorghum on clay soil would respectively record an average drop in yields ranging from -17% to -18% in Gaya and -1% to -17% in Birnin Konni for the wet scenario and the dry scenario. Tahoua and Tillabéri will also experience average declines in yields, respectively of -2 to -13% in the dry scenario only. On the other hand, rice cultivation could record a certain increase in yields of the order of 10 to more than 35% if water resources are sufficient. Moreover , in the different regions, the effect of fertilization would compensate water deficit.

6- 1.3 Risks and vulnerability to climate change in the agricultural sector

The assessment of the risks and vulnerability of the agricultural sector to climate change is generally carried out with reference to the methodology recommended by the 5th IPCC report (AR5). In this report, risks result from a combination of hazards or aliases, exposure and vulnerability (sensitivity and adaptive capacity) (IPCC, 2015). Regarding climatic hazards, historically the climate of Niger has recorded an upsurge in extreme phenomena since the 1990s (Ozer et al., 2010; Giannini & Kaplan, 2018; Held et al., 2011). However, agriculture in Niger is highly dependent on rainfall.

Future projections of climate change indicate that over the coming decades, Niger will face very significant changing conditions. For the year 2030-2050, the RCP 4.5 scenario shows a lower temperature increase than that shown by RCP 8.5. Precipitation shows the same trend in the RCP 4.5 scenario as for the RCP 8.5 where precipitation increases in a wider band from the coast to the north (NDC partnership & UNCDF-Project LoCALII, 2020). Taking socio-economic factors into account, future temperature projections show an overall continuation of the upward trend. Average daily temperatures are projected to increase between 1.1°C (reduced emissions scenario) and 1.6°C (high emissions scenario) by 2050, relative to 2004. A continuation of this increase until the end of the century is expected under the high emissions scenario. In addition, temperature extremes, namely the number of very hot days and tropical nights, will increase across the country under both emission scenarios. The biggest increases are expected in the south. Notably, the high emissions scenario projects 276 very hot days and 212 tropical nights per year for the end of the century (GIZ, 2021).

Exposure refers to the inventory of elements of an area in which hazardous events may occur (Cardona, 1990; UNISDR, 2004, 2009). The UNDDR-Desinventar database for the full period used as part of the climate risk assessment in Niger showed that over the period 1980-2019: the number of people directly or indirectly affected by drought and floods are respectively 18,428 and 6,752 per year (NDC partnership & UNCDF-LoCALII Project, 2020). Also, according to this report, the vulnerability of the agricultural sector to climate risks presents a rather contrasting pattern depending on the communes of Niger. It depends on the sensitivity of agricultural yields to water stress and the various adaptive strategies implemented by producers (AFD, 2020).

6-1.4 Environmental and social constraints in the agricultural sector

The agricultural development of the country is confronted with major constraints related to the random nature of rainfall. Droughts and the advance of desertification recorded in recent decades reinforce the following constraints:

- ✓ the extension of cultivated areas to face the drop in yields and to cope with the growing needs due to population growth, has led to a gradual disappearance of vegetation and physical degradation of soil biology and chemistry;
- ✓ demographic pressure results in the disappearance of traditional systems development and protection of natural resources (forest fallows, measures conservatories taken in favor of certain valuable forest species, certain laws decreed by customary officials for the protection of woody species endangered). Hence, a clear regression or even the disappearance of fallow land (traditional soil fertility restoration systems);
- ✓ the decrease in the total area of protected areas under the effect of the increase needs for productive activities;
- ✓ the appearance and extension of bare soils covered with erosion crusts;
  the decline in soil fertility, soil degradation (alkalinization and salinization) and the proliferation of invasive plants such as *Eichhornia crassipes* (water hyacinth); *Sida cordifolia and Typha australis.* .
- ✓ the continuous degradation of forest resources following anthropic and climatic effects ;
- ✓ improper use of fertilizers and phytosanitary products;
- ✓ the development of agricultural activities near bodies of water and the pollution of wetlands by agricultural activities;
- ✓ the occurrence of conflicts related to land use;
- ✓ the low level of technology;
- ✓ the uncontrolled management of water (underground and surface) by the producers;
- ✓ silting of watercourses, croplands and housing;
- ✓ food crop production, mainly provided by small family farms, consists mainly of cereals (mainly millet and sorghum) and is subject to strong climatic hazards and increases more slowly than the population;
- ✓ high inter-annual variability in cereal production: stable cultivated areas but uncertain yield for millet and sorghum.

