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**IMPROVING AGRI-FOOD CHAINS THROUGH THE PROMOTION  
OF SELECTED NUS AND INNOVATIVE AND SUSTAINABLE  
BUSINESS MODELS: THE CASE OF SAHEL**

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## INDEX

INTRODUCTION.....	4
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### CHAPTER I

#### **N.U.S. NEGLECTED AND UNDERUTILIZED SPECIES IN AGRICULTURE**

1.1 What are the NUS.....	11
1.2 Use and Function of NUS.....	13
1.3 The Green Revolution: a Starting Point in the Use of NUS.....	17
1.4 The Boom-and-Boost Cycle in Agricultural Business.....	20
1.4.1 The Promotion of NUS.....	21
1.5 Species List: Examples of NUS Used for Food in SustLives' Project.....	25

### CHAPTER II

#### **THE IMPORTANCE OF SUSTAINABLE FOOD VALUE CHAINS**

2.1 FAO's Outlook on Sustainable Food Value Chains: An Overview.....	33
2.1.1 Definition of the Main Concepts of Value Chains.....	36
2.1.2 Food Value Chains and Sustainability.....	39
2.2 Guiding Principles and Guidelines: The Importance of Selecting and Developing Value Chains in Agri-Food Sector.....	43
2.2.1 Guiding Principles.....	44
2.2.2 Guidelines.....	47
2.3 Restoring Agri-Food Chains through the NUS and the Difference with Commodity Crops.....	52

### CHAPTER III

#### **CREATING SUSTAINABLE BUSINESS MODELS: THE USE OF BUSINESS MODEL CANVAS IN DEVELOPING AND UNDERDEVELOPED COUNTRIES**

3.1 The Business Model Canvas: a General Definition.....	59
3.1.1 Generating a New Business Model Canvas: an Adaptation of the Model.....	61

3.1.2 The Visual Thinking, a Tool for Everyone.....	63
3.2 A Structured Canvas: the triple Layered Business Model Canvas.....	67
3.3 The Business Model for Local Entrepreneurs: The Case Study of Nigeria.....	69

#### **CHAPTER IV**

### **DOING BUSINESS IN SAHEL: HELPING WOMEN TO IMPROVE AGRI- FOOD BUSINESS THROUGH THE USE OF THE BUSINESS MODEL CANVAS**

4.1 An Outlook on Sahel’s General Condition: .....	74
4.2 Education and Gender: Two Important Pillars in the Sahel’s Agribusiness.....	80
4.2.1 Women Engagement in Agricultural Production, Inadequacies in Related Policies and Other Important Factors.....	86
4.3 Application to the Use of Sustainable Business Models in Rural Development and Related Limits to Innovation.....	89
4.3.1 Doing Business for Women in Sahel .....	91
4.3.2 Limits to the Innovation.....	94

<b>FINAL REMARKS.....</b>	<b>96</b>
---------------------------	-----------

<b>REFERENCES.....</b>	<b>103</b>
------------------------	------------

<b>REPORTS.....</b>	<b>111</b>
---------------------	------------

<b>JOURNAL ARTICLES.....</b>	<b>112</b>
------------------------------	------------

<b>WEBOGRAPHY.....</b>	<b>112</b>
------------------------	------------

## INTRODUCTION

The interest that prompted to choose food insecurity and the possible implications for minimizing hunger as a general theme was born during the United Nations Agenda 2030 course for sustainable development and economic and social studies held from the Università degli Studi Roma Tre, which aims to develop the theme of sustainable development with a multidisciplinary approach. In fact, erroneously, it is thought that when sustainability is mentioned, it refers only to the environmental issue but also the economic and social aspects that can have a sustainable declination. Growth, employment, work, justice, culture, social cohesion, peace, and international cooperation are some of the recurring themes, and the ones related to the fight against hunger, poverty, inequality, and gender issues are very important to consider sustainability tout court.

In this regard, in fact, the first definition of sustainability was introduced in 1987 thanks to the well-known "Brundtland<sup>1</sup> Report" (UN n.d. 1987), which defined critical points and that the global problems of the environment are due to the great poverty of the South and to the production and unsustainable consumption in the North. The guide, which the report outlined, was an aid based on the need to implement a strategy capable of integrating the needs of development and the environment, defined with the term "sustainable development" which, still today, is used to talk about development in the true sense of the term.

The definition, given to the concept just described, was that of "sustainable development as development that allows the current generation to satisfy their own needs without compromising the possibility of future generations to satisfy their own".

And starting from this, I decided to take into analysis the 2030 Agenda goal 2 "Zero Hunger" as a reference that has as main goal to end hunger, achieve food security, improving nutrition and promote sustainable agriculture.

It is determined that the leading cause of death in the world is hunger. Our earth has given us a wealth of resources, but millions of people are starving due to uneven

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<sup>1</sup> Gro Harlem Brundtland, president of the World Commission on Environment and Development, WCED, established in 1983

access and ineffective management of these. With the use of cutting-edge technology and equitable distribution methods, we can support the global population and ensure that no one will ever again be hungry.

In this regard, in fact, the urgent need to develop the agricultural sector leads us to give further importance to tools such as the extensive use of new technologies and consulting services which, nowadays, can give important help in developing countries or low-income countries. In this sense, the impact that climate change is having - and will have subsequently - in developing countries will also depend on agricultural development and their own resilience and, starting from this point, the connection with the goal 2 of the 2030 Agenda it is more important than ever.

Related to this, it is important to introduce and develop the concept of "food security" where we cannot forget also to include the definition of "food insecurity" and malnutrition: concepts that have evolved over the years and will continue to evolve. According to the official definition of the United Nations "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to satisfy their diet, needs and food preferences for an active and healthy." (World Food Summit n.d. 1996) And, connected to this as a development of the concept, four connected dimensions are widely recognized, such as food availability, access to food, use and stability in terms of food availability and, in 2020, two more dimensions were added by HLPE<sup>2</sup>: sustainability and agency as a vital dimensions of food security that flow directly.

From this definition, therefore, the thesis project elaborated presents an in-depth analysis to understand if it is possible to use NUS, acronym of Neglected and Underutilized Species, as a means for improving the agri-food chains in a sustainable way, necessary for development in the Sahel region and to approach the "Zero Hunger" objective of the United Nations, through the help of the Business Model Canvas as a facilitator tool because of its easy and ready-to-use characteristic of being useful, simple and easily applicable in different contexts.

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<sup>2</sup> High Level Panel of Experts on Food Security and Nutrition

SustLives, for example, is a project lead by AICS and CIHEAM – Bari<sup>3</sup>, that aims to facilitate the transition to sustainable and climate-resilient agricultural and food systems in Burkina Faso and Niger, through the enhancement of the heritage of local crops and their value chain, which proposes also to generate income in the Sahel region, having the aim to strengthen the research and innovation capacities of the actors involved, through a gender and age-sensitive approach, of agricultural innovation and the knowledge system of neglected and underutilized crops in the countries concerned, with an in-depth analysis of socio-economic and agri-environmental characteristics of the areas mentioned therein, through a comprehensive and holistic approach to protect and improve agro-biodiversity.

In this regard, it is important to introduce the concept here mentioned by moving from what is concretely intended for “biodiversity”: for Cambridge Dictionary is the the number and types of plants and animals that exist in a particular area or in the world generally”. Of course, the definition of what agro-biodiversity is, it is possible to move from research conducted by FAO in 1998, about 30,000 species of edible plants have been identified, of which 7,000 species used by humanity to satisfy food needs.

To date, no more than 150 species are cultivated for commercial purposes and only four types of these - such as rice, wheat, cornstarch, and potatoes - account for 60% of the caloric intake needed by a human being to live. Therefore, in relation to a food safety perspective, relying only on this food base can make the food chain, in Sahel, extremely vulnerable because of an important food crisis surged in the '70, moving to the Malian's one and the most recent in Burkina Faso because of high food prices, conflict and displacement, climate change impacts and the COVID-19 pandemic, leading to severe negative implications for both food safety and nutrition and driven millions of people into these conditions.

For this reason it is important to maintain excellent levels of biodiversity related to the agri-food chains with the possibility of preventing disasters related to crops and, in reference to this, the concept of NUS is applied to all those species of plants marginalized, if not ignored, by researchers, farmers and policy makers: this

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<sup>3</sup> International Center for Advanced Mediterranean Agronomic Studies

kind of crops do not belong to a particular commercial sector, but belong to a large and rich group in terms of biodiversity, which can easily adapt to smaller local crops.

Also, we can consider NUS in the sense of how a crop is consolidated in one country rather than another, whether it is neglected or not and, in some cases, statistics and research do not distinguish NUS from other crops.

Regarding the gender issue, it is also included and part of the development of the use of NUS, in some areas, women are the ones that keep these goods and the related processing methods; on the other hand, men produce necessities and commercial crops: this leads us to deduce that NUS can be particularly important for female empowerment.

Furthermore, it is important to mention the enormous opportunities that the NUS offer to all countries, regardless of their development: from improving the diet of some people to enhancing the ability of the new generations to produce income, not only referring to those involved in agriculture, but also to all those involved in value chains and, finally, making agricultural production systems resilient in the face of climate change.

In this sense, starting from this project, it is possible to make a reflection related both to food insecurity and the use of NUS for restoring food value chain in Sahel's region, this because for some of the reasons already mentioned before: Sahel region is an important area full of biodiversity and extremely important for the ones related to the environment, the important condition of women – which numbers are constantly growing in doing business, full of opportunities but with another side that is extremely suffering in the agri-food sector, with a lower redistribution of income and higher levels of food insecurity, where not all of the population can have access to adequate food conditions and everything that rounds in the sector here analyzed.

In fact, the question, and the reflection around whom this thesis rounds are the following: it is possible to reduce food insecurity by promoting the use of selected NUS in the Sahel region, by improving agri-food chains through innovative and sustainable business models?

So, taking a cue from these words, combining the needs and the main objectives of the SustLives project with the main question around whom this thesis is developed, it could be possible to find alternative ways for trying to improve the agro-economic

sector in both Burkina Faso and Niger, focusing and using the already existing theory, related to the production of small family farmers and local expertise, selecting value chains for sustainable food value chain development and the related use of business model canvas, that is a visual representation of a business model, that helps who wants to create business and generate income, highlighting all key strategic factors in a wide, comprehensive, and all-encompassing perspective of the business' operations, clients, sources of income, and more.

Starting from a reflection made by the state of education in the Sahel (The World Bank n.d. 2021), by the conclusion of elementary school, just 12% of the students can read and comprehend an age-appropriate paragraph. Less than 50% of adult females in each Sahel nation are literate, compared to 59% in Sub-Saharan Africa as a whole.

In this sense, doing business, and doing business in agriculture, is difficult. Having the help of such instruments, like the business model canvas that is based mostly on a graphic method, could be important for its simplicity, helping people to generate income, and helping reducing food insecurity, regardless of their literacy rate and the high-level knowledge necessary for starting a specific business on the agricultural sector.

So, in this approach, the main instrument that could help in answering at the goal of this thesis, therefore, starts from an accurate analysis related to the promotion of the neglected and underutilized selected crops species for restoring agri-food value chains in the Sahel region that, from the data collected from the AFD<sup>4</sup>, has a high population growth and low human development indicators (for example, Burkina Faso and Niger are listed among the ten lowest HDI groups). Then, assuming the possibility to reduce the condition of food insecurity and the possibility of doing business, with the comparison of the existing literature on some virtuous and successful projects already working, for the application of the framework on sustainable food value chains theorized by FAO and the use of business model canvas as an important tool for small family farmers and regional knowledge, one of the goals to reach, with this thesis and the analysis mentioned, is the one to try to assume, if it is possible through the use of

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<sup>4</sup> Agence Française du Développement

several important instruments, to facilitate the transition to sustainable and climate-resilient agricultural and food systems thanks to the help of the relative scientific works that integrate the role of NUS in the agri-food sector.

The path followed in the writing process of this thesis starts with the first chapter, in which will be defined an in-depth analysis of the NUS: a detailed reviewing on what they are, their definition and a brief hint to the Green Revolution of the '60, giving an indication of the first use of the NUS and how their definition developed through the years. Important is the promotion that literature refers to the maintaining traditional legacy that plays a significant role in preserving local communities' identities and boosting their self-assurance in the face of dangers brought on by tendencies toward globalization and changes in lifestyle, connected to the socio-economic analysis of the Sahel region market that will be developed deeply in the fourth and last chapter. Then, defining what are their use and functions and concluding with a list of the examples of NUS selected for food sector in SustLives' project.

The second chapter is focused on another important theme for better comprehending the work developed in the thesis: this one refers to the Sustainable Food Value Chain. Starting on what the FAO's framework told us, it is important to better comprehend what is at the base of the theory: the analysis of the value chain and sustainability, that combined gave us a clear framework to analyze better is work.

The third one is dedicated to the business model canvas, and its possible application for rural development in small family farmers business and its integration in regional knowledge for improving business and the agri-food market sector, and a specific description and related differences with the triple layered business model canvas, created for the agricultural sector with specific indicators.

The last chapter, then, is related to the specific case of the Sahel region, taking as an example what SustLives wants to pursue and developing the answer to the question of the analysis: restoring agri-food chains through the promotion and the use of the NUS previously analyzed. In this chapter, important is the study and the research that give us important elements related to the region, that could help us better to move and understanding how it is possible to create business with an in-depth PESTEL analysis. Moving from that, it is necessary to mention the importance of women in doing business and the difficulties the region must face still today.

The methodology used for this research it is the search compilation method, in which it has been combined both the compilation method that refers at the existing literature review on the following themes: NUS, Sustainable Food Value Chain, and data collection for having a detailed description of the Sahel region for better determining its condition and its difficulties. At this point, it is combined the research method as well and the data collection from detailed reports comparing the virtuous projects that has already restored agri-food chain and related papers in the scientific literature that could help to arrive at the demonstration of the importance of the use of business model canvas for the promotion and the use of NUS for business in the selected region.

At the end of the day, it is important to believe that cultural aspects and underutilized crops resources should receive more attention in the coming years when science and technology are applied to the sustainable and creative use of biodiversity. These factors open a wide window of opportunity for differentiated products with higher added value and help to create a strategic livelihood buffer for pursuing Agenda 2030 SDG 2 “zero hunger” aim.

## CHAPTER 1

# N.U.S. NEGLECTED AND UNDERUTILIZED SPECIES IN AGRICULTURE

### 1.1 WHAT ARE THE NUS

Starting from the definition given by Bioversity International<sup>5</sup>, when we refer to NUS, we define the “neglected and underutilized species”, or better say sometimes called “orphan” crops.

In this sense, this concept is utilized principally for plant species that are mostly marginalized by the scientific community and policy makers, as it is defined in the scientific literature. Of course, in this sense, it could be important to understand and develop a legit question related to producers, markets, and customers: if there was significant demand for those products and manufacturing that responds, could we still call them “neglected”?

From these reflections, going further, in a publication (Padulosi et al. 2013) that collects several research papers developed by Bioversity International, the FAO<sup>6</sup> and CINE<sup>7</sup>, is well specified that “NUS are not traded as commodities.” but “NUS present tremendous opportunities for fighting poverty hunger and malnutrition”. This mostly because they can help agricultural systems to be more resilient to climate change, that today is one of the most important causes that contributes to high levels of food insecurity in the World and can also help indigenous communities to reaffirm their identity and empower them.

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<sup>5</sup> Bioversity International is a research-for-development organization working with partners worldwide to use and conserve agricultural and forest biodiversity for improved livelihoods, nutrition, sustainability, and productive and resilient ecosystems [www.bioversityinternational.org](http://www.bioversityinternational.org)

<sup>6</sup> Food and Agriculture Organization agency of the United Nations

<sup>7</sup> Centre for Indigenous People’s Nutrition and Environment

In an article written by Padulosi<sup>8</sup>, an important problem analyzed is one related to NUS and their marginalization because, at first, there is scarce competitiveness in modern agriculture between them and commodity crops, that are advantaged in the agri-food sector (Padulosi 2017). This marginalization poses significant concerns about our ability to feed the globe well. Food is now viewed as a purely "commodity crop yield" that does not take nutrition or agro-ecological concerns into account. Crop intensification, extensive pesticide usage, mechanization, standardization of agronomic procedures, and an unparalleled loss in crop species and varieties under cultivation are therefore the key issues in production systems. In fact, NUS are marginalized by research and, regrettably, by development initiatives. As a result, it struggles in national markets and only thrives in certain local or niche ones. NUS, by the way, have changed from being cultural markers and sources of pride to being expensive gourmet meals. Oddly, supermarket shelves appear to be stacked with a wide variety of foods, but closer inspection reveals that this apparent "diversity" is the product of intensive food processing from a selected number of crops and species. The estimated 5,000+ edible plants that exist now are mostly untapped by the present food systems, which are dominated by maize, wheat, and rice, which account for more than 50% of the global calories generated from plants.

From farmers' side, numerous of them depend on a variety of NUS for their livelihoods, particularly in regions that are not suited for high-yield crop types. Quinoa and Bambara groundnut are two examples of species that have developed through time and are especially suited to the environments in which they are grown, frequently in low input, rainfed agricultural systems. In natural ecosystems, for example, there are countless plants, trees, fungus, and animals that produce food and money. NUS, usually referred as minor or orphan crops, mostly significant as it has been mentioned before, but this fact is frequently forgotten. Genetically uniform versions of a few high-yielding commodity and staple crops, such wheat, rice, tea, coffee, and cacao, are favored by agricultural policy and markets.

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<sup>8</sup> Padulosi S. is a Senior Scientist on Integrated Conservation and Use Methodologies at Bioversity International, Rome, Italy

Then, in another document (Rudebier et al. 2014) published by Bioversity International – a policy brief dedicated to NUS - for at least 20 years, these “orphan crops” have captured the interest of scientists and philanthropist, but it has only just come to the public's attention how strategically important they are to combating hunger and poverty – according to the hypotheses of some scholars - and, for instance, numerous groups are supporting initiatives to improve NUS conservation and utilization, but more funding is required to integrate these species into food and agricultural systems because of their complexity and maintenance in specific areas. Only recently, agriculture-related organizations and policymakers have acknowledged the current function and unrealized potential of NUS for ensuring food and nutrition security, generating income in rural areas, fostering resilience, adapting to climate change, and reducing climatic, agronomic, and economic risks.

## **1.2 USE AND FUNCTION OF NUS**

From the analysis conducted by Bioversity (Padulosi et al. 2013), an important problem now is, from the point of view of sustainable food security, that our food supply is vulnerable because we base our diet on a very small number of major crops. In this sense, the lack of diversity is the cause of agricultural systems vulnerable to pests and disease: to prevent, in fact, food crops from calamities, it is necessary to maintain differences.

“Biodiversity—or biological diversity—is the sum of all the species that exist, their interactions and the ecosystems they form. It is the basis for food, fodder, fiber, fuel, pharmaceuticals and many other products and services that contribute to the wellbeing of all the inhabitants of our planet.” (Bioversity International n.d. 2009, 4)

This is the answer in a paper published in 2007 by Bioversity International for explaining the importance of biodiversity in general related to its importance in agronomics. Then, in 2001, with an important financial AID from the IFAD<sup>9</sup>, Bioversity International started a program called “Enhancing the contribution of

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<sup>9</sup> International Fund for Agricultural Development agency of the United Nations

neglected and underutilized species to food security and to incomes of the rural poor”. This program was important for demonstrating that, at this point, biodiversity is important for people, and one of the best ways for protecting biodiversity is to support the use of the NUS that, unfortunately, farmers cultivate less than in the past because of their not being economically remunerative – according to the scholars, in the short period - with commercial crops that we buy every day for our diet and that, in the long period, they could be an important economic resource.

Starting from the concept that humanity is dependent on healthy agroecosystems, they require biodiversity at the level of the ecosystem, species, and genes and, more than 4,000 kinds of food plants, in fact, are consumed regularly on a global scale (Proches et al. 2008). Despite being in fast decline, the genetic diversity of NUS, key crop landraces, and their wild relatives are a crucial component of agricultural biodiversity, and, at the end of the day, what is important to say is that as urbanization, population development, and globalization disrupt the agricultural and food systems throughout the world, where farmers are giving up on NUS, of course. FAO, in 2014, estimated that crop diversity has decreased by around 75% during the 1900s. A wide range of economic, social, and demographic factors, including agricultural and food systems that prioritize the intense cultivation of a small number of crops, are to blame for this loss of agricultural diversification. This is alarming, because this leads to decline the use of these crops, having lower agroecosystems' resilience and capacity to respond to change, especially the one related to climate, and reduces future opportunities for breeding superior varieties and building value chains, necessary for improving agri-food sector markets.

Surely, one of the most important key roles in bringing back NUS into viable cultivation, is that they should respond to innovative food and lifestyle trends, being attractive to markets, etc. In this sense, of course, related to the commercial advantages, mono cropping and many improved hybrid crops are preferred by agronomists instead of crop diversity because of their profitableness and their related stability in the market but, at the same time, high levels of food insecurity and degradation of agroecosystems, but also the impact of climate change, demonstrate

that it is necessary to call urgently for new efforts and use of NUS, as the literature (Padulosi et al. 2013) says. Based on this, at the international level, the interest in using these minor crops rase, related to poor communities in developing countries, as in the Sahel region, but it is also necessary for agriculture to go beyond what the Green Revolution, that will be presented in the next section, and its related technology, based on genetic improvements, did in the last century with high external cost. Based on this, it is obvious that agro-economic sector growths, but at a high price: for reaching the “zero hunger” goal on one side it is necessary, on the other, the use of chemicals and the excessive use of water, practices that can be dangerous in loosing beneficial biodiversity, significantly reducing diversity in every case.

But what differs NUS from “classical” crops is that the first ones produced in addition to primary crops aid farmers in distributing risks. Usually, farmers frequently believe them to be stress-tolerant and to be more able to withstand drought and other climate-related risks since they are typically tailored to local circumstances. NUS are crucial, in this sense, for increasing the adaptability of agricultural production systems to climate change. However, the importance of agricultural research and development strategies must acknowledge and promote the function that NUS plays in "climate-smart agriculture" if they are to be effective and so, being sustainable. Investment in research to create new varieties with beneficial adaptation traits, improved access mechanisms for farmers to germplasm, and robust interventions to develop markets and value chains of priority NUS are just a few steps needed to realize the potential of these species in adapting to climate change and, for instance, it is important to involve farmers in the selection of the variety and to work closely with agricultural communities while testing and assessing novel genotypes of crops.

Since there have been mentioned different kind of crops, NUS differ in fundamental ways: they are “managed with traditional systems, use informal seed sources and involve strong gender element” (Padulosi et al. 2013). It is important to say that, even the processing and everything related to the market sector can be laborious, there is still a limited involvement of large enterprises, this because of the neglected condition of these crops and, it is also to consider that the impacts of climate

change in agricultural production generate malnutrition, poverty, and high levels of food insecurity, and becomes necessary to take action for supporting the development of the marginalized crops, as Bioversity mentioned in several reports dedicated to the use and development of NUS.

After mentioning their capacity in conserving agricultural biodiversity, adaptation and mitigation related to climate change, it is important to mention their strength in improving food and nutrition security. FAO estimated that between 2011 and 2013, 1/8 of the world population were suffering from hunger and, strictly related to the data mentioned at the beginning of the chapter, it is clearly a symptom of serious and developed condition of food insecurity. As it has mentioned in the introduction, the definition of food security, its contrary, in which "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to satisfy their diet, needs and food preferences for an active and healthy" (World Food Summit, 1996) affects the other side of the medal, where it can be seen a "double burden" where, if in sub-Saharan Africa, 38% of children under five due to persistent starvation, stunted, 1.4 billion adults in the World are obese or overweight, facing different types of consequences related to food insecurity. This also because agriculture policy has often prioritized boosting production when addressing food security but have given less attention to the nutritional value of food systems. Policies frequently ignore the health advantages of a varied diet composed of several nutrient-dense foods. In this sense, the NUS has a lot to contribute to this regard. In terms of vitamin and micronutrient content, several are superior to basic crops and may be utilized more frequently to vary diets and, particularly significant, are fruits and vegetables for example. The ties between the health and nutrition sectors and the agriculture sector are strengthened by a recent emphasis on nutrition-sensitive agriculture, which also incorporates nutritional goals into agricultural programs.

At least, another important topic related to NUS is the one related to pay attention to gender issues and the culture itself. Understanding the cultural practices, religious convictions, and social and economic reasons of the people who are considered the "custodians" of these crops is crucial. Frequently, women are the ones who take care

of, grow, and market NUS, including "forest foods." This indicates that a gender perspective is essential for creating value chains for these crops. In processing NUS, the role of women is important: upgrading value chains by enhancing grading, packing, and product creation are just two examples on how women's income can grow. A significant method of enhancing rural communities' identities, increasing their visibility, and empowering its members, particularly women, is through assisting them in realizing the potential of underutilized crops.

In this sense the role of NUS is important. Since the advent of the "Green Revolution", the strategy for agricultural expansion has been to boost the production of a small number of commodity and staple crops.

### **1.3 THE GREEN REVOLUTION: A STARTING POINT IN THE USE OF NUS**

As we mentioned in the precedent paragraph, it is important to better understand when the set of research and technology transfer initiatives, related to agricultural innovation, took place. Between 1950 and the late 1960s, and known as the "Green Revolution," or the "Third Agricultural Revolution" (after the Neolithic Revolution and the British Agricultural Revolution), agricultural production increased in various parts of the world, starting most noticeably in the late 1960s. As a result of the activities, new technologies were adopted, including high-yielding crop varieties, particularly dwarf wheat and rice. It was connected to mechanized farming, artificial fertilizers, agrochemicals, regulated water supply (typically using irrigation), and innovative farming techniques. In this case, what is important to say is that this revolution mentioned before, which spanned 60 years and focused on a small number of crops that required a lot of resources, increased yields and made significant contributions to eradicating hunger worldwide, has, however, come with a significant drawback: the rapid decline of our plant-based diets and the disappearance of the ecological basis for our agricultural methods. Over the past century, a startling 75% of crop variety has been lost (an estimated 300,000 varieties). Seventy-five percent of the world's food comes from just twelve crops and five animal species. Of the 137 most significant crops in the world, 20 are grown on more than 80% of the world's

agricultural land, while the other 117 are grown on just 20%. Every year, these patterns get worse.

In a book (Harwood 2013) by J. Harwood, it is underlined the successful results aimed by the Green Revolution but, as it expected, planners, in contrast, due to planners' lack of consideration for the social effects of their initiatives, rural poverty and malnutrition decreased extremely slowly in most regions and deteriorated in some, given a disappointing outcome that prompted some criticism from the late 1960s. In response to this, several specialists connected to the Green Revolution started to consider the traits of earlier programs in attempt to comprehend which elements had led to failure (and occasionally to success). In this case, three are the main topics that the book underlines and that are necessary for better understanding the role of NUS today:

- 1) At first, organization was an important point of discussion: both ecological and economic conditions in farms of the developing world are with different characteristics, of course development and research activity are decentralized. The book refers to the case of small farmers and small villages (that are the target at which is subject of study in this thesis), depicting the difficulty found in carrying forward all the requests for the government, for example, for more resources or demanding better terms from commodity distributors and processors.
- 2) The program effectiveness was thought to depend on the skills and dispositions of the specialists who worked with farmers daily: in this specific case, experts from abroad, based on a western-centric thought, were not useful for the development of programs, in which their knowledge were necessary for better improving small farmer's conditions.
- 3) Weakness as a failure of many programs considering the political dimension of development.

The problem that leads to this discussion started in nineteenth century, where governments promoted programs for agricultural modernization, arriving, in the end, at the "Green Revolution". At that time, differently from the third one, the main

problem was to help peasant farmers become more productive, and in fact many efforts were devoted to testing available plant varieties to understand if some small farmers were suitable for cultivation and production of them. In this case, and during all the development of this Green Revolution, in each case, the importance was to improve productivity using not-so-expensive technology that can help for absorbing large amounts of rural labor, helping economy to grow and generate the necessary capital for improving industrialization.

What is important to say, according to J. Harwood, public investments - in this specific case - are necessary for improving economic growth related to small farmer's needs (related, of course, to private sector) and "essential for adapting international agricultural research to local conditions, both ecological and economic" (Harwood 2013). The recent argument over whether agricultural biotechnology holds the answer for reducing rural poverty in the South best illustrates the need for state-funded research. In fact, any educated observers concur that public support will be necessary to address this issue because, predictably, selling to underprivileged farmers does not result in a profit for the huge international seed businesses, as we can see perfectly to the case of Sahel related project analyzed in this work. In conclusion, J. Harwood underlines that boosting the funds for research, improving the extension infrastructure, and promoting staff development is necessary because, at this point, only nations, as history teach us, with governments wholly devoted to reducing rural poverty, will find this profitable.

Of course, after having found the importance of public policies and the marginalization of smallholder agriculture and land degradation are results of monocropping a small number of resource-intensive crops, the use of NUS could be one of the solutions for restoring agri-food chains in Sahel's region.

In fact, if we only consider that, globally – from the article of Dr. Padulosi – “800 million people are food insecure, 2 billion suffer from micronutrient deficiencies and 2.1 billion are overweight or obese” (Padulosi 2017), we can assume that a new Green Revolution, as the one of the '60s, must take place today for tackling all the problems related to food insecurity and malnutrition. In this case, what emerges from the article

dedicated to the importance of the use of NUS is that, addressing these challenges at their core, food-based solutions, that broaden the scope of what we produce and consume, benefit local communities and the environment over the long term. Our food systems, anyway, deal with the condition of extreme vulnerability: in this case, NUS are important allies in that.

There is no doubt that the production of staple crops must be maintained to feed the globe, but this effort must be balanced by concurrent investments in the several nutritive and hardy crops contained in the NUS basket. Diversifying the production systems through the addition of various NUS will protect food systems from socioeconomic shocks while also enhancing the health of agroecosystems, promoting smallholder agriculture, and preserving food cultures and associated economies that are based on regional crops and traditions that are currently in danger of extinction. Additionally, many NUS are drought-resistant, which gives them the ability to combat the detrimental effects of climate change.

#### **1.4 THE BOOM-AND-BOOST CYCLE IN AGRICULTURAL BUSINESS**

Many so-called neglected and underutilized species (NUS) were absent from international markets until recently yet being essential to local livelihoods in the regions where they originated. Some NUS are currently the subject of intense worldwide interest and increasing demands and, from that, prices rise in response to sudden changes in consumer demand, while production rises quickly because of modifications in land use at the local and national levels. This event is called a "boom," and it is typically followed by a "bust," which is characterized by a sharp decline in prices and, consequently, in output and farmers and other agri-food system players continue to be impacted by the ups and downs of the global economy as well as by local and regional boom and bust cycles, regardless of scale.

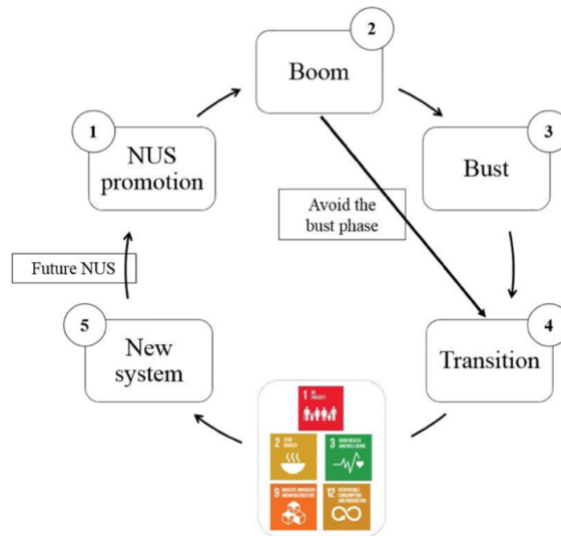


Figure 1: The NUS boom and bust cycle's phases. To establish sustainable food systems, Phases 4 and 5 rely on a sustainability transition based on the SDGs outlined by the FAO (2018) (Andreotti et al 2022).

So, in this sense, from an analysis conducted from FAO (Li et al. 2018), NUS are now called as well as “superfoods”, because of the increasing consumer demand and, as mentioned before, a resulting in the rise of prices (Andreotti et al. 2022). Belong to that, the early advantages of booms (as it has been mentioned before) often have a detrimental impact on agroecosystems over the medium and long terms, changing how land is used and having an impact on local natural resources (and not only). So, for this reason, after a period of output drop and then a time of regrowth in agricultural cultivation, crop booms are frequently followed by a similar pattern<sup>10</sup>. Of course, what it is important to say, as well, is that NUS are managed by smallholders in selected areas, and they are characterized from important traditional cultivation methods with limited external inputs, underlining the importance of their traditional and cultural value.

#### 1.4.1 THE PROMOTION OF NUS

The promotion of NUS is important for increasing crop diversity related to food traditions and, how it was mentioned before, it is the phase 1 of the boom-bust cycle of the agricultural business cycle (Andreotti et al. 2022). Literature refers to the maintaining traditional legacy that plays a significant role in preserving local

<sup>10</sup> A boom-and-bust cycle is the term used to describe this phenomenon.

communities' identities and boosting their self-assurance in the face of dangers brought on by tendencies toward globalization and changes in lifestyle.

In this sense, numerous NUS have the potential to diversify farming practices as well as human diets, enabling the development of more robust and sustainable agro-food systems.

Mabhaudhi, in his article dedicated to orphan crops and their connection with climate change (Mabhaudhi et al. 2019), defines that "There is an argument to encourage them [NUS] to sustainably solve difficulties such as growing drought and water shortages, food and nutrition insecurity, environmental degradation, and employment creation under climate change," and, further arguing that the promotion of orphan crops might help accomplish the Sustainable Development Goals, notably n.1 related to poverty, 2<sup>nd</sup> to zero hunger, 3<sup>rd</sup> on good health and well-being, 8<sup>th</sup> related to decent work and economic growth and the last one, the 15<sup>th</sup> related to life on land.

In this sense, a critical asset in the battle against poverty, food insecurity, and climate change vulnerability is related to agricultural biodiversity. In fact, 5,000 different types of food crops are thought to exist, yet only three of them—rice, maize, and wheat—account for more than 50% of all plant-based calories consumed by humans and occupy 40% of all arable land worldwide<sup>11</sup>. Crop variety is vanishing from production and food systems due to modern agricultural methods, homogeneity in agricultural markets, and changing lifestyles. Due to the destruction of natural ecosystems, the diversity of plant species that may be harvested for food in the wild is also in danger. With cultivations becoming more vulnerable to climate change, farmer assets eroding, and consumers having less options for nourishing and healthful diets, this scenario is having many effects on people's livelihoods.

Today, literature review refers to a holistic value chain approach for the utilization of NUS in the commercial food sector. More specifically, it has resulted in a number of positive outcomes in the target regions: women and men farmers and other value chain actors learned how to identify a variety of crops that are adapted to stress and have market potential as well as ways to better document and monitor their use; climate-smart practices are being developed and disseminated; high quality seed of

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<sup>11</sup> Data from Kew Royal Botanic Gardens, 2016

stress-tolerant varieties is produced by local communities and researchers; women's and men's farmer groups are in place; and market opportunities have materialized, providing farmers with incentives to keep cultivating and protecting NUS on their farms. Policymakers' understanding has increased, in this case, resulting in a variety of pertinent regulations for promoting wider applications.

And related to this, to achieve sustainable development, in fact, humanity must overcome enormous, interconnected difficulties (such as climate change, food insecurity, poverty, vulnerability of livelihoods, loss of biodiversity, and ecosystem degradation as we mentioned before) and many academics and professionals suggest orphan crops (NUS) to solve these problems, particularly in poor nations of the Global South (El Bilali 2020).

In this sense, when we speak about promotion in using these kinds of crops, it is important also to refer to large investments in research and innovation. In an article (El Bilali 2020) written by Hamid El Bilali, we can read especially the set of research dealing with NUS in the specific region of Sahel, such as Niger and Burkina Faso, in which is depicted how these orphan crops are “resilient, nutritious and adapted to marginal agro-ecosystems” (El Bilali 2020). The case of these two countries is important because they are both in the low human development category, affected by severe condition of food insecurity. According to the most recent World Bank data, agriculture contributes to 39.6% of GDP in Niger and 28.6% of GDP in Burkina Faso, while it also employs 75.9% of people in Niger and 28.6% of people in Burkina Faso. In addition, 70.6% of people in Burkina Faso and 83.5% of people in Niger resided in rural regions in 2018. However, both nations' and the Sahel region's enormous, inadequately mechanized, and mostly dependent on the erratic summer rainfall (June-September), making agriculture vulnerable to climate change. Then, related to which kind of crops are cultivated, cereals (such as millet, sorghum) and legumes (such as cowpea) are important dryland crops, while cotton and groundnut are important cash crops.

Then, due to increased violence, the country's northern regions are experiencing a particularly bad situation about food security and livelihoods, as it was mentioned before. High rainfall unpredictability in the climate makes life challenging for most farmers. Climate change is making this issue worse by raising temperatures, increasing

the frequency and severity of extreme weather events, and decreasing rainfall]. Resources related to water, agriculture, and forests are particularly susceptible to climate change and harsh weather. Nearly 80% of the active population in Burkina Faso works in the agricultural sector, which is a major contributor to the country's economy. Cereal production takes up more than half of the cultivated land (e.g., sorghum, pearl millet, maize, and rice) (Institut National de la Statistique et de la Démographie au Burkina Faso n.d. 2018/2019).

Contrary to rainy season farming, subsistence production predominates. Sesame, cotton, groundnuts, and cowpeas are the main cash crops. In the southwest, on the other hand, the production is dedicated mostly to a wider range of fruits, nuts, sugarcane, cashews, and roots and tubers, including yam, sweet potato, and cocoyam. Most agricultural exports are cotton and animal goods with little other variety (El Bilali 2020).

In the promotion of the use of NUS, what is important to say, working on a specific literature review, is that they can help systematically developing market alternatives that both Burkina Faso and Niger, for example, are facing. According to Mr. El Bilali, in his paper (El Bilali 2020), mentioned that in the Sahel area in general, and BF and Niger in particular, orphan crops provide opportunity to alleviate several environmental and socioeconomic concerns. However, despite the benefits of orphan crops in addressing a variety of issues, including climate change, livelihood vulnerability and poverty, food and nutrition insecurity, and biodiversity loss and ecosystem degradation, the capacity to promote and exploit these crops in both countries is currently limited by research and knowledge gaps. In this sense it is necessary to promote the use of NUS. In this sense it is necessary to promote the use of NUS, highlighting an inclusive way, resilient use of NUS and the importance to improve the transfer of knowledge of the agricultural sector: through coordinated efforts engaging all the stakeholders in the AKIS<sup>12</sup> and food system, from researchers to policymakers, farmers, and consumers, developing a structural agenda for research, innovation, and development.

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<sup>12</sup> Agricultural Knowledge and Innovation Systems

In conclusion of this paragraph, projects like SustLives (that will be discussed later) are important for coordinating efforts that must be integrated on the local, regional, and worldwide levels and engaging several stakeholders from the governmental, business, and civil society sectors to fully realize the promise of orphan crops. Additionally, a framework for policy is required that acknowledges the role orphan crops play in sustainable food systems and resilience to climate change, particularly in isolated rural areas. This will encourage local researchers to collaborate effectively with other domestic stakeholders and global research networks to study and develop orphan crops that will significantly aid in the implementation of the Paris Climate Agreement and the 2030 Agenda for Sustainable Development in Burkina Faso and Niger.

Orphan crops may, in fact, play a significant role in developing a resilient and prosperous agricultural sector that can maintain food and nutrition security and sustainable rural lives under climate change if properly supported via research and innovation.

### **1.5 SPECIES LIST: EXAMPLES OF NUS USED FOR FOOD IN SUSTLIVES' PROJECT**

After the important literature review dedicated to NUS and their related promotion it is also important to mention that in history different plant species have been cultivated and collected by humans, but modern agriculture revolves around three staples: rice, maize, and wheat. Of course, in the last century it was given attention only to a small number of species: this is one of the principles related to the fact that the problems mentioned above related to famine and food insecurity.