As institutional constraints:

- the instability and multiplicity of institutions responsible for promoting agriculture and livestock;
- the poor performance of the research system, particularly in terms of extension;
- excessive centralization of administration;
- the relative weakness of rural organizations;
- insufficient contribution from the private sector;

- Weak inclusion of climate change in policy and programmes such as the weak inclusion of climate actions in the budget at communal, regional and national level in Niger;
- Lack of well-trained human resources related to climate finance in order to formulate the projects and programmes to get access to the convention climate funds;
- Lack of governance of climate change;
- Inadequate basic rural infrastructure.

6-2. Gender consideration in climate change impacts, vulnerabilities assessment

When addressing the issue of gender mainstreaming, three interrelated aspects are commonly highlighted (Tidjani Alou at al., 2015): it is about access, control and governance of resources. The UNDP (2009) perceives the concept of gender as the socio-cultural construction of female and male roles and of the relations between women and men. Indeed, it emerged from the results of the study commissioned by the Ministry in charge of the Environment of Niger that the majority of the participants interviewed have a solid knowledge on gender issues . Thus, more than a third of the people surveyed, i.e. 43.5%, indicate that gender is a social construction that refers to the roles and responsibilities of men and women. On the other hand, 18% think that gender is the difference between men and women and 6% think that it is the integration of young people and women in development actions (ME/LCD, 2021b). Obviously, in Niger the concept of gender is understood to varying degrees even by agricultural development actors, so taking this dimension into account, which has been promoted so much by stakeholders, has so far only produced mixed results.

In practice, efforts to improve women's access to land have not made significant progress, as evidenced by a report by the FAO (2008) which states that despite the demographic importance of women in the agricultural sector in many developing countries, they often have very limited access to the resources they need to support their livelihoods, including land, livestock, technologies, agricultural labour, support services, financial services and education. The report suggests that by closing the gender gap in the agricultural sector and increasing women's access to agricultural resources, it would be possible to generate significant advances in the agricultural sector and for society, with increase in overall harvests in developing countries by 2.5-4%, which, in turn, could reduce the number of hungry people worldwide by 12-17%. It is about granting or offering opportunities to men and women according to their abilities and according to their needs. Gender inequalities in the agriculture, forestry and livestock sectors, combined with the environmental effects of climate change in these sectors, contribute to jeopardizing the country's food security.

The impact of climate change aggravates the exclusion of women engaged in agriculture due to their lack of fertile land, means of production and training. Compared to men, women bear the responsibility for agricultural productivity, in a context of environmental degradation, without having the rights and resources they need to make this activity sustainable. Women are more active in the lowest paid links in production and processing, while men own the factors of production. In the livestock sector, gender norms, for example those that hinder their

membership in professional livestock organizations or legitimize their dispossession of animals, severely limit their equitable participation in this sector and therefore slow its evolution. country (Care ALP, 2011). In the AFOLU and Energy sector, men and women are fully involved almost to the same degree of the order of 30% of women in urban areas and 70% of women in rural areas are involved in the AFOLU sector, 30% of men in urban areas and 70% men in rural areas (ME/LCD, 2021b).

Speaking of governance, (ONU Femme, 2016) points out that the poverty of women, linked to their status in society, higher illiteracy among women, mentalities that do not accept equality between women and men strongly hinder women's capacities in decision-making spheres. Only young people have less access to breeding (20.45%) and control (17.65%). Women and men have access to livestock products except that women's access is much greater for small ruminants 27.27%. On the other hand, in terms of control, men have the monopoly in this area. The means of production are more controlled by men, which gives them a say in the roles and responsibilities of other actors, namely women and young people. Their representation at the decision-making level will certainly be reduced since their purchasing power is lower. (National Environmental Council for Sustainable Development, 2020). Land is one of the main sources whose exploitation generates a lot of income and makes it possible to meet the essential and specific needs of men and women and allows them to better position themselves in the decision-making sphere. The more you are economically well positioned, the better you have a grip on those who depend on you. Access is certainly important, but control is better. There is no big difference in access (between 23% and 27%). It is noted that 26.92% of women have access to these resources, but only 21.62% control them. Men and women all have access to agricultural resources, but men have the decision-making power over the use of these resources (ME/LCD, 2021b).

In addition, several studies have referred to a dynamic towards the empowerment of women, supported by the development of networks of women's organizations. This networking is illustrated by the strengthening of the capacities of women producers and promotion of products by associations such as: CONGAFEN, KASSAÏ, ZAM-ZAM (production of compost) confederation of battling women (processor of local products and processing of cereals: millet, peanuts, maize, cowpea) (CNEDD, 2020).

6-3. Assessment of needs and gaps of knowledge and capacity

6-3.1 Ideal capacities of the institutions for the assessment of the vulnerability

Climate change is a large scale phenomena which concerns all aspects of human life. It has created many challenges to the agriculture sector. Thus, to address these issues, many competences, skills and equipment are needed in order to evaluate the impacts and the vulnerability of the sector. During the stakeholders' dialogue, a discussion group has been organized in order to define the activities to perform and to determine the desired competencies

for each activity. The activities have been identified for each risk of climate change in agriculture (Table 1).

Table 1: Identification of the desired knowledges and capacities

Risks in the sector of agriculture	Impacts of the risk on agriculture	Activities for the assessment of the impacts	Description of the activity	Knowledge and capacity required
Drought	Yield drop	Data collection	Installation of instruments and sensors, archiving and data, management, monitoring, remote sensing	Agricultural sciences, IT, deployment and maintenance of tools and equipment
		Data analysis	Data processing and interpretation	Statistics, Geomatics
	Cereal and fodder deficits	Data collection and data analysis, evaluation of the production and need in food	Households' surveys and statistical analysis	Agroeconomics, Demography, Statistics, Geomatics

Risks in the sector of agriculture	Impacts of the risk on agriculture	Activities for the assessment of the impacts	Description of the activity	Knowledge and capacity required
Drought	Land degradation	Data collection on soil and data analysis	Elaboration of maps and spatial analysis	Cartography, pedology, agronomy
	Livestock loss	Data collection and data analysis	Households' surveys and statistical analysis	Veterinary, Agroeconomics, Demography, Statistics, Geomatics
	Decrease in water resources (surface and groundwater)	Data collection and data analysis on water resources	Elaboration of maps and spatial analysis	Hydrology, climatology, Statistics, Geomatics
Flood	Destruction of crops and infrastructures	Data collection and data analysis	Households' surveys and statistical analysis, Elaboration of maps and spatial analysis	Hydrology, Climatology, Statistics, Geomatics, Agroeconomics, Demography
Strong winds, sandstorms	Destruction of crops	Data collection and data analysis	Elaboration of maps and spatial analysis	Climatology, Statistics, Geomatics, Agroeconomics, Demography
Extreme temperature	Yield drop	Data collection and data analysis	Households' surveys, Elaboration of maps and spatial analysis	Climatology, Statistics, Geomatics, Agroeconomics,
Wildfire	Destruction of crops and infrastructures	Data collection and data analysis	Elaboration of maps and spatial analysis	Climatology, Statistics, Geomatics, Agroeconomics, Demography, fire agents

Niger is highly affected by the first risk which has revealed the vulnerability of the sector to climate change. The two last risks are not significant in the country.