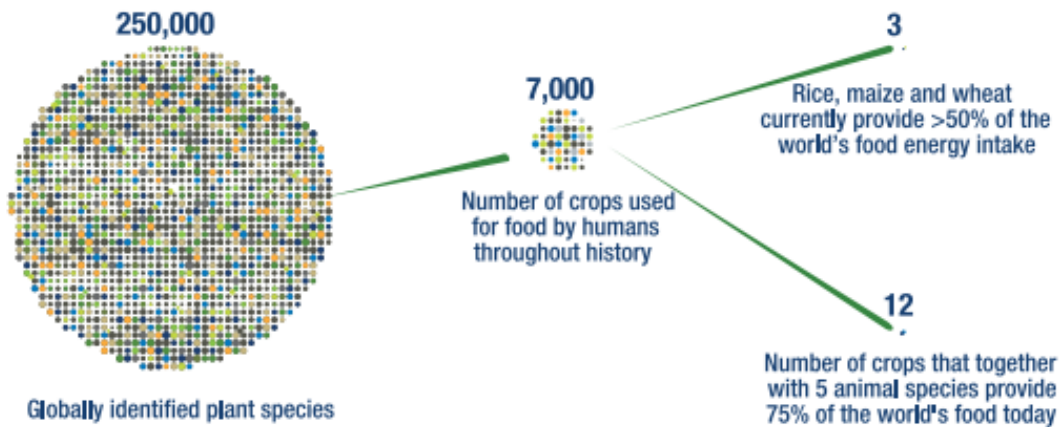
In this specific case, in fact, NUS are, from the dedicated platform<sup>13</sup> realized by Bioversity International:

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<sup>13</sup> <http://nuscommunity.org> From the section About Us “The NUS Community is an on-line platform for sharing research results, development news and policy advice regarding the use and conservation of neglected and underutilized species, or NUS for short. The platform aims to support research and promote the use of neglected and underutilized crops and trees to strengthen food security, build more

- Adapted to marginal environments: they can grow in stressful conditions that limit agricultural productivity in certain cases,
- Highly nutritious: they contribute to healthy diets, in rural areas and poor conditions,
- They can generate income for smallholder farmers and their communities because they have a great development potential,
- They are part of local cultural food traditions, trying to empower marginalized communities.

### Shrinking diversity



Source: FAO, 1997.

Figure 2: Infographic source: Bioversity International's 10-year Strategy 2014 - 2024. Data source: FAO 1997<sup>14</sup>

In a specific research (Bioversity International n.d. 2007), an example list of NUS has been published in the following table<sup>15</sup> where some species are neglected only in certain conditions. As it has been mentioned at the beginning of this chapter, for neglected species it is referred to a very little attention to these crops given to

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resilient, climate-smart agriculture, and empower people through income generation and revitalized local food culture.”

<sup>14</sup> From <http://www.nuscommunity.org/nus/neglected-underutilized-species/>

<sup>15</sup> It has been taken as reference only a list of NUS from Africa since the focus of this research is Sahel region and Burkina Faso agricultural sector.

research and development and everything related to management practices, marketing, and their potential.

Different is for the underutilized species, that refers to their potential: they completely differ from rivals such as rice and not being a complementary good as the classical economic theory says, and that could be important in food systems in general, helping producers to produce income.

Scientific Name	Common Name	Use
<i>Digitaria exilis</i>	Fonio	Cereal
<i>Eragrostis tef</i>	Tef	Cereal
<i>Kerstingiella geocarpa</i>	Kersting's groundnut	Legume
<i>Lablab purpureus</i>	Hyacinth bean	Legume, fodder
<i>Sphenostylis stenocarpa</i>	African yam bean	Legume
<i>Plectranthus esculentus</i>	Livingstone potato	Tuber
<i>Adansonia digitata</i>	Baobab	Fruit, leafy vegetable
<i>Annona squamosa</i>	Custard apple	Fruit
<i>Carissa edulis</i>	Natal plum	Fruit
<i>Ceratonia siliqua</i>	Carob, locust bean	Fruit
<i>Irvingia gabonensis</i>	Dika nut	Fruit, nut
<i>Lagenaria sphaerica</i>	Wild calabash	Fruit, medicine
<i>Ziziphus sp.</i>	Ber, jujube	Fruit
<i>Amaranthus spp.</i>	Amaranth	Vegetable
<i>Boscia coriacea</i>	Boscia	Vegetable, medicinal
<i>Cleome gynandra</i>	Cat's whiskers	Vegetable
<i>Corchorus olitorius</i>	Jute	Vegetable, fibre crop
<i>Leucaena leucocephala</i>	Leucaena	Vegetable, fodder
<i>Moringa oleifera</i>	Moringa	Medicinal, vegetable
<i>Solanum nigrum</i>	Black nightshade	Vegetable

Another important list to mention, in this specific work, is the one that SustLives, (SUSTaining and improving local crop heritage in Burkina Faso and Niger

for better LIVEs and EcoSystems) a project funded by the European Union whose objective is to promote the transition to sustainable and resilient agricultural and food systems in Burkina Faso and Niger through the enhancement of the heritage of local cultures and their value chains, did in a bulletin published last June 2022 related to the activity A1.1 on the “Identification of target areas and stress-tolerant NUS”, main subject of the following work analyzed in this thesis for better us knowing what the NUS are engaged in selected Sahel’s regions: Burkina Faso and Niger.

- For Niger, the list is the following:

Scientific Name	Common Name	Use
<i>Manihot esculenta</i>	Manioc	Tuber
<i>Hibiscus sabdariffa</i>	Roselle (carcade)	Vegetable
<i>Abelmoschus esculentus</i>	Okro	Vegetable
<i>Vigna subterranea</i>	Bambara groundnut	Legume, fodder
<i>Ipomoea batatas</i>	Sweet potato	Tuber
<i>Moringa oleifera</i>	Moringa	Vegetable

- Then, related to Burkina Faso:

Scientific Name	Common Name	Use
<i>Ipomoea batatas</i>	Sweet potato	Tuber
<i>Hibiscus sabdariffa</i>	Roselle (carcade)	Vegetable
<i>Plectranthus rotundifolius</i>	Fabirama	Tuber
<i>Vigna subterranea</i>	Bambara groundnut	Legume, fodder
<i>Amaranthus</i>	Amaranth	Vegetable
<i>Moringa oleifera</i>	Moringa	Vegetable

And the zones taken in consideration are the following:

- For Burkina Faso: Boulkiemdé (midwest), Oubritenga (center tray), Bazèga (central south), Kadiogo (Central)

- For Niger: Boboye et Loga (Dosso region), Kollo et Say (Tillabéry region) et Niamey.

This activity mentioned, which falls under the first output of the project, that is related under the “Knowledge about selected NUS” that are available and, also, the access to NUS improved for “AKIS” actors in Burkina Faso and Niger, are undoubtedly one of the key activities, because it concerns the identification of targeted areas and NUS. This Activity examined the commercial potential of crops and the socio-economic conditions of women and youth, and their contribution to the local food system, with the aim of ranking prioritize species that have the greatest impact on their empowerment.

The report analyzed is the main deliverable of the activity and focuses on the crop selection process targets based on a consultative and participatory approach between stakeholders, with focus to the nutrition, resilience, and income-generating opportunities, with the addition of very detailed technical sheets on the selected NUS. Following the selection procedure of NUS that help the research project’s team, it is important to mention that the starting point is always the definition of NUS in literature, and, from that, the list mentioned before was the one presented for the development of the project.

Some of the criteria used for choosing specific nus were the following:

- Ensure technical, scientific, and methodological alignment regarding the activities of SUSTLIVES especially those starting during the first year of the project (August 2021 – July 2022), with particular attention to those that are essential to the implementation of the whole project
- and produce a detailed and shared plan of activities for the first year of the project, in particular the workshops and meetings to be organized in Burkina Faso and Niger and involving local actors, researchers, and other stakeholders.

The first group of criteria (SustLives DeSIRA n.d. 2022) defined is the one related to the selection. This makes it possible to define dichotomously, according to each partner, whether the selected NUS responds to the selected criteria. If most of the selection are not met, the NUS can be eliminated, without having to go through the prioritization. In this sense the criteria are the following:

Selection Criteria	Description
<i>Neglected by the research</i>	There are many aspects of research that have not yet been explored.
<i>Food plant</i>	NUS has good nutritional value.
<i>Resistant to drought</i>	NUS is grown in project areas with agro-climatic conditions reviews.
<i>Known cultivation area</i>	The main cultivation area of the plant is known.
<i>Cultivated species</i>	The species is cultivated and not spontaneous.

Then, there are defined also prioritization criteria (SustLives DeSIRA n.d. 2022):

- A) *Level of cultural significance of NUS despite unfavorable political/institutional system.* This criterion helps to understand the level of socio-cultural importance of the NUS. It considers the use of NUS for ceremonies, community events, weddings, funerals, etc. Does the NUS have a strong cultural anchoring? Does it present values symbolic and several different uses?
- B) *Adaptation to growing on small areas.* This criterion determines whether NUS can be grown on small plots. This implies that she could be grown, collected, and traded by women or disadvantaged groups who may have limited access to land and external inputs (fertilizers and pesticides). The small areas of cultivation could be considered vegetable gardens, degraded lands, or edges of road.
- C) *Degree of inclusion among the priority plants in the sectoral policies of the country.* This criterion makes it possible to establish whether NUS is considered in national action plans or other operational strategic tools of different sectors (e.g., agriculture, food security, nutrition, climate change, environment) or on biodiversity which aim to ensure the conservation or restoration to a favorable conservation status of threatened species or subject of particular interest.

- D) *Degree of knowledge of production potential.* This criterion is used to establish the availability of agricultural production data for the NUS. The data may be available at national, regional, or local level (where applicable) and may include qualitative or quantitative information.
- E) *Availability during the lean season.* This criterion establishes whether the NUS is available and used during the lean season at a given site.
- F) *Agronomic value = level of productivity/yield for farmers.* This criterion captures the current productivity and yield for NUS farmers at the level agronomic. What is the agronomic performance of NUS?
- G) *Degree of promotion by state extension services.* This criterion makes it possible to understand whether the NUS is popularized in the country. Are there any NUS outreach policies or strategies? Varieties improved and adapted have they already been developed (or are being developed) by the researched and popularized by extension services?
- H) *Degree of availability of peasant varieties with short multiplication time.* This criterion makes it possible to understand whether traditional varieties with a short cycle are available or farmers, in terms of seeds and seedlings. Traditional varieties with a cycle of production runs available? Are there many? Is it easy to get the seeds or information on how to grow them?
- I) *Degree of knowledge of agro-morphological development of the NUS.* This criterion captures current information on crop agro-morphology. This information must come from its culture in the country (or in similar contexts, if applicable). The Available data may include qualitative or quantitative information.
- J) *Quality of the institutional framework.* This criterion seeks to capture whether the current policy/institutional environment conducive to the promotion of the NUS. Is it part of political development plans? Are there any push activities by the public sector to facilitate its dissemination or trade?
- K) *Contribution to employment, especially of women and young people.* This criterion reflects the socio-economic dimension of the production system and supply chain. value. A culture is considered to contribute positively to employment in a way inclusive if the value chain (from production to

processing and sale) creates employment opportunities for women and young people.

- L) *Potential consumer demand for NUS*. NUS has promising characteristics or favorable market parameters exist that can stimulate demand for NUS in the short term.

Then, not only were used these criteria, but they were integrated with an online survey that begins with a brief introduction to the purpose of the project and the importance of collecting information on each NUS already present for each selected criterion. The candidate is then asked to choose the country to be considered in the survey. There follows a series of questions in which each criterion, for each NUS, is evaluated by the expert according to its importance. The participant must assign a value from 0 to 5 depending on the level of importance of the criterion for the NUS. The expert also can add additional comments for each criterion and for each crop. From the bulletin (SustLives DeSIRA n.d. 2022) of the activity A1.1, 71 people responded, which of them 47 in Burkina Faso and 25 in Niger.

In conclusion, another important aspect to mention, is that the one related to the determination of the project action area: from security to the distance from the Capital to considerations related to agro-ecological factors and climate-related, or at least possible cooperation.

At the end of the day, it is possible to consider that this project can certainly be a watershed on the definition of a new sustainable economic and business model based on crops that can really revolutionize the agricultural market, particularly in developing countries, to tackle problems related not only to food security, but also the possibility of sharing knowledge and integrating it with traditional systems, to make everything more competitive and highly profitable from the point of view of the agricultural market.

## **CHAPTER 2**

### **THE IMPORTANCE OF SUSTAINABLE FOOD VALUE CHAINS**

#### **2.1 FAO'S OUTLOOK ON SUSTAINABLE FOOD VALUE CHAINS: AN OVERVIEW**

Millions of poor households in emerging nations may find significant avenues out of poverty through the establishment of sustainable food value chains, that are intricate networks, and their reported underperformance may not always have evident root reasons. To genuinely end poverty cycles, several issues typically need to be addressed at once.

This, suggests the necessity of cooperation amongst the many value chain players, including farmers, agribusinesses, governments, and civil society. The need that values chain improvements adhere to the so-called triple bottom line of profit, people, and planet further increases the difficulty of the task.

Development professionals working for public, commercial, and non-governmental organizations worldwide are continually developing and putting into practice new ways to solve these issues. These practitioners facilitate the upgrading of products, technologies, business models, policy environments and so on and, while some of these ideas fall short of producing long-term change, others can make significant, long-lasting improvements to the system.

In the handbook (Neven 2014) published by FAO in 2014, a sustainable food value chain is defined as “the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society, and does not permanently deplete natural resources” (Neven 2014, vii). In this sense, the SFVC idea concurrently emphasizes the relevance of three components, in contrast to similar notions like the filière and supply chain. It acknowledges that vertical coordination (governance) is the primary dimension of VCs, which are dynamic, market-driven systems. Secondly, the idea is used broadly,

generally including every product subsector in a nation (e.g., beef, maize, or salmon). Thirdly, value contributed, and sustainability are clear, multifaceted performance metrics that are evaluated on an overall scale.

For what it concerns, the sustainable food value chain paradigm starts from the point that food insecurity is a symptom of poverty. So, what it is important to know is that families, with constant access to adequate funds, produce the real demand that propels the supply of food. Then, on the supply side, a more competitive food system will lower food product costs for consumers or boost their benefits.

In the specific case of value chains, still quoting the FAO’s guidelines, they create added value that has five components:

1. Salaries for workers,
2. A return on assets (earnings) for business owners,
3. Tax revenues for the government,
4. A better food supply for costumers,
5. A net influence on the environment, whether favorable or unfavorable.

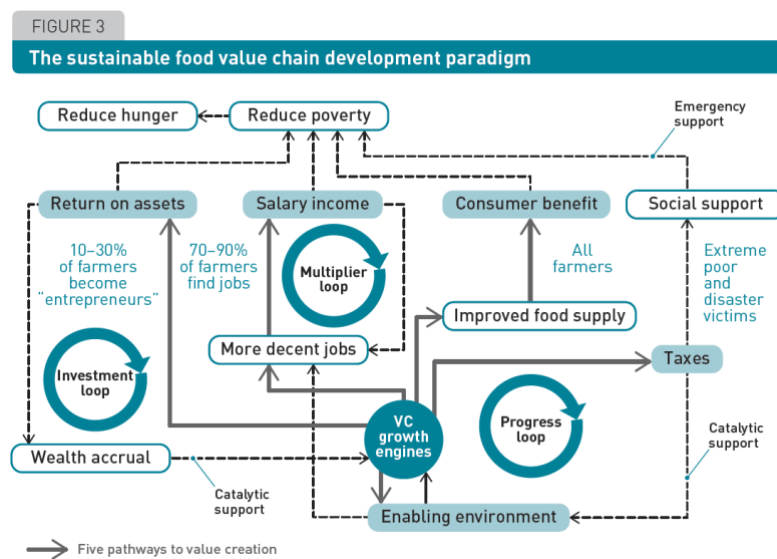


Figure 3: Infographic source: D. Neven, *Developing Sustainable Food Value Chains – Guiding Principles*, FAO, Rome, 2014, p. 15

Still in FAO’s guidelines (Neven 2014, viii) on sustainable food value chains, the value added we are talking about is necessary for creating three fundamental loops, related to the improvement of social, economic and sustainability that, of course, impacts hunger, poverty and, also, food security.

The sustainability component of sustainable food value chains goes beyond financial and commercial viability and entails a change in institutional procedures that results in a more equal distribution of the enhanced value produced and a decreased usage of and impact on non-renewable resources and, in this case, social and environmental sustainability increasingly affecting market access and competitiveness.

In fact, the initial focus of sustainable food value chains is mostly on efficiency enhancements that lower food prices, expand the supply of food, and enable households to purchase more food. Although households tend to spend more money on higher-value foods (i.e., foods with superior nutritional content, more convenience, health advantages, or better image) when their earnings rise, they tend to consume less food overall as the classic economic theory says normally. Then, this shift in consumer demand, in turn, serves as a key impetus for innovation and value creation at every stage of the food supply chain, resulting in ongoing improvements to the food supply and growing advantages for consumers. In this case, this paradigm debunks a variety of myths about the growth of the food chain, including the ones that smallholder agriculture should be protected, so value chain expansion can only benefit a tiny percentage of farmers, and the solution to food poverty can be found in the food system.

Two major obstacles are noted by the general development model that was presented previously. The first is the requirement to comprehend the underlying issues, crucial leverage points, and strategies that will have the most impact for a certain value chain in a particular nation. The second is how to create a successful collaboration (also called "golden triangle") between the governmental, private, and civil society sectors that would, in the end, put money in the wallets of the rural poor and food on their tables.

In the following paragraphs, will be described, singularly, how value chains can be assembled with the sustainability of food and understand how it is possible to select value chains for sustainable food value chain development, with a view to restoring agri-food chains through the NUS.

### 2.1.1 DEFINITION OF THE MAIN CONCEPTS OF VALUE CHAINS

Of course, the most important thing before going further, is to define singularly all the concepts already mentioned separately: value chains and sustainability.

By Kaplinsky and Morris (Kaplinsky et al. 2014, 4), the definition of the simple value chain is the following “the value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. Considered in its general form, it takes the shape as described in Figure 1. As can be seen from this, production per se is only one of several value-added links. Moreover, there are ranges of activities within each link of the chain. Although often depicted as a vertical chain, intra-chain linkages are most often of a two-way nature – for example, specialized design agencies not only influence the nature of the production process and marketing but are in turn influenced by the constraints in these downstream links in the chain.”

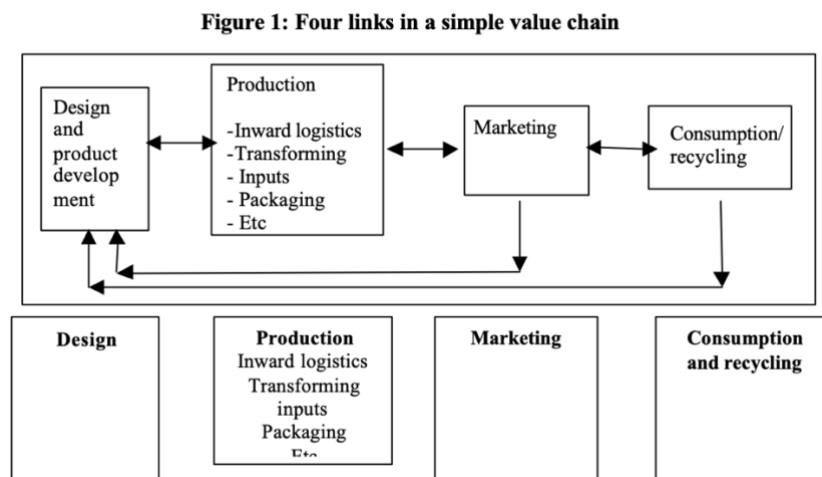


Figure 4: Infographic source: R. Kaplinsky and M. Morris, A Handbook for Value Chain Research, Institute of Development Studies, University of Sussex, Brighton, UK, 2001, p. 4

But, following the reasoning done by Kaplinsky and Morris, it is reductive speaking about only simple value chain, because in the real world these are more complex than the one described before. Taking as an example the one reported in the publication (Kaplinsky et al. 2014, 4-5) mentioned before, it is mentioned the one related to the furniture industry, involving the provision of seed inputs, chemicals,

equipment, and water for the forestry sector. In that case, the sawmill sector, which receives most of its inputs from the equipment sector, receives the cut logs. After that, sawn timber is sent to furniture producers, who then use input from the equipment, adhesives, and paint sectors as well as the design and branding expertise of the services industry. The furniture then goes through several intermediate steps, depending on the market it serves, until it is delivered to the final user, who subsequently consigns the furniture for recycling after usage.

But, at this point, it is necessary to mention the three main sets of reasons why value chain analysis is considered the basis to better understanding the FAO's framework analyzed in this chapter:

- Systemic competitiveness has grown more crucial because of the expanding division of labor and the component production's worldwide dispersion
- Production efficiency is merely a prerequisite for effectively entering international markets
- Making the most of globalization entails entering markets on a sustainable basis and comprehending dynamic elements along the whole value chain.