6-3.2 Needs and gaps of knowledge and capacity in the sector

For the whole country, most of the institutions do not have the full competences required for the assessment of the impacts of the different risks in the agriculture sector. Furthermore, the availability of the competences decreases from the central institutions at the ministries to the village where few technicians are available for the supervisions of farmers.

Furthermore, an evaluation of the capacities, skills and constraints have been done from the local scale to the national scale (table 2) through a survey. The survey was carried out at the individual (15 experts have responded) and institutional level (12 institutions have responded). Altogether, the capacities and needs in the different institutions are not related to gender. But this aspect appears in the assess to high level position in the decision making. There is a weak proportion of women in the different institutions and in the different platforms from the local level to the national level. Even if in the villages, the constraints for women participation are social, at the institutions level, the main constraint is low proportion of high educated women.

At the legislative level, overall, the concept of gender is timidly addressed in sectoral policies for agriculture in Niger (National Environmental Council for Sustainable Development, 2020). Although these policies contain some data disaggregated by sex and gender is often recognized as a cross-cutting theme or guiding principle, they generally lack objectives, results, indicators and budgets aimed at effectively reducing gender inequalities. The recent adoption by the Government of Niger of the national gender policy and the national strategy for the prevention and response to gender-based violence in Niger (2017-2021) marks an important turning point on the path to women's empowerment.

Table 2: Evaluation of the gaps and needs from the local scale to the national scale

Items	Village / municipality	Sub region	Region	National
Capacity and Skills available	Deconcentrated technical services with one or two technicians; agriculture, livestock, environment, local councilors, traditional authorities and some NGOs, primary and secondary schools.	Departmental directorates of technical services with engineers; Prefecture, development projects, NGOs and High schools	Regional offices, the governorate, local elected officials, the regional council, NGOs and ADs, universities, CRA	Ministries, institutions, international and regional organizations, universities, NGOs and AD, RECA, large projects, Research Institutions
Major constraints in the agricultural sector	Climatic hazards, limited inputs (fertilizers, seeds, phytosanitary products, etc.); land problems, cultural enemies, insufficient	Climatic hazards, limited inputs (fertilizers, seeds, phytosanitary products, etc.); land problems, cultural	Climatic hazards, limited inputs (fertilizers, seeds,	Climatic hazards, limited inputs (fertilizers, seeds, phytosanitary products, etc.); land problems, cultural enemies,

Items	Village / municipality	Sub region	Region	National
	equipment... insufficient or lack of advisory support	enemies, insufficient equipment... insufficient or lack of advisory support	phytosanitary products, etc.); land problems, cultural enemies, insufficient equipment... insufficient or lack of advisory support	insufficient equipment... insufficient or lack of advisory support
Major shortcomings in the agricultural sector	Insufficient advisory support, insufficient inputs, low coverage of technical services, absence of agricultural credit, poverty of farmers	Insufficient advisory support, insufficient inputs, low coverage of technical services, absence of agricultural credit, poverty of farmers	Insufficient advisory support, insufficient inputs, low coverage of technical services, absence of agricultural credit, poverty of farmers	Insufficient advisory support, insufficient inputs, low coverage of technical services, absence of agricultural credit, poverty of farmers
Level of women involvement in the sector	high	high	Mean	Mean
Level of youth involvement in the sector	high	high	Mean	low
Distribution of agricultural land (youth, women and men) in percentage of ownership (%)	10%, 15%, 75%	5%, 10%, 85%	5%, 10%, 85%	5%, 10%, 85%

Items	Village / municipality	Sub region	Region	National
What is the proportion of women in agricultural services	Less than 5%	10	18	20
What is the proportion of young people in agricultural services	70	50	30	20
Management of agricultural income in households	Domination of men in management	Mainly men	Mainly men	Shared
Interactions between different actors and institutions	Collaboration between farmers' cooperatives, meeting	Multi actors, meetings	Collaboration between actors, meeting and workshop	Platforms and central services, institutions
Gaps in the sector in assessing climate change impacts, vulnerability and risks	Absence of data and means of collection, lack of experts and tools, equipment, etc.	Low archiving capacity, skills, low data collection coverage, low equipment, etc.	Low archiving capacity, skills, low data collection coverage, low equipment, etc.	Low archiving capacity, skills, low data collection coverage, low equipment, etc.
Needs in the sector in terms of assessing the impacts, vulnerability and risks of climate change	Competent human resources in quantity and equipment, trainings and capacity building	Competent human resources in quantity and equipment, trainings and capacity building	Competent human resources in quantity and equipment, trainings and capacity building	Competent human resources in quantity and equipment, trainings and capacity building