In this sense, according to Adam Smith (Reisman 1998, 357-383), the size of the market affects how the labor is divided. By this, he suggested that small scale markets did not allow for much specialization; for example, a small-scale chair manufacturer might do all the necessary activities without hiring any workers. However, as the market grew, it became profitable to hire people and give them each a niche. Smith stated that task specialization allowed workers to focus on honing their specialized talents rather than wasting time picking up and putting down their work-in-progress. Additionally, it paved the door for the development of mechanization because basic, repetitive processes were far simpler to automate than complicated ones.

Then, quoting F.W. Taylor's theories on work-organization, the goal of that was to increase the efficiency of each of these workstations through "scientific management" procedures should be seen from the perspective of the production plant itself. Even as scale of the production plant increased, the work process could be divided into an

increasing number of workstations. A more systemic focus was adopted in the approach to intra-plant and interfirm production organization.

After that, of course, it is possible to assume that the importance of value chain analysis in determining the necessity and potential of overall competitiveness and its identification will cause the company, we consider, to outsource those tasks for which it lacks a unique set of competencies.

The production chain's input flow may be mapped, including the flow of both commodities and services, and each company should identify the individuals whose actions are crucial to its success, moreover the firm's own attempts to improve and increase efficiency will thus have little impact in those situations where it does not internalize most or even most of the value chain in its own operations.

The same issue applies to managing national or regional economies: if a region's businesses are mired in a sea of inefficiency, improving their performance may not have much of an impact.

In the case of global economy, that is interesting to analyze in the context how it is important the distribution of income, related to global economy.

Because of this, it is simpler to determine the policies that may be put in place to help individual producers and nations raise their share of these advantages. At the turn of the millennium, this problem has gained particular attention and interest from a wide range of groups: the discussion is almost always divided into two camps, for those who believe globalization benefits the poor and those who believe it harms them. However, this is an overly simplified viewpoint since it is more important to consider how producers and nations participate in the global economy than whether globalization is inherently good or harmful. In this sense, the debate must take a detour to highlight the risks associated with a damaging pattern of insertion into the global economy. Value chain analysis may assist both comprehend these dynamics (positive analysis) and then design an acceptable regulatory response (normative analysis) (Kaplinsky et al. 2001, 14).

When we speak about globalization, we intend the widespread reduction of obstacles to the free movement of commodities, services, capital, ideas, and factors (particularly skilled labor and capital). So, it is evident that it has a variety of

dimensions, but it is also evident that globalization is intended differently from a region to another of the world and, for analyzing it, its indicator is in relation to trade-based international integration. The global economy has benefited from increased market and communication openness, as well as increased travel and cultural exchange and the level of life has recently increased significantly for a large portion of the global population.

As Kaplinsky and Morris mentioned (Kaplinsky et al. 2001, 16-17), the factors that continue to advance openness are evidence of the magnitude of these advantages as well as the political and economic clout of their recipients. However, there have also been a significant number of "casualties", from those who have been left out of globalization, who have suffered, and who have benefited but are still in poverty. And, as some like to say, this is not a phenomenon of the "north versus south," as these groups exist in both industrially developed and developing nations. The effects of globalization on inequality are quite intricate and, in this sense, the main obstacle in resolving this complexity is to theoretically and empirically separate many factors that influence how profits from globalization are distributed.

What is important to underline is that the movement of products and services up and down the chain as well as between other chains are shown using value chain analysis. The value chain is a descriptive concept that, at most, offers a framework for heuristic data production. However, recent advances in value chain theory have started to offer an analytical framework that offers crucial insights into our dual concerns with the factors influencing the distribution of income globally and the identification of efficient policy levers to reverse trends toward unequalization.

### **2.1.2 FOOD VALUE CHAINS AND SUSTAINABILITY**

The network of parties engaged in producing, processing, and selling the food that customers consume from farm to table is known as the food value chain. This includes five stakeholders, recognized in the producers who study, cultivate, and trade food commodities like corn and cattle; the primary and value-added processors who manufacture, process, and market food goods like flour and bread; the distributors,

including wholesalers and retailers who market and sell food; the consumers who shop for, buy, and consume food; and governments, non-governmental organizations (NGOs), and regulators who watch over and regulate the food industry, according to a publication by Deloitte (Deloitte n.d. 2013).

Related to these (Barling et al. 2022), as their produce progresses through the agricultural value chain to the end customer, farmer-growers may face challenging paths to market. In turn, how food value chains operate, are managed, and are governed affects what is cultivated and where it is grown in agriculture, horticulture, and aquaculture. One of the most important factors affecting the food and nutrition security of the food supply in contemporary cultures is the ability of food chains to withstand shocks from the environment, the economy, society, geopolitics, pandemics, and weather-related weather events and, the interactions between the key players in the supply chains determine how much of the end product's value goes to the farmers and growers and how much goes to the other players. Policymakers, in this sense, have been interested in fairness because of the distribution of value and as a set of procedures for how that distribution is decided. Numerous food value chains, from harvest to packaging to food service and retail, rely on low-wage, sometimes insecure, and immigrant labor, raising concerns about the sustainability of society. Food chains produce external environmental costs along the way, along with related health benefits, expenses, and waste due to the material and information movement, as well as the energy and environmental life cycle consequences.

In this sense, many agrifood value chains in developing nations must undergo transformation to fulfill the demanding quality and safety criteria to serve high-value international markets, according to Hidayati (Hidayati et al. 2021). Growing sustainability standards have made this changeover process more challenging. The main actors in these selected nations, who are frequently smallholders, are having difficulty adjusting to this new sustainability value focus. In this setting, in fact, economic factors are pervasive, and a lack of integration frequently separates manufacturers from the end market.

The main factors that permit and hinder the change of the agri-food value chain, particularly in developing nations can be solved by applying a specific paradigm that resides in the integration of three key dimensions: sustainability, governance, and value creations that allows for the synthesis and prioritization of transformational initiatives and, for this reason, smallholders in developing countries may now access higher value markets because to the integration of sustainability drivers into value chain governance, which offers a comprehensive strategy that balances profit maximization with social and environmental implications.

And, following the path related to sustainability, social and environmental implications, Dr. Galli, and Brunori, in an evidence document (Galli et al. 2013) related to short food supply chains and its involvement in sustainable development, explain the correlation between food value chains and sustainability, starting to their contribution they gave to rural development and healthier communities. But what happens if we take into consideration the under-developed? Of course, as it has defined into paragraph 2.1.2<sup>16</sup> of this chapter regarding the main definition of value chain by Kaplinsky and Morris, the concept of value chain is applicable everywhere and for everything that concerns production and markets, this because, primarily, thanks to globalization. In the evidence document mentioned, of course, it is also defined that sustainable food value chains are applied in different contexts, and they operate following the socio – economic conditions of the country that it is considered and, due to the variations across these, it is impossible to offer a general summary of the related sustainability consequences. The economic, social, and environmental pillars of sustainability each encompass complementary and incompatible concerns, further complicating an overall study. However, data suggests that proximity—both physically and socially—often has a positive influence on the sustainability of goods from sustainable food value chains.

A fundamental human need and ambition is good health (Marmot 2007, 1153-1163). The standard of the population's, the fairness with which health is spread

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<sup>16</sup> Cf. paragraph 2.1.2 *Definition of the Main concepts of Value Chains*

throughout the socioeconomic spectrum, and the extent of protection against disadvantage brought on by ill health may all be used to assess the growth of a society and, in fact, what determines food safety and security and nutritional quality, is strictly connected to human development as well: the food security itself, health, and welfare of individuals and communities depend on reliable access to inexpensive, secure, and nourishing food (Chahbazi et al. 2008, 769-788).

Although it is difficult to distinguish the specific effects of each of these elements in each food chain, but there are several sustainable food value chains features that suggest the possibility of higher-quality goods, like, for example, the one connected with the use of NUS. In fact, this may be very dependent on the season, in some areas, and these chains provide a more varied selection of goods (Edward Jones 2010, 582 – 591), notably fruit and vegetables, helping to promote dietary diversity, food security, and balanced diets. Furthermore, there is little high-quality research about how sustainable food value chains affect people's access to cheap, healthful food. In some cases, such as the chains of farmers markets and places where customers help cultivate or produce their own food, like Grow-Your-Own (Corrigan 2011, 1232-1241) (GYO), have been demonstrated to improve some elements of access to nutritious food, especially fruit and vegetables.

But moving to the sustainable impact of these short value chains, the effects of each chain's production process, like processing, packing, distribution, cooling, transportation, and waste generation should be considered. However, in some circumstances, such as when the usage of fossil fuels or packaging is minimized or when the adoption of pesticide-free/less intensive production methods, sustainable food value chains do offer advantages in terms of environmental sustainability. And then, relatively to the economic side of this, competitiveness and viability of food chains are necessary to develop such as improvement in terms of creation of jobs, valorization of the human capital and increase the level of income, related to the case of small and medium farmers or enterprises, because of their specific characteristic to be less competitive and simple, in the specific case dealt in this thesis work.

These farms frequently lack convenient access to the traditional channels because to the variability of their supply in terms of quantity, quality, and/or continuity. Small and medium farms, or enterprises, and processing businesses can become more economically viable by using sustainable food value chains, which offer equitable access to the market. So, in this sense, to "shorten" and deepen linkages among local enterprises and utilize local resources in a synergetic way, these value chains are frequently created as collective economic initiatives in reaction to worsening unfavorable market conditions (Orstrom et al. 2018). In this way, what is important to focalize whom is that local economies can benefit from the (re-)vitalization of the short sustainable chains because they protect small and medium farms, which are the foundation of regional rural economies (Rosset 1999), as was said before. They boost or assist in recirculating community money, provide new employment, and support the knowledge and expertise of several small food producers and processors (especially knowledge about local varieties). Additionally, the benefits of sustainable food value short chains to the local economy may extend beyond the agri-food industry. Operating in one of these chains, however, sometimes necessitates additional expenditures and/or specialized knowledge, which may pose obstacles to financial success. Additionally, the rivalry from growing grocery chains—some of which even began with local delivery and regional product lines in bigger towns—put financial strain on that effort.

## **2.2 GUIDING PRINCIPLES AND GUIDELINES: THE IMPORTANCE OF SELECTING AND DEVELOPING VALUE CHAINS IN AGRIFOOD SECTOR**

Putting together the concept of value chains and the one related to food and sustainability, as it was mentioned in the first paragraph<sup>17</sup> of this chapter, since the main theme of this thesis is to restore agri-food chains, it is important to understand, in a detailed way, what FAO intended with its guiding principles and related guidelines that published on this specific topic.

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<sup>17</sup> Cf. paragraph 2.1 *FAO's Outlook on Sustainable Food Value Chains: An Overview*

Starting from the concept that the use of sustainable food, as it is mentioned in the publication on guiding principles, meets the intention to reduce poverty, the intended concept of the sustainable food value chain itself is to be successful. It needs a systems approach to locating the fundamental causes of issues, creative problem-solving, and broad-based collaborations to execute programs that have a significant impact, and, in this sense, value-chain projects can easily have a limited or non-sustainable impact if their core nature is misunderstood. Additionally, development professionals all throughout the world are gaining important lessons from both triumphs and mistakes, but many of them are not widely shared.

## 2.2.1 GUIDING PRINCIPLES

FAO developed a specific paradigm that necessitates a specific strategy for analyzing the current situation on the food value chain, creating support strategies and goals, and evaluating the impact on development and, this process, entails creating a stakeholder vision for the value chain, identifying and ranking the most important set of interrelated constraints, and creating integrated upgrading strategies and workable development plans that can effectively realize the stakeholder vision for the VC while fostering synergies (Neven 2014, 22). In this sense, FAO developed some principles to develop these specific sustainable food value chains, that consists in understanding, improving, and measuring performance of the entire process.

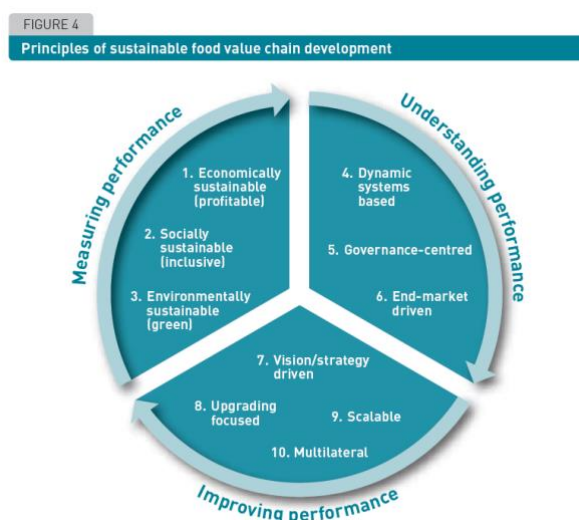


Figure 5: Infographic source: D. Neven, *Developing Sustainable Food Value Chains – Guiding Principles*, FAO, Rome, 2014, p. 22

These ten principles here illustrated are how effectively the sustainable food value chain is developed. Of course, this schema is not working for all of the scientific literature cases mentioned in the booklet because one or more of the sustainability characteristics may not yet have been fully handled, but this could be a starting point to try to identify the use of promotion of NUS as part for restoring agri-food chains in a sustainable and easy way in countries and regions of the world that are underdeveloped or developing.

In details, the first three guiding principles are concerned with monitoring the value chain performance from the standpoint of the triple bottom line: sustainability in terms of the economy, society, and the environment in which they follow a logical sequence in terms of timing and importance, overlapping:

- 1) The improved specific value chain model should offer better (or at least not decreased) earnings or incomes relative to the status quo for each stakeholder, and they should be sustained over time in terms of economic sustainability (competitiveness, commercial viability, growth). The concept won't be viable even in the near run unless everyone involved in the value chain benefits.
- 2) The upgraded model should produce extra value (additional profits and wage incomes in particular) that benefits enough poor households, is equally distributed along the chain (in proportion to the added value created) and has no effects that would be socially unacceptable in terms of social sustainability (inclusiveness, equitability, social norms, social institutions, and organizations). There should be no socially unacceptable practices, such as unhealthy working conditions, child labor, animal mistreatment, or violations of strong cultural traditions, and everyone involved (farmers and processors, young and old, women and men, etc.) should feel they are receiving their fair share (win-win). The model will not be long-term viable if this is not the case.
- 3) The improved model should generate more value without permanently diminishing natural resources in terms of environmental sustainability (water, soil, air, flora, fauna etc.). If this is not the case, the model won't be long-term viable.

Furthermore, as it affects market access (standards compliance) and may boost competitiveness, social and environmental sustainability is rapidly becoming a strategic goal for agri-food companies (market differentiation). As a result, improved social and environmental sustainability may pave the door for fresh approaches to boost value generation in the food value chain.

Then, moving in principles 4, 5 and 6 that describe the analytical stage of the process mentioned, we can assume that, unlike many other development approaches, value chain development takes a holistic perspective that allows the identification of the interlinked root causes of why end-market opportunities are not being taken advantage of. The identification of these root causes essentially implies a particularly broad and dynamic interpretation of the structure–conduct–performance (SCP) paradigm (Bain 1959) that calls for an in-depth understanding of the structure of the system, of how this structure influences the conduct of the various stakeholders and of how this results in an overall performance that changes the system’s structure over time.

Differently from the principles mentioned till now, that were presented in general terms, the last four principles direct the process by which a precise and thorough comprehension of the present state of the food chain may be transformed into successful and effective programs that aid in or promote the value chain development. There are three stages that identify this:

- 1) Defined objectives (vision) and a plan (core competitiveness strategy) for accomplishing them
- 2) Developing a strategy for the VC's technological, institutional, and/or organizational upgrading that will enable it to produce outcomes at scale
- 3) Creating and implementing a monitoring and evaluation system that allows for adjustments as needed and continually tracks performance against the vision.

At the very end of this literature review on the FAO’s guiding principles, we can assume that the overarching goal of sustainable food value chains is to greatly increase

society's welfare on a whole, for both the present and the generations to come, in particular through the framework analyzed above, embracing the multifaceted nature of the ideas behind sustainability and value added, that is seized in different methods: returns to financial institutions, wage earnings, value to the customer, revenues, and environmental consequences that could help different realities to go beyond competitiveness and inclusion of small realities, such as the ones we are taking into account in this thesis regarding Sahel region.

Instead, the three aspects of sustainability—economic, social, and environmental—are simultaneously considered when evaluating effect and, the performance of a food value chain is influenced by a variety of factors, including the growth of overall income, the quantity and type of new direct and indirect employment, an improved food supply, a larger tax base, and a smaller environmental impact of food production and distribution (Neven 2014, 64).

Of course, we all know that this mechanism described in this paragraph cannot solve all the problems related to food insecurity, the food system itself, poverty and so on, but public policies and the intervention of innovative business models that face the problems connected to human development – also from the private investments – can prevent that reducing poverty and hunger at the same time.

### **2.2.2 GUIDELINES**

In the meantime, it has been published another booklet (Walker et al. 2021, ix) as well from FAO, related to the guidelines for selecting value chains for sustainable food value chain development. In that sense, FAO proposes a “step-by-step process” that helps the user on how to evaluate, compare, and choose value chains for their developing in being sustainable. Value chain selection, a crucial first stage in its development, identifies the value chain or value chains that are most eligible for upgrading based on their potential to help accomplish the Sustainable Development Goals. These principles were created to offer a value chain selection process that is more organized, interactive, and objective by FAO and it generally addresses development professionals, such as international organizations, non-governmental organizations (NGOs), regional authorities, or national governments looking to

advance their agri-food value chain development initiatives to accomplish certain goals.

The six steps here mentioned (Walker et al. 2021, ix), are the following:

- 1) Adapt the tools based on the project goals
- 2) Produce a longlist of potential value chains;
- 3) carry out a shortlisting exercise;
- 4) gather information about the shortlisted value chains;
- 5) score the shortlisted value chains;
- 6) make the final decision and notify stakeholders.

Going back a bit to the concept of value chains, that choice is a crucial first step in value chain development, which aims to determine the value chains most appropriate for upgrading based on their capability to achieve Sustainable Development Goals like poverty reduction, improved food security and nutrition, youth employment generation, and gender empowerment, just to name a few (Walker et al. 2021, 2). This process can be developed by several stakeholders, with different targets. The guidelines developed by FAO are important to give, after the step-by-step process, previous mentioned, an in-depth analysis for selecting constraints and opportunities for better improving their scope. In this sense, what is important to say, is that designing and executing creative ways to solve value chain underperformance is known as value chain upgrading. Key value chain stakeholders will build a common vision and plan to direct value chain upgrading actions based on the findings of this study, with the practitioner's support.

Going into details on what are the key principles that moves these guidelines, we can list them into five sections:

- 1) Participatory, starting the selection process with the participation of important stakeholders;
- 2) Evidence-Based, using insights from secondary and primary data, if appropriate;
- 3) Adaptable, with relation to the project context and the value chains considered;

- 4) Sustainability-Focused, considering resilience, a meta-dimension of sustainability, and the triple bottom line of sustainability;
- 5) Commercially viable, guaranteeing that there is enough consumer demand for the chosen value chain items to be viable.

What we can say on the process here described, is that the user is guided through a step-by-step procedure for evaluating, contrasting, and choosing value chains. The ways in which the processes are carried out will vary based on the project's size, goals, and budget.

Where applicable, it is noted that several phases can be completed concurrently (such as during a value chain selection workshop). For this reason, the six processes basically consist of the following:

- 1) Tailor the tools depending on the project goals;
- 2) Produce a longlist of potential value chains;
- 3) Perform a shortlisting exercise;
- 4) Gather data;
- 5) Score the value chains;
- 6) Finalize and educate stakeholders.

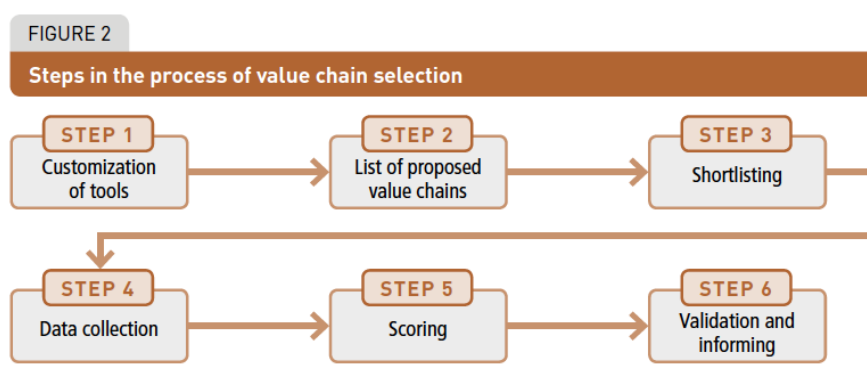


Figure 63: Infographic source: Walker C., DeMatteis L., Lienert A., Selecting Value Chains for Sustainable Food Value Chain Development – Guidelines, FAO, Rome, 2021, p. 12

Then presented here, the project context, target beneficiaries, and project goals must be configured in the following matrix. In fact, what is important in the implementation team, completes this stage after closely consulting with the funders. It can be carried out through online or in-person meetings with the pertinent parties. The

implementation team must choose the entire set of standards to be used throughout the final selection process as well as a more condensed collection of essential standards to be applied during shortlisting.

TABLE 1	
SIX SUBCATEGORIES FOR VALUE CHAIN SELECTION	
FEASIBILITY	IMPACT
Economic feasibility	Economic impacts
Societal feasibility	Social impacts
Environmental feasibility	Environmental impacts

Figure 7: Infographic source: Walker C., DeMatteis L., Lienert A., *Selecting Value Chains for Sustainable Food Value Chain Development – Guidelines*, FAO, Rome, 2021, p. 13

Concretely, one case study that is important for us to better understanding the way how this selection of value chain is implemented, is the one of coffee in Uganda called “Integrated country approach for promoting decent rural employment” (Walker et al. 2021, Case study 4. 32), developed with funds from the Swedish International Development Cooperation Agency and FAO for better improving employment and working conditions in this specific value chain, identifying the potential and, then upgrading it for reaching that goal.

- To oversee the country-level selection process, a local NGO was hired. To assure consistency with the project objectives, the selected NGO evaluated the normal selection matrix and added certain factors, such as the potential to provide employment and entrepreneurial possibilities for youth, gender mainstreaming, and youth financial inclusion.
- Following that, the NGO called a meeting of the Technical Working Group of the project with the goal of selecting 6 value chains from a longlist of 12 value chains that had been strategically highlighted by the Uganda National Development Plan. The Technical working group was made up of a variety of professionals from government organizations, academic institutions, the commercial sector, FAO Youth Champions, and other value chain participants. The following six value chains were chosen from a shortlist of 12 after

members scored the 12 suggested chains using a subset of selection criteria: maize, coffee, fish, cassava, milk, and banana.

- To inform the selection process, the NGO then gathered secondary data and created value chain summary reports for each of the value chains that had been selected. The value chain summary reports should be kept brief and to the point (about two pages) to ensure efficient utilization despite time restrictions.
- During a one-day in-person workshop that was held at the national level, value chain selection and validation were completed. 37 people in total attended the workshop, including government officials (from the Ministry of Agriculture, the National Planning Authority, the Ministry of Gender, Labor and Social Development, and the Presidential Initiative on Banana Industrial Development), specialists from research centers and financial institutions, cooperatives and business associations from the shortlisted value chains, and FAO Youth Champions.
- The facilitators, who were FAO and NGO officials, gave an overview of the selection criteria and the value chain summary reports before the session began. Before the participants were separated into three groups to perform the scoring, the weights of the selection criteria were debated and decided in the plenary. With one facilitator designated to support each group and offer clarifications as required, each group included a fair representation of kids, men, and women with varying levels of competence.
- The stakeholders were able to confirm the ranking and decide on the final choice of the coffee value chain at a final plenary session after each group had assigned the scores and ranked the value chains. It is advised to set aside enough time for the plenary discussion and final validation after the group scoring phase. A participatory approach will strengthen involvement during upgrading interventions by increasing stakeholders' ownership of the selection process.

What is important in the publication of FAO is that, for the development of a sustainable food value chain, is important to have a structured and participatory process. Using secondary and primary data to apply the selection criteria, it provides

a participatory method that fosters the early participation of important stakeholders and evidence-based decision-making. Development professionals may readily alter the step-by-step procedure detailed in FAO provide us, so that this technique can be utilized for projects with varying scopes, objectives, and budgets. This tool, in fact, enables development practitioners to pinpoint value chains based on the triple bottom line of sustainability (economic, social, and environmental impacts) by adopting an end-market-driven approach, encouraging the selection of value chains with a high potential for hastening the achievement of the SDGs.

With this, emerges that two are the categories of selection criteria that could be useful having a positive impact at economic, social and environment level:

- Feasibility (the kind of upgrading that should be done for reaching the goal);
- Impact (the results after the upgrading).

This technique excels in adaptability, which suggests that users must devote enough effort to personalizing the tools provided here.

Additionally, development practitioners utilizing these guidelines here resumed and described, should be conversant with sustainable value chain development ideas to guarantee that value chain selection yields the desired results. Value chains with a high potential for producing beneficial economic, social, and environmental consequences will only be chosen, enabling a successful beginning to the value chain development cycle, when value chain selection is approached from a systems viewpoint.

### **2.3 RESTORING AGRI-FOOD CHAINS THROUGH THE NUS AND THE DIFFERENCE WITH COMMODITY CROPS**

A recent body of work (produced under the title of "Transition Management") that spans sustainability, complexity, environmental, and governance research has established a theory on how sustainability transitions go from a specialized to a mainstream level (Dentoni et al. 2017, 8-13). Despite being widely used in both global food and agricultural systems and other economic sectors, this branch of research has generated controversy about how it conceptualizes its transformational routes. In fact,

co-creating change strategies is important to transformation management issues, especially in the agricultural sector.

And it is precisely in terms of agricultural transition that nus are important in this sense. The locations where indigenous people dwell are hotspots for NUS variety are typically rural areas where agricultural standardization has not been extremely intense and where agro-ecological methods have predominated. Due to their early maturity, low water needs, and ability to flourish on marginal soils, among other traits, NUS are important in traditional farming and risk management techniques in many of these places, which are characterized by difficult agricultural circumstances in which, for example, commodity crops would be short-lived.

Through research funds funded by IFAD<sup>18</sup> and a paper published for the promotion of NUS (IFAD and Bioversity International n.d. 2021), a holistic value chain approach for the use-enhancement of NUS has been created and tested. To get over bottlenecks in the use of NUS and enable resilience, nutrition, and income generating objectives to be realized, this strategy incorporates transdisciplinary and participatory interventions at many levels of the value chain.

In this sense, in fact, five are the steps for developing a holistic value chain approach:

- 1) Setting priorities for resilience and nutrition;
- 2) Evaluating value chains' developing prospects and market demands;
- 3) Supportive interventions for NUS domestic markets;
- 4) Supportive measures for the NUS export market;
- 5) NUS mainstreaming and policy.

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<sup>18</sup> International Fund for Agriculture and Development of the United Nations

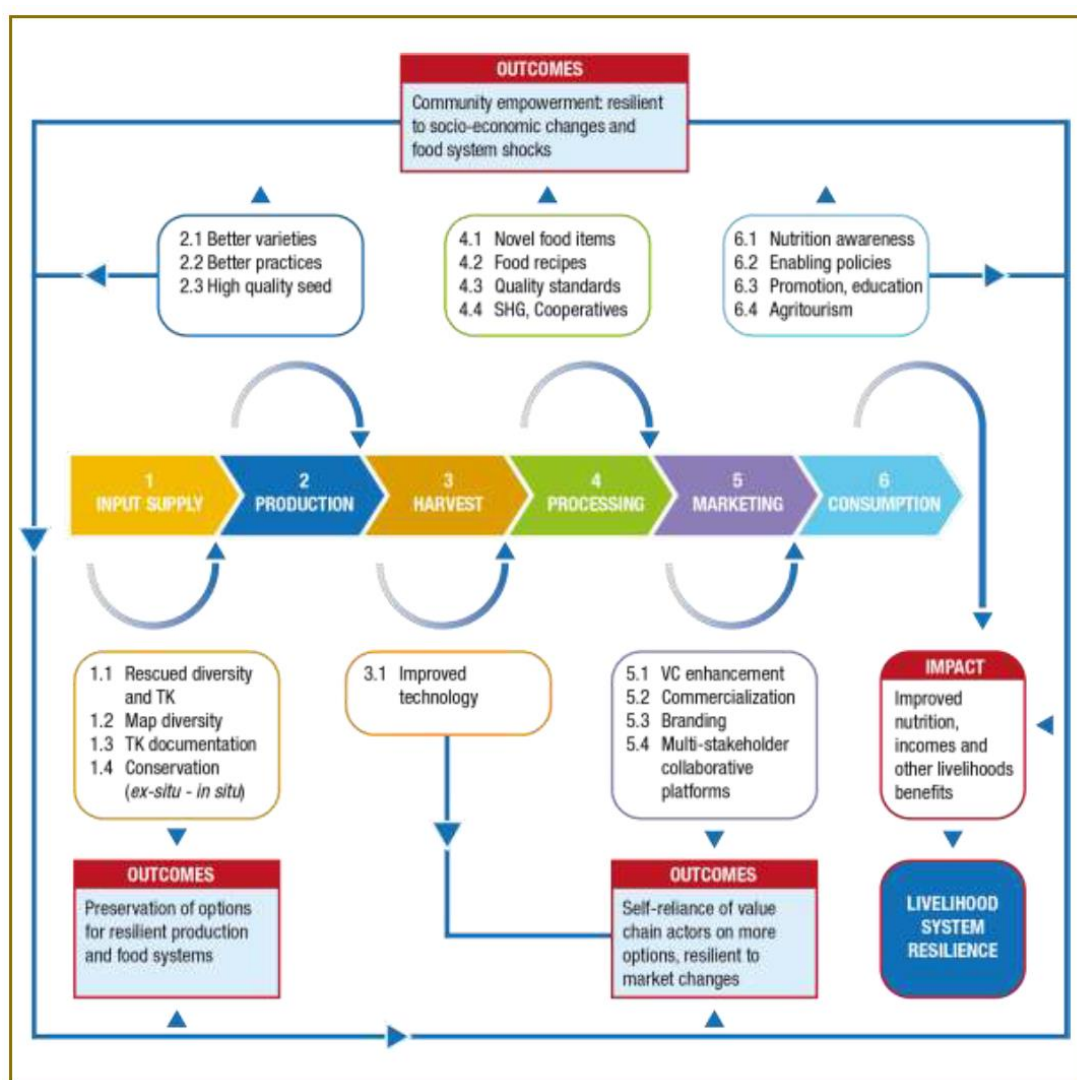


Figure 8: Infographic source: Padulosi S., Amaya K., Jager M., Gotor E., Rojas W., Valdivia R., *A Holistic Approach to Enhance the Use of Neglected and Underutilized Species: The Case of Andean Grains in Bolivia and Peru, Sustainability, Vol. 6, 2014, pp. 1283 - 1312*

As demonstrated by IFAD-supported programs on Andean grains in Bolivia in 2014 (Padulosi et al. 2014, 1283-1312) and minor millets in India in 2015 (Padulosi et al. 2015, 8904-8933), promoting NUS has proven to be a priceless tool for enhancing the standard of living for residents. Recent years have seen a lot of publicity about their contribution to food and nutrition security, and it is now increasingly acknowledged. NUS are attracting more attention in development initiatives for the reasons noted below from the notes of IFAD (IFAD and Bioversity International n.d. 2021):

- 1) Various NUS have been discovered to have incredibly high nutrient or nutraceutical qualities, earning them the moniker "superfoods". NUS

frequently have nutritional qualities that are comparable to or even superior to those of comparable commodity crops, like as quinoa or millets when compared to rice or wheat and they has, also, a high potential for developing market value since it is gaining recognition as an effective and efficient supply of critical nutrients or significant micronutrients. Food security, diet diversity, and nutrition are the ultimate goals of food production. A great technique for domestic market growth is to discover nutritional gaps between rural and urban populations, then locate NUS and promote delectable recipes for those groups' broader adoption, to meet those gaps.

- 2) Persistent poverty in rural areas: hotspots of NUS diversity are generally distant regions where high-yielding commodity crop types and uniformity of agricultural techniques did not produce the anticipated economic progress. Instead, conventional agro-ecological methods are still in use in these areas so, it is less risky and more affordable for farmers in such remote and frequently marginal areas to explore markets for low input and lower investment cultivations, such as those including NUS, to safeguard home consumption and target domestic or niche markets for traditional or novel foods.
- 3) Increase adaptability to climate change: NUS are frequently more suited to extreme weather and soil conditions than high yielding commodity crops, and it lowers risks such as harvest failure under extreme and unpredictable weather conditions, which are expected to become more frequent and extreme in the future. While some nutrient-dense NUS can survive in poor marginal soils, others can better withstand salt, high rainfall, and waterlogging, many nutrient-dense NUS are drought-resistant, have early maturity and short growth cycles, and require little water. It has been demonstrated that identifying climatic trends and the prevalence of unfavorable weather conditions in particular agricultural regions and supporting the cultivation of suitable NUS or their introduction into cropping systems is an efficient way to minimize yield risks and adapt to climate change.
- 4) Epidemics, dwindling water levels caused by unchecked groundwater usage, salinity issues brought on by extensive irrigation, and soil fatigue caused by excessive use of chemical fertilizers and pesticides: farmers in these regions

can employ agricultural diversification, which includes NUS, to enhance soil quality and transition to organic farming methods that are more environmentally friendly. NUS may contribute to farm system diversification by serving as a vital soil fertility restorative, a source of animal feed, or a rotating crop that generates additional revenue, all of which are ultimately necessary for the viability of the entire agro-ecosystem.

- 5) Affordable pharmaceuticals and cosmetics: many NUS are regarded for their medicinal or cosmetic properties in many traditional treatments like Ayurveda, a rapidly expanding market sector globally. These NUS are frequently gathered from the wild. Traditional medicine plays a significant role in low-income nations, especially for the poor, by providing a cheap substitute for pricy commercial pharmaceutical treatments. According to the WHO<sup>19</sup>, herbal medicines constitute the primary and even the only form of healthcare for millions of millions of people. Numerous NUS are being rediscovered and reinvigorated because to scientific proof of their strong antioxidant content, ability to aid in weight reduction, or contribute to good meals. Thus, it is crucial to support forest communities in using both cultivated and wild NUS for therapeutic or health purposes.
- 6) Heritage, both natural and cultural: hotspots of NUS variety are precisely where Indigenous Peoples reside. NUS are an essential component of regional cultures, are frequently utilized in traditional culinary dishes, and offer farmers other significant advantages like animal feed or agricultural implements. They are becoming more prominent in initiatives to revive regional culinary traditions and honor the essence of *terroir*. Although the first generation of urban populations who immigrated to cities frequently distance themselves from rural life and traditional foods, in emerging economies we frequently see affluent second- or third-generation city dwellers with expendable income looking to reconnect to their rural past, perceived as a healthier way of life, and to those traditional products as an expression of that sentiment. Remote areas frequently have remarkable natural beauty and may provide significant

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<sup>19</sup> World Health Organization of the United Nations

opportunities for the growth of agro-ecotourism. In Thailand, India, Malaysia, and Bolivia, promoting NUS in conjunction with traditional cultural events and agro-ecotourism has proven to be an effective tactic.

Then, moving to the difference of NUS value chains and commodity crops, the same value chain development methodologies and tools may be applied for both, and a value chain development plan for NUS is in theory the same as for commodity (IFAD and Bioversity International n.d. 2021). NUS value chains do, however, exhibit certain unusual traits. The Ansoff matrix<sup>20</sup>, as it is mentioned in the IFAD paper, provides the clearest explanation of how a value chain development approach for NUS differs from that for commodity crops that, at first, was created to help people better understand market or value chain development plans and to distinguish between them based on whether they are aimed at current or new markets and goods, respectively.

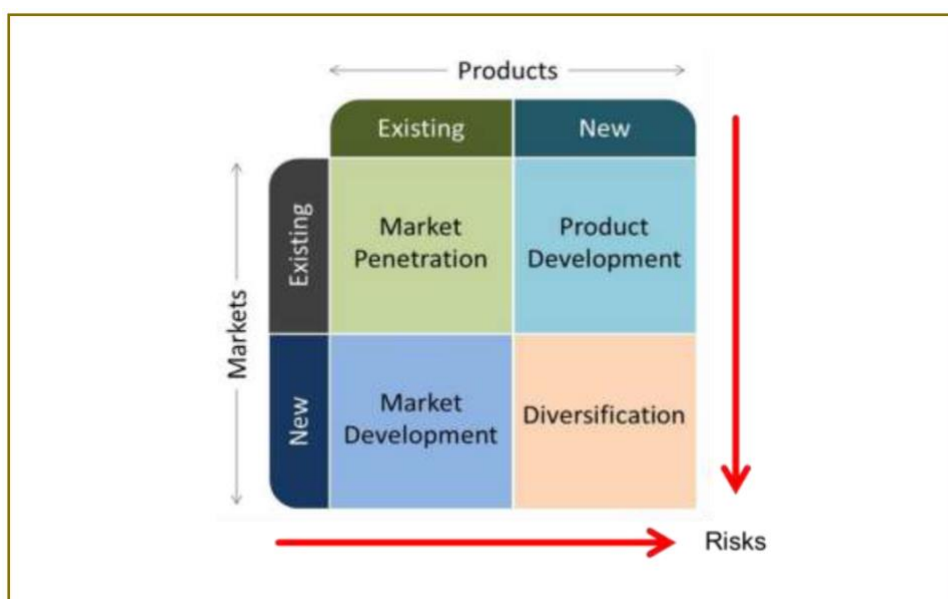


Figure 9: Infographic Source: VV. AA., *How to do: Promote Neglected and Underutilized Species for Domestic Markets - Nutrition-Sensitive Agriculture, Note n. 3, IFAD and Bioversity International, March 2021, p. 10*

The greatest market risks occur when developing new goods for new markets (diversification strategy), as there is less expertise and market knowledge available to

<sup>20</sup> Management teams and the analyst community utilize the Ansoff Matrix, also known as the Product/Market Expansion Grid, as a two-by-two structure to assist plan and assess expansion projects. The tool specifically aids stakeholders in conceptualizing the degree of risk associated with various development plans.

ensure that products are developed in accordance with the requirements, preferences, or wants of their intended customers. On the other hand, a value chain strategy (also known as a market penetration strategy) that focuses on the marketing of current goods for current markets is frequently less risky but also has more competition and lower profits (IFAD and Bioversity International n.d. 2021). For introducing a new product to an existing market (product development plan) or an existing product to a new market (market development strategy), the market risks are moderate since at the very least, the product or the target market is well-known.

Value chain development initiatives sometimes ignore the potential of the home market in favor of going for international markets. What it is possible to say, in conclusion, is that since wealthy customer groups with high disposable income in developed nations may be targeted, export markets frequently have the greatest price levels and margins. There may be a very big number of prospective customers to target. Even yet, exporting takes significant expenditure to achieve quality, food safety, and product criteria, particularly when going to markets like the USA, EU, Australia, Canada, and Japan.

Then, since customers, as well as in underdeveloped nations tend to be less wealthy and have fewer disposable means, these markets for NUS are generally not given much thought. The fact that these meals are seen unfavorably is another frequent issue impeding the use of NUS. They are regarded as a poor man's crop, or food related to hunger and difficult times. However, major southern nations like India, Brazil, or Nigeria have sizable and quickly expanding middle classes and rich customers who may be targeted as NUS consumers by capitalizing on their desire for wholesome, pesticide-free goods and well-planned programs aimed at meeting the needs of people with lower incomes can potentially significantly increase domestic demand for these crops.

## **CHAPTER 3**

### **CREATING SUSTAINABLE BUSINESS MODELS: THE USE OF BUSINESS MODEL CANVAS**

#### **3.1 THE BUSINESS MODEL CANVAS: A GENERAL DEFINITION**

When we refer to the Business Model Canvas, it is important to mention what Osterwalder and Pigneur developed in their book “Business Model Generation” (Ostewalder et al. 2010) dedicated entirely to what and how is used the Model itself.

In fact, the book started with an important reflection, starting assuming that numerous novel business concepts are now evolving and, as older sectors decline, brand-new ones are emerging. Newcomers are taking on the establishment, some of which are desperately trying to redefine themselves and, in this sense, this is where business model innovation is trying to collocate, since 1950, year when the creators of Diners Club were experimenting with new business models when they, at least, unveiled the credit card. In fact, we can date business model innovation back to Johannes Gutenberg's search for uses for the mechanical printing press he had created in the fifteenth century (Ostewalder et al. 2010, 5).

However, the scope and speed with which cutting-edge business models are altering the face of industries today is unparalleled. It is imperative that business owners, executives, consultants, and scholars comprehend the significance of this amazing evolution, and, in this sense, this is because value creation is at the heart of business model innovation for organizations, consumers, and society that can be adapted to the context we would like to refer to.