6-4 Opportunities related to gender inequality reduction

The Sustainable Development and Inclusive Growth Strategy (SDDCI) is the framework orientation of the economic and social policy of the country. For the rural sector development, the orientations are contained in the Strategy of the 3N Initiative (Les Nigeriens Nourissent les Nigeriens) adopted in April 2012 (HCI3N, 2015 and 2020). Its objective is to "contribute to putting populations of Niger free from hunger and guarantee them the conditions for a full participation in national production and the improvement of their incomes", through strengthening national capacities for food production, supply and resilience to food crises and disasters.

Promotion and dissemination of Climate-Smart Agriculture (CSA) approaches by the government and the NGOs help to increase the capacities of the actors in the sector. The AIC approach aims to achieve objectives by considering different scales, from the plot to the landscape, and a short and long-term time horizon, taking into account the specificities and priorities at different levels (from local to national) (AFD, 2020). It is based on knowledge and know-how and presupposes a detailed analysis and planning of the transitions necessary for adaptation. It integrates technologies, institution building and investments. A so-called "climate-smart" local authority relies on local knowledge and know-how to develop and implement a local development plan ensuring the transition to CSA adaptation practices and techniques, mobilizing services climate information (AFD, 2020).

The existence of universities, research institutions and high education schools could help to improve human capacities in the sector of agriculture at the different levels.

The creation of women's groups of interest by NGOs and development projects in the villages is an opportunity for women. In some villages, they are the main manager of the irrigation schemes, which allow them to have more revenue than the men. They now play an important role in the processing and the marketing of agricultural products.

CONCLUSION

Niger, like all Sahelian countries, is strongly affected by the effects of climate change. Most of the country's natural resources have suffered severe degradation or decline. Niger in particular and the Sahel in general is affected by the main risks (flood, drought) of climate change since some decades and have shown a high vulnerability to climate change. The agricultural production systems are affected by the drop in rainfall and the increase in temperature. Niger is one of the most fragile countries with a low capacity for resilience and adaptation.

To better fight against the various effects of climate change, Niger is part of many international conventions and protocols. This has led to the creation of many services, frameworks and platforms that work on climate change. Development projects have also been developed and implemented to support the government and the

population. But, despite the presence of these institutions and projects, many gaps persist in the development and implementation of relevant strategies to build resilience and ensure better adaptation to climate change.

Assessment of knowledge and capacity needs and gaps, on the issue of climate change related to agriculture and gender in Niger has provided a baseline data that can serve to formulate policies and strategies in order to reduce vulnerability and to build resilience in Niger.

RECOMMENDATIONS

Niger economy depends on agriculture with a contribution of about 40% to the GDP (AFD, 2020). Thus, any challenge in the sector entails a negative impact on the population's life . The previous drought due to the decrease in rainfall have created some famines. It's urgent to reinforce the sector through the capacity building at the different levels and the implementation of relevant policies and strategies which take into account the issue of climate change. The capacity building should contribute to reduce the gaps and to satisfy the needs for the assessment of climate change impacts and vulnerability. The approaches tending to strengthen the capacities of actors must reduce the discrimination against women in terms of access to agricultural resources, education, financial benefits and labor markets. It also requires investing in labor-saving and productivity-enhancing infrastructure and technologies to save women time that they could spend on more productive activities; and facilitating women's participation in flexible, efficient and equitable rural labor markets.