The rationale behind how an organization generates, delivers, and collects value is described by its business model, that is the starting point of what is behind the concept of the Business Model Canvas. A shared knowledge of what a business model is should serve as the foundation for any fruitful debate, gathering, or workshop on business model innovation. Everybody must be able to understand the notion of a business model for it to be easy to describe and debate and it is necessary to discuss the same subject and begin at the same place. The difficulty is that the concept must be clear, pertinent, and easy to grasp without oversimplifying the nuances of how

businesses operate. In this sense, in fact, this idea mentioned in these lines can be turned into a common language that makes it simple to describe and adapt company models to provide fresh tactical options. It is challenging to properly challenge presumptions about one's business strategy without such a common language, in contexts where – for example – there are low education rates or important difficulties related to developing a strong market where there are less opportunities, at a sustainable level and, for this reason, the business model functions as a roadmap for a plan that must be put into action by means of organizational structures, procedures, and systems.

Ostewalder and Pigneur (Ostewalder et al. 2010, 16), describe what are the 9 building blocks that make the Business Model Canvas for what we know it today:

1. Customer Segments: a business caters to several customer segments.
2. Value Proposition: it uses value propositions to address consumer demands and solve customer problems.
3. Channels: customers receive value propositions through communication, distribution, and sales channels.
4. Customer Relationships: each customer segment is engaged in the development and maintenance of customer connections.
5. Revenue Streams: value propositions that are successfully offered to customers result in revenue streams.
6. Key Resources: the resources necessary to provide and deliver the aspects previously outlined are considered key resources.
7. Key Activities: carrying out several Key Activities.
8. Key Partnerships: some tasks are delegated, and some resources are obtained from outside the company.
9. Cost Structure: the cost structure is the product of the business model components.

**The Business Model Canvas**

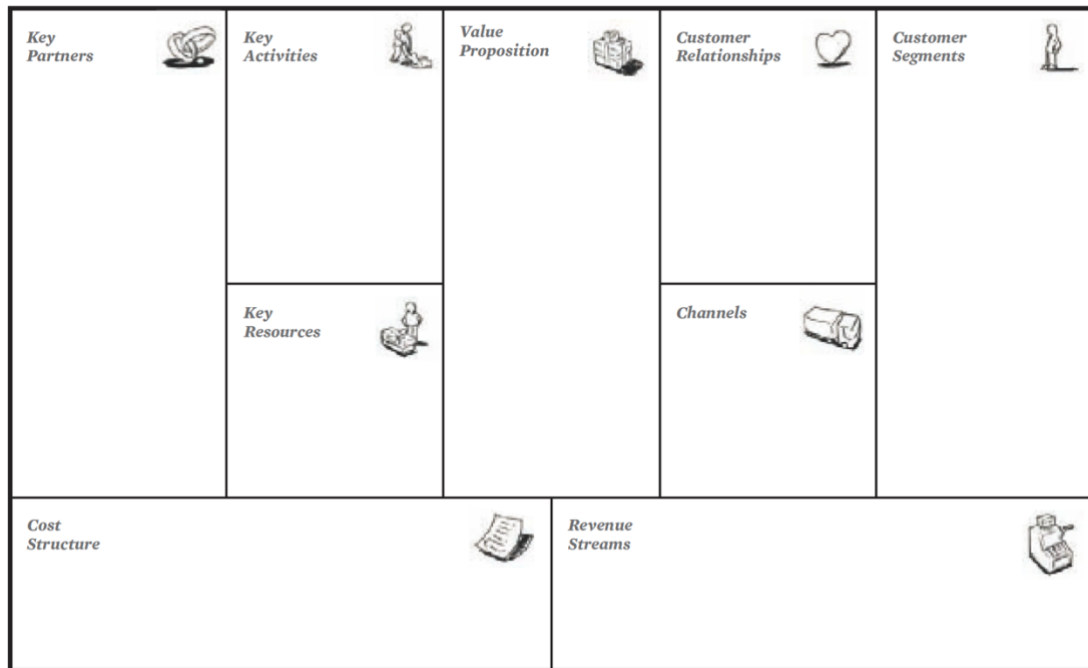


Figure 10: Infographic Source: Osterwalder A., Pigneur Y., Business Model Generation: a Handbook for Visionaries, Game Changers, and Challengers, John Wiley and Sons, 20 August 2010, p. 44

This tool lets us paint pictures of new or existing business models. It is like a painter's canvas and comes preformatted with the nine blocks. The Business Model Canvas works best when it is printed out on a wide surface so that groups of people can discuss and brainstorm business model components while simultaneously sketching them out with notes or board markers. It is a practical instrument that encourages comprehension, dialogue, imagination, and analysis.

**3.1.1 GENERATING A NEW BUSINESS MODEL CANVAS: AN ADAPTATION OF THE MODEL**

A new and inventive business model is different from mapping an existing business model plan. What is required is a creative method for generating plenty of potential business model concepts and selecting the best ones. Ideation is the process in question and designing successful new business models requires mastering the art of ideation. In the past, in fact, a dominating business model defined most sectors. This has drastically changed. Today, there are a lot more options available for creating new company models. Different business strategies now compete in the same markets, and industry borders are becoming increasingly hazy or sometimes dissolving altogether. One difficulty that can be encountered when trying to come up with fresh business

model alternatives is ignoring the status quo and putting operational considerations on hold to come up with truly original concepts: looking backwards is not a part of business model innovation because it offers little insight into potential future company models. Since business model innovation is not about copying or benchmarking but rather about developing new mechanisms to create value and generate income, it is not necessary to look at rivals. Instead, business model innovation is defying convention to create new models that address unmet, undiscovered, or hidden client demands. On this way, it is necessary to generate a wide range of ideas before whittling them down to a manageable number of options to come up with fresh or better alternatives. Idea creation, where quantity matters, and synthesis, where ideas are discussed, merged, and filtered down to a small number of feasible possibilities, are thus the two key processes of ideation. Choices don't always represent innovative business strategies; they might involve developments that push the limits of your existing business model to make it more competitive. Innovative business model concepts might come from a variety of diverse starting points: each of the nine components of a business model can serve as a springboard for ideas for business model innovation. Multiple pillars are impacted by innovative, transformative business models and the epicenters of business model innovation fall into four categories: resource-driven, offer-driven, customer-driven, and finance-driven and, each of them, has the potential to be the catalyst for a significant shift in the business model and to have a significant influence on the other eight building blocks.

Business model innovation, in this case, can occasionally come from multiple epicenters and, additionally, a SWOT analysis<sup>21</sup>, which examines a company model's strengths, weaknesses, opportunities, and threats, frequently identifies the places where transformation begins (Ostewalder et al. 2010, 138).

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<sup>21</sup> SWOT analysis is a framework used to assess a company's competitive position and to create strategic planning. It stands for strengths, weaknesses, opportunities, and threats, evaluating internal and external variables as well as present and anticipated future situations and it is intended to help in taking a practical, fact-based, and data-driven look at the advantages and disadvantages of a company, its efforts, or its sector. The organization must avoid preconceived notions or gray regions and concentrate on real-life settings to maintain the analyses' accuracy and, in this case, companies should use it as a reference rather than a strict prescription.

### **3.1.2 THE VISUAL THINKING, A TOOL FOR EVERYONE**

The strength point of the Business Model Canvas is to be an important visual thinking tool that, contextualizing its operating, can facilitate a lot the possibility to develop a simple and sustainable business model also in developing and underdeveloped countries where, for example, there are the lowest levels of education in the World.

Working with business models requires the ability to visualize concepts and, by "visual thinking," it is defined the actions of creating and debating meaning using visual tools like images, sketches, diagrams, and notes. It is difficult to fully comprehend a business model without sketching it down because they are intricate concepts made up of many building components and how they interact. Starting from the concept that the business model is a system in which one component affects the others and only makes sense when taken as a whole, it is challenging to capture the big picture without visualizing it, of course, but a business model's implicit assumptions become clear knowledge when it is visually represented that gives it a concrete form and makes debates and modifications more understandable. Visual tools help co-creation and give a company idea "life", as Ostewalder and Pigneur mention in their volume (Ostewalder et al 2010, 148), and a model that we are creating becomes a lasting entity and a conceptual anchor that conversations may always refer to after being sketched. This is crucial because it increases the quality of argument and moves discourse away from the abstract and toward the concrete. Visualizing an existing business model will typically reveal any logical flaws and make it easier to discuss them if the goal to pursue is to change it. Like this, by developing an entirely new business model, it could be necessary to quickly discuss various choices by adding, removing, or rearranging the graphics.

Businesses already frequently employ visual tools like charts and diagrams: these components are frequently used to make communications within reports and plans clearer. However, using visual methods to debate, investigate, and define business issues is less common. But visual thinking can be quite valuable during the planning phase. By making the abstract concrete, highlighting connections between pieces, and simplifying the complex, visual thinking improves strategic investigations.

“There’s not a single model... There are really a lot of opportunities and a lot of options, and we just must discover all of them”.

This is what Tim O’Reilly, O’Reilly Media<sup>22</sup>’s CEO, said regarding the possibility of using the Business Model Canvas for everyone and everything and, starting from this assumption, it is possible to develop the Business Model Canvas as a useful tool for everyone, independently from its environment or the market in which this could be used. In this sense, in fact, having a solid awareness of the environment in which the business operates enables everyone to create business models that are more robust, competitive and, also, sustainable. Because of the economic landscape's increasing complexity (for example, in which market I am oriented to? What is the socio-economic frame in which I will develop my business model?), increased uncertainty (e.g., technological innovations), and significant market disruptions (e.g., political unrest, disruptive new Value Propositions), continuous environmental scanning is more crucial than ever. Understanding environmental changes enables the person (or the market that will use this tool) to adjust the model more successfully to changing external pressures. In fact, could be useful to perceive the external environment as a big canvas, in which it is possible to develop and design the business model that could be suitable for the purpose to reach, trying to transform the environment around and setting new standards for the project had in mind.

Ostewalder and Pigneur advise loosely mapping the four key aspects of the surroundings to acquire a better understanding of the business model's "design space." Market forces, industry forces, significant trends, and macroeconomic forces make up the first group (empirically speaking). A profitable strategy that is appropriate for the current environment may be dated or could become dated tomorrow. However, it is possible to create a variety of possibilities to serve as guides for creating the business models of the future.

And, for creating these innovative business models, it is important to start from the design process. In facts, each business model design project is different from the others, with its own set of difficulties, hindrances, and essential ingredients for success.

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<sup>22</sup> O’Reilly Media is an American publishing house founded by Tim O’Reilly that publishes books and websites relating to information technology.

When an organization starts addressing a problem as basic as its business model, it does it from a new vantage point and with its own context and goals. Some might be responding to a crisis, some might be looking for new growth opportunities, some might be in the startup phase, and yet others might be preparing to launch a novel product or piece of technology. The starting point of this process, has five phases: mobilize, understand, design, implement and manage and, consequently, one of the following four goals leads to the creation of new business models:

1. To fulfill current but unmet market needs,
2. To introduce new bringing technology, goods, or services to market,
3. Enhancing, upsetting or develop a superior business model to convert an existing market,
4. To open a brand-new market.

Business model innovation initiatives in established businesses usually mirror the current model and organizational layout. The effort is typically driven by one of four factors:

1. A crisis with the existing business model (in some situations, a sense of "near death"),
2. Enhancing, protecting, or modifying the current model to conform,
3. Introducing new technology and products to a changing environment bringing products or services to market,
4. Planning for the future by investigating and exploring whole new business models that may one day swap out the current ones.

The Canvas can be used by organizations other than for-profit businesses. The method is simple to use regarding non-profit organizations, charities, government agencies, and for-profit social projects. Even if the term "business" is not used as a descriptor, every organization has a business model. Every organization that develops and delivers value needs to make enough money to cover its costs to exist. Consequently, it has a business plan. Simply said, the for-profit company's concentration is on maximizing profits, but some other organizations have significant non-financial purposes centered on environmental issues, social causes, and public service mandates. In this sense, it is important to distinguish between two types of beyond-profit business models: those

with external funding (such as philanthropy, charities, and the government) and those with a clear ecological and/or social mission. The term "triple bottom line"<sup>23</sup> refers to the practice of accounting for environmental and social costs in addition to financial ones. These two are primarily distinguished by their revenue sources, but as a direct result, they have two quite different business model patterns and drivers. Many businesses are experimenting with combining the two models to take use of their finest qualities.

For example, in Ostewalder and Pigneur's volume on Business Model Canvas, it is taken as an example the tale of Iqbal Quadir, a New York-based investment banker who founded Grameenphone. In his native Bangladesh, he wanted to give everyone access to telecommunications services in isolated, rural locations. He succeeded in his goal by using a business model that was for profit and which greatly benefited rural Bangladesh. In the end, Grameenphone gave almost 200,000 rural women opportunity to earn an income, improved their social standing, connected 60,000 villages to a mobile phone network, reached 100 million people, generated a profit, and became the largest taxpayer for the Bangladeshi government (Ostewalder et al. 2010, 265). Thanks to this, it is possible to imagine and expand the Canvas to include Blocks that show two outcomes to accommodate triple bottom line business models:

1. The social and environmental costs of a business model (i.e., its negative impact),
2. The social and environmental benefits of a business model (i.e., its positive impact).

The triple bottom line concept aims, in this way, to minimize negative social and environmental impacts and maximize positive ones, just as earnings are raised by limiting financial costs and maximizing income.

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<sup>23</sup> It can be summed up as the "three Ps": profit, people, and the planet. The triple bottom line is a business concept that asserts companies should commit to measuring their social and environmental impact—along with their financial performance—rather than focusing only on generating profit, or the standard "bottom line."

### **3.2 A STRUCTURED CANVAS: THE TRIPLE LAYERED BUSINESS MODEL CANVAS**

From the main concept of the Business Model Canvas presented before, it is important to underline and return to the concept that can be modeled and designed in different ways, referring to the goal that should be reach.

It has also been mentioned the importance of the triple bottom line approach, for developing a model to account for environmental and social costs in addition to financial ones, making the business model more sustainable. By escaping the old business model through trial and error, which educates new approaches and understanding, business model innovation is a practice that restores growth and profits (Chesbrough 2010, 354-363) and then, organizations of all sizes eventually come to a decision point where a plan for their revival is developed. Planning and actively orchestrating a change at the level of the business model is one way to solve that conundrum and, at this point, it is important to agree with Chesbrough in his paper (Chesbrough 2010, 354-363) previously mentioned that experimentation, creativity, and the transformation of organizational processes are essential for successful business model innovation.

Before entering in detail what a triple layered business model canvas is, it is important to move to the critics made on the simple Business Model Canvas that has an innovation bias and neglects to take other organizational management factors like company structure, business objectives, performance metrics, strategy management, and competitive analysis into account by Rosenberg (Rosenberg et al 2011).

A second criticism comes from Upward (Upward 2013), who claims that the original business model canvas was constructed using the principle of profit first. The components of the company model can be calculated to guarantee that, strictly financially, revenues exceed costs. Even though a business model's initial design centers on the notion of value, it is assumed that only the financial value of anything would be quantified.

According to Joyce, Paquin and Pigneur in their paper (Joyce et al 2015) related to the triple layered business model canvas, the critic to follow is the second one, trying to unhinge the concept behind the financial value of the business models and to follow

the sense in which, today, it is necessary more than ever to include sustainability principles at the bottom of the scheme.

In the introduction of this thesis, it has been mentioned the concept of sustainability, introduced by the Brundtland Report in 1987 defining the fact that the concept is insert in a continuous becoming, looking at the future taking into consideration the errors done in the past. However, it is important also to mention the concept of the triple bottom line (Elkington 1998, 37-51), that influence the business decisions, that means to give attention and add a sustainable approach to business.

But, following what Upward told us in his thesis (Upward 2013), he offers a canvas with 14 elements on a single layer that is very sustainable, and, in this way, it is demonstrated that strong sustainability aims to eradicate all negative effects. Contrast this with limited sustainability, which only mitigates negative effects without generating long-term positive effects, in Upward's canvas, on the other hand, there is a significantly from the original business model canvas and develops a whole new ontology. To make the very sustainable canvas more practical, he and his colleagues created a thriving business canvas, in which the most recent canvas is encouraging since it was constructed with the intention of nesting or embedding the economic difficulties within the social issues and those within the environmental constraints.

But, in the paper presented by Joyce, Paquin and Pigneur, in which they add the triple bottom line approach to create this new sustainable business model canvas, they pursue the fact that this approach is much more structured than the simple one, theorized at first and mentioned in the first paragraph of this chapter. In fact, they specified that, even its simplicity, the Business Model Canvas, for being much sustainable, should be modified with additional layers: by projecting the significance of each original building element onto a new element in accordance with the new layer theme, we ensured vertical coherence. Understanding how value might be understood differently for each of the three layers was the first step in this project's development. The creation of the value side of the canvas and its delivery were translated as a collection of related items for each new layer. Then, to ensure that the value capture of the canvas was accurately translated into measuring performance, the authors went back to it. The environmental life cycle business model layer and the social

stakeholder's business model are the two new layers we are currently presenting as the results.

Of course, even the new triple layered business model could be an important and useful tool in terms of social responsibility and sustainability, it presents limits. The authors, in fact, recognize that the triple bottom line approach to sustainability that is written in their tool is the first boundary that they want to acknowledge. Although they did not intentionally embed each layer into the next to demonstrate great sustainability, they do refrain from doing so to preserve the original business model canvas. When employing the canvas tool to increase the wellbeing of future generations, one can use a sustainability strategy. Furthermore, when considering all resources and production in addition to those supplied and outsourced, there are no externalities. In this way, it is possible to link to the concept of embedded sustainability by potentially embracing the entire biosphere.

The second restriction on the study effort mentioned is the result of their current field validation. In fact, during the continued testing the triple-layered canvas by utilizing it in their innovation workshops with organization was successful but in a limited point of view: the most important one is that, even the innovative way of thinking the Business Model Canvas, the participants had a propensity to examine the entire picture rather than just the financial ones. In this case, the Triple Layered Business Model Canvas cannot be completely useful as considered as a "simple tool" for helping to restore agri-food chains markets in underdeveloped and developing countries, because it uses some specific patterns – translated into indicators – that do not consider several conditions and several difficulties to face off, like the ones related to political and socio-economic ones, or simply to try to introduce concepts that, in the northern part of the world are commonly used and, on the other hand, in small villages in the Sahel region are not even known.

### **3.3 THE BUSINESS MODEL FOR LOCAL ENTREPRENEURS: THE CASE STUDY OF NIGERIA**

An interesting point of view is the one from Osterwalder, Rossi and Dong (Osterwalder et al. 2002) that developed the "Business Model Handbook for Developing Countries", that contains several ideas and reflections on how it is possible to develop a tool that

has a goal to help small entrepreneurs doing business (in that case is mostly oriented for ICT technologies, but it could be interesting to develop a similar strategy using the Business Model Canvas for the agricultural sector regarding NUS market, for example) trying to develop a strategy for being also more efficient, flexible and responsive to faced opportunities in everyday life and generate income and sustainable revenue streams.

Therefore, their business model architecture is broken down into four main parts:

1. The goods and services a business provides that have a significant value to the client and that he is willing to pay for. Theoretically, in the case analyzed in this thesis in the Sahel region, NUS can do businesses in poorer nations, giving new options for agriproducts and related things,
2. The customer relationships that a business builds and maintains to please them, build relationships of trust, and produce long-term profits,
3. The systems and network of collaborators required to generate value and preserve positive client relationships.
4. Finally, a business model includes the financial elements, such as cost and revenue structures, that are present in the first three components.

And, by this, it is possible to develop what could be the goals to reach, starting from the transfer of knowledge, then to helps identifying new opportunities in using NUS (for example), in which government agencies and NGOs could be surely involved.

Arriving at this point, it is important to mention an important and virtuous paper case in which is involved the Business Model Canvas tool.

In a paper dedicated to the adoption of a sustainable technology transfer and adoption using the Business Model Canvas in Nigeria (Amoussouhoui et al., 2022), in which it has been described and studied that, to scale new technologies sustainably and transfer them to boost household resilience, it has been suggested a service-based business model. To the original Canvas business model, two new segments, such as cost-benefit analysis and the sensitivity analysis were introduced. To implement the business model, there have been deployed two cutting-edge technologies: a customized extension application and a rice threshing equipment. In that case it has been used quantitative information from 700 randomly chosen rice farmers in Kano region (in

the north center part of Nigeria) and qualitative information gathered by the Delphi method<sup>24</sup>. When both technologies were employed independently, the adapted Canvas business model is definitively lucrative, with an Internal Rate of Return (IRR) for the threshing machine and the application of 23 and 28%, respectively. However, it has been found that combining both technologies into one business model results in increased profitability. In that case, were created two kinds of Business Model Canvas, one for each technology used, trying to find the relationship between the two business models and then combined in one. The Canvas business model's cost structure and revenue outline all the expenses required to run the model as well as the money the unit makes. However, a cost-benefit analysis was carried out in that business model and the study's setting without making any assumptions regarding the company model's viability. To establish the optimal strategy to enter this business, the sensitivity of the business model was evaluated. After that, regarding anticipated costs, revenues, and capital costs, the business model was simulated. The depreciation technique, net present value, and internal rate of return were used to evaluate profitability and then, business model analysis was broken down into other five sections: three scenarios are presented along with the following information, such as input data, depreciation schedule, residual values, anticipated/projected net cash flows, net present value, and internal rate of return.

In this sense it is important to understand, in that case, technologies are created to support and improve performance in response to the difficulties and challenges faced by farmers. These new technologies encompass information transport, agricultural methods, and it is important that the government, which has the largest network with farmers, must provide support for the innovative entrepreneurship through private extension services and research and development. In fact, promoting agricultural technology transfer through private extension will free up financial resources for the government and provide jobs for young people or business owners who are interested in investing in the agribusiness sector. To achieve successful business model

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<sup>24</sup> The Delphi method is a framework for forecasting based on the responses to several rounds of questionnaires distributed to a group of experts.

deployment and long-term technology adoption, upstream analysis asks for a flexible business concept and evaluation pathway before business model creation.

Based on the most recent theoretical and empirical research, they suggest, in the research, an orientated concept. A Political, Economic, Social, Technological, Environmental, and Legal analysis<sup>25</sup> is the first step in the extended version of the original Canvas business model's pathway for the sustainable adoption of new technology. This analysis will help determine the environment in which the business will be implemented. Details on the advantages and potential effects of these aspects on the business model are also included in this analysis.

The second step of the pathway is a downstream study that adds two new lines to the original Canvas framework to evaluate the business's profitability and pinpoint its flaws. For a more dependable and effective strategy, it is also crucial to move beyond the business model design and carry out an ex-ante and ex post assessment. These two evaluations will give all the data required to ensure a successful execution of the business model, an effective transfer of technology to primary users (business units or governments), and long-term acceptance of technology by end users, despite being more expensive to conduct. The orientated approach of the business model is still not frequently adopted, despite a growing focus on business model innovation and sustainability throughout the proposed service-based company approach. The most advanced and popular strategy is sustainability-oriented, although it still must be spread and scaled up.

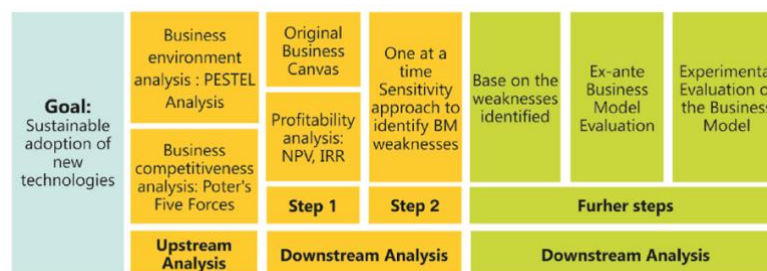


Figure 11: Infographic source: Amoussohoui R., Arouna A., Bavorova M., Tsangari H., Banout J., *An Extended Canvas Business Model, a Tool for Sustainable Technology Transfer and Adoption, Technology in Society*, Vol. 68, 25<sup>th</sup> January 2022

<sup>25</sup> Or also known as PESTEL analysis, is a framework or instrument used to analyze and keep track of the macroenvironmental elements that could significantly affect an organization's performance. When launching a new firm or entering a foreign market, this tool is extremely helpful.

In conclusion of this chapter, what is important to say, is that a perfect framework for scaling up and distributing innovative technology to potential end users is provided by the service-based business model. The study mentioned (Amoussouhoui et al., 2022) offers users who want to introduce and accomplish the sustainable adoption of new technology a new line for technology transfer (or, at least, introducing the promotion of specific agricultural products in the market) and a new method for looking at business model literature. The Canvas method is a simple technique that may be adjusted to any new technology, in particularly also in agriculture. To evaluate the market, the environment, and any potential impacts that environmental factors may have on the business model, the authors, in any case, advise conducting an upstream analysis.

## CHAPTER 4

### DOING BUSINESS IN SAHEL: AN ANALYSIS FOR UNDERSTANDING THE WEAK POINTS TO IMPROVE THE CONDITION OF THE REGION

#### 4.1 AN OUTLOOK ON SAHEL'S GENERAL CONDITION

To develop the question around which the thesis outlined here can conclude, it is good to take a step back to analyze some essential elements without which it might not be possible to define why and how important it is to apply sustainable business models and related strategic tools, so that agri-food chains can be improved by promoting NUS.

In the previous chapter was introduced the concept of the PESTEL<sup>26</sup> analysis that is a fundamental tool for carrying out a market analysis, as it allows us to study external factors that may have an impact on the company's (or what we are looking to improve) operations and may therefore affect the company's success or not. In particular, the factors that are analyzed with the PESTEL analysis must be done to try to understand how they can negatively affect the business and what kind of obstacles they can create. In fact, analyzing in detail the six factors that make up the current analysis therefore allows first to realize the possible feasibility of a business plan, and then to be aware of any obstacles that may arise for the achievement of the objectives established at the company level and therefore know how to manage and solve them, also with the stakeholder<sup>27</sup>'s one, necessary and prior to the application as well of the Business Model Canvas trying to understand what is the target we are referring to .

Starting, in fact, with these two helpful tool for helping better understand what it is going to face off for applying the considerations taken into account in the previous chapters related to the sustainable food value chain and the use of the Business Model

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<sup>26</sup> PESTEL stays for political, economic, social, technological, environmental, and legal analysis, a fundamental tool in which all these components are helpful for developing an accurate analysis.

<sup>27</sup> Stakeholder analysis is the process of identifying the above individuals prior to the start of the project, classifying them according to their levels of involvement, interest, and influence, and figuring out the best ways to involve and communicate with each of these stakeholder groups throughout the project.

Canvas as a toolkit for people in small villages for better improving the agri-food cultivations in terms of development, it is necessary to define the Sahel as that portion of land that extends from the Atlantic Ocean to the Red Sea: therefore, from Senegal to Eritrea. The countries of the central-western region (up to Chad) during the nineteenth century were part of the French colonial empire (in which today France still exercises a strong influence on this area, from a cultural and economic point of view, and military). The political situation in the area is one of the most chaotic in the internal international scenario: just think that according to the latest United Nations data, 29 million people need humanitarian assistance (Aljazeera and news agencies, 27 Apr. 2021). In this sense, political and security instability in the Sahel has altered in scope and type throughout the years, from the famine crisis in the '70s to the Malian's one, and the last crisis in Burkina Faso, with the return of military figures to the political stage and the widespread public support for military juntas after coups are indications of weak administration and a serious degradation in the legitimacy of elected officials.

In fact, over the past ten years, the Sahel has become an area synonymous with instability and insecurity. The context of political uncertainties, armed conflicts and security deterioration that prevails in the area is the result of the confluence of three major vectors of instability that still dominate the Sahelian landscape in 2015: the transnational gangster-religious terrorism of Al -Qaeda in the Islamic Maghreb (AQIM) and its avatars since 2005, the security upheavals of the Libyan revolution since 2011 and the Malian crisis, caused by both the Tuareg rebellion and the coup d'état of March 22, 2012, followed by the French military intervention of January 2013. These three intertwined crises, which have different causes, today mark consequent lines of rupture adding to fragile social balances, precarious State matrices and economic underperformances which are perpetuated since the 1960s. Any reading of the region cannot dissociate them without loss of meaning. Like other regions of the world – East Africa, the Middle East and Afghanistan in particular – this part of Africa is marked by the presence of parallel hotbeds of social, political, ethnic, and religious conflicts which have intensified in recent years without encountering any real prospect of a solution (Ould Mohamedou 2017, 290 – 297).

However, the G5 Sahel nations—Burkina Faso, Chad, Mali, Mauritania, and Niger—face significant development and security obstacles. Multiple conflicts, poor

governance, insufficient service delivery, low human development, and rapid population expansion are all problems in the region. While the security situation is frequently at the center of attention and discussion when discussing the Sahel - and rightfully so - it is important to recognize that the current instability is the result of the combined effects of poor governance and low development. It also faces high rates of poverty and ecological regression due to climate change, which undermines food security and farmer-herder relations in the region. Since both have afflicted the area for many years, each of the three-need action.

With strong leadership, political will, and a focus on sectors that can drive development results throughout the area, the G5 Sahel countries can gradually start to reverse the current dismal growth trajectory despite the region's complexity.

In the Regional Economic Outlook published in April 2012 by the IMF<sup>28</sup> it refers to the fact that, despite challenging external conditions, Sub-Saharan Africa's economy (and so, the one of Sahel) grew at a steady rate in 2011, with the region's output increasing by 5%. This rate was faster than the global economy but still significantly slower than the region's average growth rate during the pre-crisis period (2004–08), which was 6<sup>1/2</sup>%.

Although most nations took part in this expansion, drought hindered growth in many West Africa Economic and Monetary Union members<sup>29</sup>, and post-election civil unrest caused Côte d'Ivoire's GDP to drop by over 5%. Supportive macroeconomic policies were crucial in keeping growth going in several of the region's nations and even though local supply conditions have a substantial impact on food costs across the area, rising global food and fuel prices led to inflationary pressures in many nations. Throughout 2012, it has been anticipated that several impacted countries had seen sharp monetary tightening because of the large and prolonged increases in inflation that were mostly centered in eastern Africa.

Furthermore, if we move until 2022, in the recent report still from IMF, the recovery in Sub-Saharan Africa, and so Sahel, has been abruptly stopped. The activity

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<sup>28</sup> International Monetary Fund.

<sup>29</sup> Members of the West African Economic and Monetary Union (also known UEMOA) are Benin, Burkina Faso, Côte D'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo.

eventually recovered in 2021, which increased GDP growth in 2022 to 4.7%. However, 2021 growth fell significantly by more than 1% to 3.6% because of a global slowdown, tighter financial conditions globally, and a steep increase in global inflation that affects a region already weakened by a continuous stream of shocks.

The outlook for the foreseeable future is incredibly hazy. Concisely, the sociopolitical and security situations in many nations continue to be quite challenging, and the region's prospects are closely related to changes in the global economy. The situation for policymakers is the most difficult it has been in a while in this regard. They must put out fires and deal with social crises as they arise in the present, while simultaneously doing their utmost to lessen their vulnerability to shocks in the future (building resilience). But ultimately, the safety and prosperity of the area will depend on high-quality growth, so policies must also pave the path for a long-lasting recovery (moving away from the edge).

Three significant global changes are reshaping the future for sub-Saharan Africa: the decline in tightening in developed and developing markets worldwide economic conditions and unstable commodities prices. As an example, global growth predictions have been reduced in the months following April. Global growth for 2022 has been reduced by approximately 0.2% points, with China and advanced economies both experiencing a roughly 1% decline. The rapid rise in global inflation has accelerated the normalization of monetary policy in industrialized nations. Capital flows have remained unstable in this situation. Exchange rates were under pressure during the first half of the year due to outflows from sub-Saharan Africa that were comparable to those brought on by the COVID-19 crisis or the shock of the 2015 commodities prices.

Still from the 2022's report, it is possible to understand that commodity prices around the world have been extremely volatile. For instance, wheat virtually doubled when Russia invaded Ukraine but has now decreased to prewar levels. More generally, sub-Saharan Africa's terms of trade are still anticipated to rise in 2022 compared to last year, though some gains have been curtailed since April and significant heterogeneity still exists. However, the external pricing of commodities is currently becoming more unpredictable for both importers and exporters.

Speaking in terms of policymaking, the path ahead is difficult for many sub-Saharan African policymakers. The latest crisis has brought many of them even closer to the precipice due to expanding social needs, shifting imbalances, and increased hazards, with dwindling policy space and depleted buffers, decisions frequently involve striking a difficult balance between conflicting objectives, most notably:

- Putting out fires: the saving of life should come first and foremost. Throughout the COVID-19 crisis, the area maintained a focus on quick actions to save the lives and health of people who were most at risk. A comparable immediate response is needed now since a cost-of-living crisis is aggravating an already precarious food security scenario.
- Developing resiliency: authorities must do everything in their power to lessen vulnerability to upcoming shocks considering the uncertain and turbulent outlook. In the beginning, this might necessitate rebuilding buffers and protecting economies from greater tail risks. Additionally, countries might increase their resilience by making their policy frameworks stronger. Although the sub-Saharan African region's current imbalances may remind some of the 1990s, the area has advanced significantly since then, especially in terms of better budgetary structures, monetary credibility, and governance. These accomplishments have lessened some of the recent unrest, but they must be sustained and safeguarded.
- Leaving the edge behind. The need for upfront structural transformation is more important than ever because, in the long run, getting out of the current crisis will need high-quality development. A growing economy creates a larger tax base and more room for policymaking, making strong growth one of the most important remedies for eradicating imbalances. For an average African country, an additional 1% point of annual GDP growth over a ten-year period could reduce the debt ratio by almost 15 percentage points.

In the specific case of food security two-thirds of the world's population, or 123 million people, are predicted to live in Sub-Saharan Africa by the end of 2022; of these, one-third have experienced extreme food insecurity since the pandemic's start. And a significant part of these are children, whose future health and prospects can be

irreparably hampered by chronic hunger. The recent conflict in Ukraine and its aftermath, the deteriorating security situation in some areas of the region, the four-season drought in the Horn of Africa, and other climate shocks (in Angola and Madagascar) are the main causes of the rapid rise in food insecurity during the past two years. Some Sub-Saharan countries, and in particular the Sahel states are among the regions of particular concern. The world's worst food emergency in 2022, according to the World Food Programme, will be the drought in the Horn of Africa.

Food security is significantly influenced by global food prices in addition to local considerations (such as climatic changes or regional conflicts). Nearly 40% of Sub-Saharan Africa's consumption is made up of food, and several nations are net importers of important commodities (corn, rice, wheat). International prices for some of these goods have increased by double since the beginning of 2020, while fuel and fertilizer costs have increased by as much as threefold, increasing transportation expenses and reducing crop yields. Additionally, climate-related disasters are getting harsher, which will further jeopardize regional food security, and, for this reason, global pricing should ideally be permitted to affect domestic prices as a policy response, with the most vulnerable being protected by authorities through targeted cash transfers or an enlargement of the local social safety net. A large portion of sub-Saharan Africa, however, would find this strategy to be ineffective. Fewer countries still have the infrastructure or administrative capacity to expand their targeted support at the scale or pace required. Instead, many nations have resorted to readily accessible short-term support measures, addressing both the pressures on fuel and food prices in the context of a general compression on the standard of living. According to a recent survey of IMF country teams, most of the short-term actions taken this year were not targeted and were split equally between tackling increasing fuel prices and food security.

Only a few nations have implemented targeted in-kind or monetary transfers. Some of these actions may be required in the current circumstances, but they should gradually be phased away. Numerous initiatives, such as subsidies, are frequently pricy and poorly targeted, diverting public monies to those who consume the most rather than those who have the greatest needs, and doing so at the expense of other crucial goals like public investment. For instance, fuel subsidies are frequently quite

expensive, regressive, and eventually unsustainable—even though they currently seem less important than food aid programs. Like price ceilings, export limitations can also lead to major distortions, which have a negative impact on growth, reducing poverty, and food insecurity.

Depending on the difference between local and international pricing, the degree of fiscal leeway, and the accessibility of mitigating social support options, the transition away from emergency measures will differ from one country to the next. Prices for food subsidies may be gradually increased, and policymakers might think about focusing on products, like basic staples, that can better prevent leakage to higher-income people. Of course, it is important to say that in Sahel food insecurity is a result of climate change, global price shocks, national conditions, and political instability. Countries have turned to second-best short-term policy responses to the recent crisis, such tax cuts, and subsidies, which should be phased out gradually. With continued support from the international community, boosting climate-resilient agricultural production and productivity will be essential in the future to solve issues with food security while setting the groundwork for more readily available and reasonably priced food.

#### **4.2 EDUCATION AND GENDER: TWO IMPORTANT PILLARS IN THE SAHEL'S AGRIBUSINESS**

Before moving to the core part of the paragraph, it is important to give some important demographic data to better understand the situation in Sahel for better developing the conclusion after this chapter.

Young people are assuming leadership roles all throughout Africa and the Sahel to create goods and services that address the requirements of their neighborhood, including access to energy, health care, and food security. Of course, it is a region full of opportunities: geographically speaking the entire region is located below the Sahara Desert, stretching from the Atlantic Coast and the Red Sea and it concerns several countries, including Burkina Faso and Niger, the two thesis' main countries of dedicated analysis.

As it is possible to assume, development challenges in that specific region of Africa are numerous, but so are the opportunities: from some data collected by the

UNDP<sup>30</sup>, it can be defined that its population grows at about 3% per year and is expected to reach 340 million in 2050. Also, as it was mentioned at the top of the chapter, the region is one of the youngest in the World, with about 64% of its population under the age of 25.

It is also estimated that 1% increase in the working age population increases real GDP growth per capita by 0.5% (Drummond et al. 2014) and, in the following graphs, it has been given an idea on how these data explain the correlation between the labor force with basic – intermediate and advanced education, specifically for the cases of Niger and Burkina Faso in a 10-years’ time variation realized in the World Bank’s dataset:

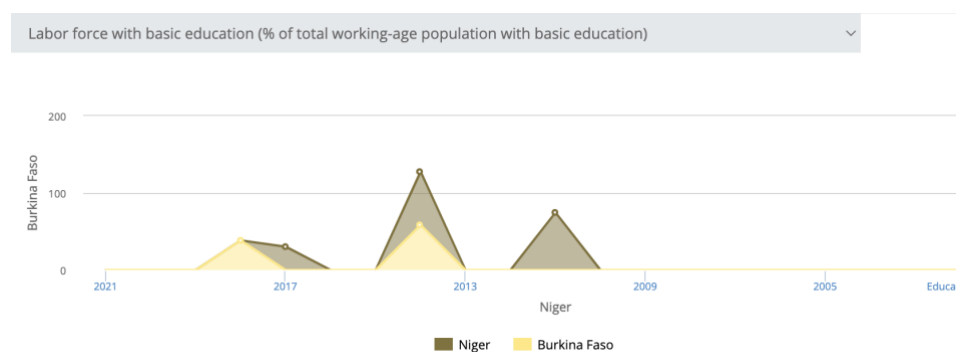


Figure 14: Infographic Source: World Bank's Data Catalog

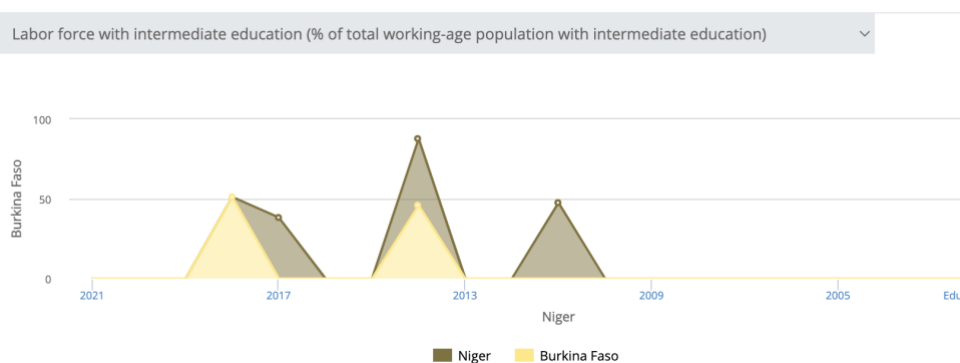


Figure 15: Infographic Source: World Bank's Data Catalog

<sup>30</sup> United Nations Development Program

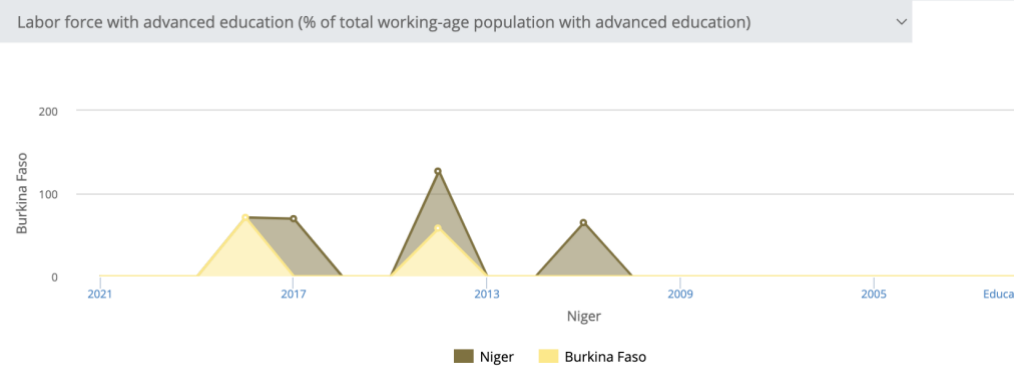


Figure 16: Infographic Source: World Bank's Data Catalog

In these three cases we can assume that the level of people engaged between Niger and Burkina Faso as labor force with certain level of education has been increased in the last 10 years. But, of course, still moving on the education side (that is strictly connected to the labor force as it was mentioned in the introduction from the Sahel Education White Paper of the World Bank), it is important to say, also, that according to classical economic theory and the principles of human development, education increases employability and income, reduces gender disparities, alleviates poverty for families, strengthens institutions, and has positive effects that are carried over to the next generation and, in this sense, Sahel, in general, has made significant initial moves toward creating this future.