It is concretely about:

- encourage the development of agricultural technologies sensitive to Climate Change with the involvement of men and women and access to these technologies;
- promote biotechnology, with water-saving agricultural technologies;
- encourage the development of agricultural technologies favorable to the fight against soil erosion;
- raise awareness and training in entrepreneurship;
- create the conditions for a large number of women to become landowners, by promoting the schooling of young girls;
- promote the use of energy-saving technologies such as biogas;
- strengthen environmental and social safeguard measures sensitive to gender and vulnerable groups;
- promote the creation of databases with information and indicators;
- systematize the integration of gender dimension in planning and budgeting for development.

More specifically table 3 presents a summary on the gender issues.

Table 3: Summary of main capacity and knowledge gaps and needs related to gender

Activities and capacities	Needs and knowledge gaps	Recommendations
Data collection	- conduction of socio-economic surveys -installation and maintenance of sensors - computing knowledge for data management	Capacity buildings for women: - Socio economy - Statistic - Database management - Computer science
Data analysis	- Statistical knowledge - Database management - Use of geomatic tools - Skills in some software, modeling tools	Capacity buildings for women: - Statistic - Database management - Computer science - Geomatic
General knowledge	- Agronomy - Climatology - Environment - W ater resources (hydrology)	Promotion of women access to high education
Equipment and materials	- Computers - Sensors and data loggers - Materials for survey - Tools and software - Access to new technologies	Financial support and creation of women organization platforms in the sector of agriculture
Exchanges and platforms	- Policies and strategies in climate change - Institutional organization	- Capacity building and sensitization - Creation of women organization platforms in the sector of agriculture

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APPENDIXES

Appendix 1: List of stakeholders

1. AGRHYMET
2. CNEDD (Conseil National pour l'Environnement et le Développement Durable)
3. Ministère de l'environnement et de la lutte contre la désertification
4. INRAN (Institut National de Recherche Agronomique du Niger)
5. CNES (Centre National d'Énergie Solaire)
6. CTNCVC (Commission Technique Nationale sur les Changements et Variabilité Climatiques)
7. DMN (Direction de la Météorologie Nationale)
8. UAM (Université Abdou Moumouni)
9. AGRHYMET (Centre Régional de Formation et d'Application en Agrométéorologie et en Hydrologie Opérationnelle)
10. ACMAD (Centre Africain pour les Applications de la Météorologie au Développement)
11. FAO (Organisation des Nations Unies pour l'Alimentation et l'Agriculture)
12. OMM (Organisation Météorologique Mondiale)
13. PNUD (Programme des Nations Unies pour le Développement)
14. FEM (Fonds pour l'Environnement Mondial)
15. UICN (Union Internationale pour la Conservation de la Nature)
16. ABN (Autorité du Bassin du Niger)
17. Projets de développement (PGRC/DU, PIDACC, PRODEV, etc.)
18. ONGs (KARKARA, DEMI-E, Mercy Corps, WaterAids, RECA, etc.)
19. PRAPS II (Projet Regional d'Appui au Pastoralisme au Sahel, Phase II
20. 3N
21. Commission Nationale des Droits Humains (CNDH)
22. Agence Nationale de la Grande Muraille Verte au Niger
23. Programme de Développement de l'Agriculture Familiale (PRODAF)
24. CRS, World vision, UNICEF, GIZ, Plan Niger, SNV, Care International, etc.
25. Ministère de l'Agriculture de élevage
26. Ministère de l'hydraulique
27. Ministère du Plan
28. Projet d'Appui à l'Agriculture Sensible aux risques Climatiques (PASEC)
29. Secrétariat Permanent du Code Rural
30. Haute Autorité à la Consolidation de la Paix
31. INS-Niger
32. ICRISAT
33. Réseau de la Jeunesse Nigérienne sur le Changement Climatique (RJNCC)
34. Fédération des Unions et Coopératives des Producteurs de Riz (FUCOPRI)
35. Association pour la Redynamisation de le L'Elevage au Niger (AREN)
36. Projet d'autonomisation des femmes et du dividende démographique au Sahel-Niger (PRAF/DD-SWEDD)

37. Plateforme de la Société civile sur le Changement Climatique et le Développement Durable
38. Le Ministère de la Population, de la Promotion de la Femme et de la Protection de l'Enfant
39. Projet Genre, Population et Développement
40. ONU Femmes-Niger

Appendix 2: Main stakeholders mapping

The sectors of climate change and agriculture are led by several actors, from the institutions to the platforms and from the individual to the national levels.

A) Government ministries and technical services

A.1) The Ministry of agriculture and livestock

This ministerial department of government is responsible for the design, implementation and monitoring of the country's agricultural and livestock policies and strategies. The mission of the Ministry of Agriculture is to design, develop and implement government policy in the areas of agricultural development and food security. His missions are:

- ✓ To design, develop, implement and ensure the monitoring and evaluation of national agricultural development strategies;
- ✓ To promote the private sector in the development of agricultural production sectors,
- ✓ To design and implement agricultural development programs and projects and to monitor them;
- ✓ To ensure the establishment of hydro-agricultural infrastructure, rural buildings and agricultural tracks;
- ✓ To design and define lines of applied research in rural development and food security,
- ✓ To promote technology transfer, agricultural advice, supervision, support for rural women and the structuring of the rural world;
- ✓ To contribute to the achievement of food security;
- ✓ To design the agricultural map;
- ✓ To create a database on the agricultural sector;
- ✓ To support the emergence of a dynamic private sector for the production, supply and local distribution of agricultural inputs and equipment;
- ✓ To stimulate the development of agro-industrial and export crops;
- ✓ To ensure the maintenance of agricultural statistics;
- ✓ To strengthen the information and communication system at the level of actors in the agricultural sector;
- ✓ To ensure the protection of plants, information, awareness and education of the population in this area;
- ✓ To ensure the rational management of natural resources in terms of land tenure security and soil fertility;
- ✓ To participate in the implementation of the regional economic integration policy,
- ✓ To participate in the establishment and strengthening of credit and savings structures adapted and accessible to producers and operators in the rural world;
- ✓ To put in place mechanisms for resolving farmer-herder conflicts;

- ✓ To participate in meetings, symposia, conferences, seminars and sub-regional and international negotiations dealing with issues relating to the areas of competence of the Ministry;
- ✓ To consider the environmental dimension in the programs and projects in the sectors;
- ✓ To promote food agroforestry and urban and peri-urban farming;
- ✓ To promote gender and equity in the activities in the sectors.

A.2) Ministry of environment and the fight against the desertification

The key points of the missions of the ministry:

- ✓ environmental protection and monitoring of international environmental conventions ratified by the country;
- ✓ development and monitoring of environmental education programs;
- ✓ coordination of activities to combat desertification and other causes of environmental degradation;
- ✓ constitution, classification, conservation, development and management of the national forest heritage;
- ✓ constitution, classification, conservation and management of reserves, national parks, wildlife reserves and similar reserves in relation with the Ministry in charge of tourism;
- ✓ enhancement of wildlife potential;
- ✓ regulations on forest, wildlife and fisheries resources and the control of their application;
- ✓ water protection in conjunction with the competent ministers and local authorities;
- ✓ initiation, coordination, regulation and monitoring of actions related to environmental sanitation and improvement of the living environment in both rural and urban areas;
- ✓ development of a national policy on the development of green spaces and beautification;
- ✓ the drafting of regulatory texts on the fight against pollution and nuisances.

A.3) CNEDD (Conseil National de l'Environnement pour un Développement Durable)

The CNEDD (the National Environmental Council for Sustainable Development) attached to the Prime Minister's office is a structure, an institution of a social nature. According to article 2 of the decree n°96-004/PM of January 09, 1996, the National Council of the Environment for a Sustainable Development (CNEDD), has the missions "to elaborate, to implement, to monitor and to evaluate the National Environmental Plan for Sustainable Development (PNEDD)". CNEDD is the national focal point of the different conventions and agreements on climate change.

It has enabled Niger to undertake a number of actions on climate change, including:

- The development of its Initial National Communication (CNI) on climate change;
- Adoption of the national strategy and action plan on climate change and variability;
- The development of the National Action Program for Adaptation to Climate Change (PANA);
- The development and implementation of the National Strategy and Action Plan for Capacity Building to manage the global and national environment;

 The development of the Second National Communication (SCN) on the

climatic changes.

The missions of CNEDDD are to:

- ✓ Define a national reference framework on policy, guidelines, objectives, strategies and action programs in the field of the Environment for Sustainable Development;
- ✓ Design and promote the establishment of an adequate institutional framework and mechanisms, ensuring the coordination and harmonization of the activities of all stakeholders in the PNEDD process;
- ✓ Ensure compliance with national and international environmental standards in all economic, social and cultural development activities;
- ✓ Mobilize the resources necessary for the development and execution of the National Environmental Plan for Sustainable Development and ensure their rational use;
- ✓ Promote a real change of mentality and attitude for a sustainable use of natural resources and a rational management of the environment;
- ✓ Ensure the integration of the dimension of climate change and adaptation in development policies, strategies and programs;
- ✓ Ensure climate governance and administration of funds related to climate change and climate adaptation;
- ✓ Ensure the mobilization of the financial resources necessary for the implementation of climate change and adaptation activities.

A.4) RECA (Réseau National des Chambres d'Agriculture ; National Network of Chambers of Agriculture)

The Chambers of Agriculture of Niger were created by Law 2000-15 of August 21, 2000, supplemented by the implementing decree of 18 May 2001. However, it was necessary to wait until 2004 and 2005 for elections of consular representatives to get organized and ensure that the eight Regional Chambers of Agriculture (CRA) are effectively put in place after the election of their offices by the consular members. The National Network of Chambers of Agriculture (RECA) was set up in July 2006.

The functions of RECA are to:

- Publicize the concerns of the various categories of rural producers and assert their points of view within the framework of development policies and programs;
- Inform rural producers in all areas that concern them and facilitate their access to services and resources by providing them with adequate guidance and advice;
- Help rural producers in the promotion and realization of their projects, by promoting their organization and facilitating the mobilization of technical support and funds they need;
- Defend the interests of rural producers.

B) **Development projects**

Many development projects are implemented in Niger in the sector of agriculture from the local level of municipalities to the national level with the aim to combat climate change. Most of these projects take into account the gender issue.

C) International institutions

The United Nations organizations such as FAO and UNDP are contributing in the sector of agriculture and climate through many development projects, elaboration of some policies and strategies. In line with these organizations , there are other regional and sub-regional organizations which support the government.

D) NGOs and associations

The national and international NGOs are also playing an important role in the sector of agriculture and climate change. The National Coordination Committee of NGOs is a national forum of organizations working in the field of the environment. It is mandated by civil society to coordinate the action of grassroots NGOs and community organizations, with a view to synergizing efforts.

E) Educational, research and training institutions

Niger has a few research and training centers in the field of Agriculture. The Practical Institute for Rural Development (IPDR), created in 1933, is the oldest training center for agronomy technicians. Since 2011, the government of Niger has created basic training centers in all 266 municipalities (Training Centers for Trades) and Professional and Technical Training Centers in the 8 regions. In addition, a Professional Agricultural High School has been created in Téra.

At the University level, the oldest university in Niger, Abdou Moumouni University has had a faculty of agronomy since its creation in 1971. University training has been reinforced since 2014 by the Boubakar Bâ University of Tillabéry solely dedicated to the agricultural sector.

In addition to the research activities carried out in the various universities, Niger has a research center solely dedicated to agriculture. The National Institute of Agronomic Research in Niger (INRAN), created in 1975, has been a public establishment of a scientific, cultural and technical nature (EPSCT) since April 2010. INRAN's missions are the design and execution of agricultural research programs in all areas of rural development and the coordination of all agricultural research undertaken on the national territory.