Over the past 15 years, many more children have had access to education: elementary and secondary enrolment in the region has almost quadrupled and tripled, respectively. Additionally, governments have made several high-level promises and undertaken several projects to assist education: they have introduced several programs and made important pledges to assist that sector. Even nevertheless, many kids continue to skip school, and those who do go learn substantially less than they need to. 40% of the region's primary school-age youngsters are not enrolled in classes. Additionally, the region has an 88% learning poverty rate, which means that only 12% of kids are enrolled in school and can read and comprehend a passage that is suitable for their age at the end of primary school. Less people have access to higher education; enrolment in lower secondary schools is below 56% in the Sahel G5 and between 2 and 10% in pre-primary and tertiary. Due to all these influencing variables, the Sahel area has poor production and low educational attainment. For instance, in Niger, 72% of working-age individuals now lack any form of schooling.

These changes become more evident after the great droughts of the 1970s, that caused a critical famine crisis in the country. Today, of course, several things are better improving, but some others not yet. There are still significant differences of opinion over how to develop more lucrative but long-lasting livelihood systems in the area. Conflicts exist between those who think that local people can sustain rural lives on their own, those who think that several types of outside assistance are required, and others who are committed to a vision of the Sahel that is driven by regional urbanization. The future of this region under economic and cultural globalization is, at best, uncertain. There is unanimity across the publications in this collection that Sahelian ecosystems are diverse and that Sahelians value and take use of diversity and edibility. They also assert that the only way to quickly advance progress is to build on this historical variety with a newfound purpose (Batterbury et al. 2001, 1-8).

And in fact, if we can continue in taking use of diversity and taking advantage of it, an important pillar to focus is the one related to the importance of the gender issue.

In fact, as it has been mentioned in the Biannual report 2019-2020 from the OECD and the Sahel and West Africa Secretariat committed to the regional integration, growth, and stability of West Africa, it has been analyzed that Gender inequality is among the highest in the world in the Sahel and West African nations. For example, “Women of the Sahel: Desertification as a Way of Life”, a 1989 publication by the Secretariat, highlighted the various forms of discrimination women face as well as their capacity for resiliency and initiative in overcoming them.

Twenty years later, very little has really altered with the situation. There is a substantial body of research that shows how vulnerable women are to food insecurity and various forms of malnutrition, despite the lack of sufficient sex-disaggregated data or gender-specific studies of food and nutrition security on a worldwide scale. They take part in conflicts as both victims and occasionally perpetrators. But they also, and perhaps more importantly, serve as a catalyst for innovation, growth, and problem-solving. Two thirds of women with jobs are employed in the food system, which is what drives the West African food economy. They are also significant participants in international trade.

For writing this paragraph, three were the paper analyzed published still from the OECD:

- Gender analysis on food and nutrition security (Pepper 2019): To make the food and nutrition early warning systems gender-responsive, this article addresses the shortcomings that currently exist at both the national and regional levels. To establish the pre-requisites (such as sex-disaggregated data collection, targeting strategy, etc.) for the establishment of a more targeted and more equal approach, more coordinated efforts are needed to assess and track the gender dimensions.
- Women and conflicts (Walther 2020): Conflicts have been more violent during the past ten years, with an increase in the number of civilian casualties. Women suffer from these and they also are purposefully targeted by Islamist organizations and militias in conflict zones, and they also suffer at the hands of government forces during counter-insurgency operations, according to a paper on the developments in conflicts involving women during the past 20 years. For example, Nigeria accounts for 87% of all violent crimes against women in the area. They frequently suffer attacks and kidnappings in the north of the nation. The study demonstrates that women engage in violent behavior as well, particularly suicide attacks. Since the middle of the 2010s, this occurrence has significantly lessened, nevertheless. The research emphasizes the necessity to employ counterinsurgency tactics that prioritize defending populations, particularly women, and to make investments in weaker regions. The reintroduction of public institutions, governance, and the provision of essential services are necessary for the restoration of political stability.
- Women and climate change (McOmber 2020): For adaptation and resilience efforts related to climate change, gender inequalities in the Sahel region provide a profoundly severe problem. Better prepared people will be those who have the resources to respond to and plan for upcoming climate events. However, at the home, neighborhood, and state levels, these resources are rarely dispersed evenly. This essay examines the efforts being made by state and development organizations to address gender inequality

through climate resilience policy and suggests some tactics to increase chances for both gender equality and climate resilience.

And, continuing the path on the role of women in the Sahel, particularly in the agri-food sector, as it is mentioned in a paper written by Ms. Ugwu in 2019, female farmers are the foundation of the growth of rural and national economies since they are essential to food production and security. They make up most people working in the agricultural industry, employing 43% of all agricultural workers globally (and up to 70% in some nations). Small farmers in Africa, the majority of whom are rural women, produce 80% of the continent's agricultural output. Many agricultural workers are women, yet they do not have access to or control over all the land and productive resources.

Across the world, women prepare meals for their families and work on various stages and steps of the food production process, and they are also typically in charge of providing meals for their families in various cultures and nations. Women have a significant stake in protecting the environment and halting environmental deterioration because they are the ones who provide their families with the essential foods, fuel, and water and, following that path, crop cultivation (planting, weeding, applying fertilizers and pesticides, harvesting, and threshing the crops), food processing and marketing activities, and animal husbandry of small livestock are among the jobs undertaken by women in agriculture.

Food production is primarily done by women, with little assistance from men, in Africa in particular, where subsistence agriculture is common (Boserup, 1970) and, this opinion is backed by a later study by Pala (1996) on the Heluo village in Kenya, which discovered that women farmers perform a vast majority of the work compared to men. Like Ghana, where tiny farms run by women produce around 80% of the nation's food. However, in Tanzania 87% of women who live in rural regions perform similar tasks, and in Zambia women work up to 80% of the time on household crops. Furthermore, in Nigeria, women work in post-harvest activities at a rate of 16% and agroforestry at 15%, with about 73 percent of women engaged in cash crops, arable farming, and vegetable gardening.

In sub-Saharan Africa, the proportion of women working in agriculture has increased from around 45% in 1980 to about 50% today. Africa has varying percentages; the average for East Africa is about 50%, while the average for Southern Africa is about 40%. Except for North Africa, where female participation in agricultural activities increased from 30% to 45%, these figures have remained rather consistent across the African continent. However, it is significant to highlight that there are significant disparities between nations in each sub-region regarding both the trend and the share of female labor in agriculture (as it was explained in the SOFA<sup>31</sup> in 2011).

What is important to say, in this frame, is that women contribute significantly to the agricultural labor force and to agricultural activities, even though these contributions are frequently undervalued. Although it is challenging to accurately measure their efforts because to a lack of consistent data that tracks their agricultural activities, they make a very significant impact. However, some researchers have attempted to analyze contributions to agricultural outputs by gender in the past (by assuming that some crops are grown by women and others by men), but this approach has proven to be challenging because in most agricultural households, both men and women are jointly responsible for crop production.

#### **4.2.1 WOMEN ENGAGEMENT IN AGRICULTURAL PRODUCTION, INADEQUACIES IN RELATED POLICIES AND OTHER IMPORTANT FACTORS**

Like in other civilizations, socioeconomic circumstances, among other things, have an impact on how women in Sahel make decisions in the agricultural sector. Taking as an example a study on the role of rural women in farm management decision-making in the local government areas of Chikum and Igabi in Kaduna State in Nigeria (Damisa et al 2007, 241–245) concluded that although women farmers are heavily involved in agriculture in Nigeria, their level of participation in farm management decision-making is quite low due to factors like their age, education, land tenancy, and wealth status. Most of the women who were interviewed were found to

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<sup>31</sup> State of Food and Agriculture, FAO

be low-income and illiterate, thus, to increase women's access to fundamental farm inputs, including financing, and to increase their participation in agriculture and its different decision-making processes, their study advocated gender-specific policy initiatives.

In another study (Ognuella et al. 2009, 19-30), they make references to a few writers while highlighting the urgent need for an African agriculture strategy that takes a gendered perspective. This plea is made because, even though women constitute a crucial component of African agriculture, they have been largely overlooked by policymakers, who have done so at great expense to the continent's agricultural and gender parity. Because men tend to have greater levels of education than women and as a result are more likely to be picked for such posts at the government level, this might be one possible explanation for the low levels of female representation in policy formation.

In this sense, while rural women's low socioeconomic level limits their ability to participate extensively in agricultural production, other factors, such as their assigned duties as homemakers, caregivers, and child bearers, also contribute to this limitation. The fact that they carry out these domestic duties in addition to their farm labor suggests that these women work longer hours than their male colleagues. Additionally, Doss in 1999 pointed out that being pregnant inhibits their capacity to participate in farm chores. This further shows that women's pregnancy may result in a reduction in the amount of home farm labor that is available. Like this, rural women's contributions to agriculture are frequently overlooked and undervalued. Even though they manage the family and produce most of the food, women's decisions are always taken after males. As a result, they are less able to access loans and markets for cash crops than men are, as well as the advantages of AKST (Agricultural Knowledge, Science, and Technology). Women are underrepresented in scientific and technical research institutions, which may lead to technical innovations that do not consider women's unique perspective and farming needs. African women farmers are also unlikely to benefit from extension services and farm inputs. In addition, they can hardly afford agricultural technologies (Wakhungu 2010).

Despite the issues that Nigerian women face in the agricultural industry, they have demonstrated over the years that they have the skills and readiness to contribute

significantly if given the chance and opportunity. Therefore, eliminating the gender bias problem holding these women back is urgently needed; only once this is done can women begin to meaningfully contribute to policy making and governance (Ogunlela and Mukhtar, 2009). In contrast, Olawoye (2002) notes that the Nigerian government has made strides in recognizing the crucial role played by rural women in agricultural productivity, and as a result, there has been some focus on developing agricultural policies that take gender into account. This acknowledgment has led to the conduct of several in-depth investigations among various Nigerian tribes. Additionally, Ogunlela and Mukhtar (2009) say that the government's recent admission of the problem is a direct outcome of the growing urgency with which poverty must be addressed to boost the country's economy. Given that most of the nation's impoverished are women, government investment in initiatives to reduce poverty and recognition of these women's contributions to the agricultural sector are essential.

In this sense, we can assume that – also according to an important article (Theriault et. al 2010, 177-191) published in 2017 on how the gender affects sustainable intensification in cereal production, in particularly from the study case based on an investigation of grain production in Burkina Faso, gender disparities in adoption rates, probability, and drivers of strategy sets that improve yields, safeguard crops, and repair soils in the West African Sahel have been explored. Applying a multivariate regression analysis to a nationally representative household panel, they use the individual plot as the analytical unit and take additional variables and the traits of the plot manager into account finding that female managers of individual cereal fields are less likely than their male counterparts to adopt yield-enhancing and soil-restoring strategies, although no difference is apparent for yield-protecting strategies, reflecting the socio-cultural context of farming as well as the economic attributes of inputs. More generally, gender-disaggregated regressions show, in the paper, that gender differences exist in the determinants of adoption. Age, marital status, and access to financing or extension services are just a few of the plot manager traits that might affect an adoption choice. Additionally, the gender of the plot manager affects household resources differently in terms of the likelihood of choosing intensification strategy sets. The adoption of soil-restoring techniques by female plot managers is significantly influenced by variables that represent the availability of domestic labor.

In contrast, the adoption preferences of male plot managers are influenced by household resources such as the quantity of livestock held, the amount of non-farm income, and the area planted to cotton.

In conclusion, what is important to say and to reflect to is that correcting the gender imbalance in extension services and enhancing female plot managers' access to financing, income, and equipment might support sustainable agricultural intensification that, for example, with the use of the Business Model Canvas created on purpose to this category of stakeholder directly involved, a hypothetical good result could make the difference.

#### **4.3 APPLICATION TO THE USE OF SUSTAINABLE BUSINESS MODELS IN RURAL DEVELOPMENT AND RELATED LIMITS TO INNOVATION**

In the past ten years, research has been done to examine how innovation occurs in the agricultural industry and what factors might help to create inclusive agricultural enterprises and there is increasing indication that Africa is embracing the chance to transition to a green economy, which is anticipated to produce long-term economic development, jobs, and social benefits in addition to protecting its essential natural resources (UNEP<sup>32</sup> 2015). Due to efficiency improvements, green agricultural techniques also enable farmers to lower production costs and maybe prevent additional expenses that could result from climate change or unsustainable practices. An interesting example is the one of Burkina Faso: the National Investment Plan for Environment and Sustainable Development, with a target of US\$100 million, was authorized in 2013 with the purpose of promoting a green economy through greater investment for pro-poor environmental sustainability. Burkina Faso, in this sense, enacted its Green Economy Strategy that same year to promote growth in several areas and provide recommendations for the future. The nation is also creating an Environment Intervention Fund under the PEI (Poverty and Environment Initiative), with initial funding of US\$10 million. Still, the agriculture industry of Burkina Faso is extremely susceptible to the effects of

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<sup>32</sup> United Nations Environment Program

projected climate change. If no action is taken, changes in temperature and rainfall patterns might have an impact on up to 30% of agricultural productivity. On the other side, modeling research in the nation revealed that green economy investment might reduce some of the consequences of climate change by funding sustainable agricultural and climate resilient farming methods.

Of course, the reason behind the application of newest methods of doing business, derives from the conception that micro enterprises and farms are currently battling to develop an inventive response to a difficult culture and a globalizing market. Small firms, particularly those in rural regions, must strike a balance among a variety of factors, including specialized innovation solutions, targeted customer interaction methods, novel value creation approaches, and fresh business ideas that can transform current markets. In this sense, taking a cue from all the chapters written by now, where the path developed lead the theory research from the analysis of what are the NUS and their promotion, the implication in passing from the literature review on what the basic value chain is and its related specific implication in what is the sustainable food value chain, and what is the Business Model Canvas and how it is powerful and sustainable in better improving agri-food chains, the important thing to analyze and propose now is: how it is possible to implicate the use of the Business Model Canvas addressed to young women – that, as it has been assumed they are important in the agri-food sector and business in west Africa - in the Sahel region, taking into consideration the related obstacles that they could face in promoting, under suggestion some external actors, in using NUS for the economic development into small and rural villages and their related realities for contrasting food insecurity?

By the International Finance Corporation – the World Bank Group (Monnier and Maiga, 2022), with a third of the Sahel's GDP and 75% of its jobs coming from the agri-food sector, this industry is the region's main economic sector. The subregion has tremendous potential for horticulture items, oilseed crops, and nuts in addition to being a major producer of cotton, grains, and animals and farmers in the Sahel have put a lot of effort into their fields during the past ten years to fulfill the demands of the region's rapidly urbanizing and expanding local populations as well as an expanding worldwide market.

The value of the Sahel's food economy has more than quadrupled since 2010, and by 2030, the OECD Sahel and West Africa Club projects that this sector would account for approximately 90% of all new jobs in the subregion. However, a closer look reveals underlying issues such as low productivity, restricted farmer access to markets, and scant local processing or value addition. Small, family-run farms that lack access to inputs or training and have little ambition beyond providing for their families and making a meager living make up a large portion of the Sahel's agricultural industry. Together, the business sector, governments, and international development agencies are striving to dismantle obstacles that are impeding Sahelian agriculture while also assisting in the introduction of cutting-edge techniques to make the most of the region's fertile soil. For instance, the creation of agricultural Special Economic Zones is viewed as a chance to draw investment, spur industrialization, and generate employment in high-potential locations. These zones are now being proposed in Burkina Faso, Mali, or Chad and related projects have the potential to significantly alter the region's agriculture industry with the proper legal, regulatory, and institutional framework.

Access to credit might be increased by adopting cutting-edge financing technologies like warehouse receipt systems, which use safely kept commodities as loan collateral, but also proposing some toolkits as part of innovating the agri-food business sector, are necessary nowadays.

#### **4.3.1 DOING BUSINESS FOR WOMEN IN SAHEL**

As it has already developed and analyzed in this chapter, one of the most important target groups in the agricultural production sector are women. In sub-Saharan Africa, women generate up to 80% of the food, yet they also make up 50% of the undernourished people there. 60 percent of African women and girls work in agriculture on average and women tend to be proportionally more involved in informal employment than males, where they are paid less or receive no compensation for their job, even if they are active in many food value chain sectors.

In 2015 during the Sahel and West Africa Forum in Milan run by the Sahel and West Africa Club and the European Commission in the frame of the EXPO 2015, it

has been evidenced that women all around the world have been more conscious of the disparity that defines their lives in the private and public spheres since the early 20th century, particularly since the World Conference on Women in Mexico in 1975. They have organized and mobilized themselves to fight for the realization of their civil, political, economic, social, and cultural rights in their communities, nations, and the world at large. According to West African women, the secret to their economic emancipation is thriving female entrepreneurship, especially in the food and agricultural industry. The latter serves as the foundation for their increased empowerment and the creation of a society with more gender equality. Entrepreneurship among women fosters economic expansion and employment development. Given that women play a crucial role in ensuring that their families have access to food and nutrition and prioritize their children's education and health over other demands, it is also a key tool for resilience. During the EXPO 2015 in Milan for the *Semaine du Sahel & de l'Afrique de l'Ouest*, it has been underlined that, in Burkina Faso, there were more and more women entrepreneurs in all sectors of activity, industry, research, agricultural or cultural activities, trade, etc. and especially women entrepreneurs were particularly active in the rural sector and operate throughout the value chain of agricultural products (production, processing, marketing, Research & Development).

By Simone Zoundi<sup>33</sup>, the lecturer that presented the case of Burkina, the social and professional rooting of women entrepreneurs presented:

- For small businesses:
  - o The activities of women remain limited at the base and do not reach the level of the structured business;
- For medium-sized enterprises:
  - o Women often lack information on business opportunities to guide them in the choice of activities.

As can be seen, the duties of the female entrepreneur are numerous, intricate, and diverse given her position and function as a woman. To deal with this, female company

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<sup>33</sup> Simone Zoundi is Director of the Food Products Operating Company (Sodepal) and President of the National Federation of Agri-Food and Processing Industries of Burkina (FIAB).

owners invest a lot of time and effort into their families and their companies. In this respect, the complete involvement of the female entrepreneur in the process of economic growth is irrefutable as a producer and a procreator. Women's entrepreneurship must be at the center of development initiatives due to the impact of economic power on social affirmation of the person. Women must, however, take the lead and be the architects of change for a seamless and long-lasting integration of women into all aspects of growth, including political, economic, social, and cultural ones.

To have an impact, policy coordination and coherence are crucial. Building the enabling infrastructure West African countries need to achieve food security, resilience, and sustainable development would need enormous and ongoing expenditures. To be successful, efforts must be long-term and broad-based and, priorities for women's empowerment include fostering the economic endeavors and entrepreneurship of individuals with significant but unrealized potential, such women, and young people, by recognizing and fostering their competitive advantages in various regional food value chain sectors. It is crucial to invest in education, training, and capacity building. To accommodate the varying living styles of the performers and to meet a range of demands, they ought to be available in flexible formats. In addition to being crucial for the girls and boys who will make up the workforce and residents of West Africa in the future, knowledge, information, and educational services are crucial for the women who are currently vying for positions in the economic and political system.

Effective and equal access to productive resources, in particular land, continues to be paramount. Policies have been progressively adopted in most West African countries to secure rights and entitlements, including of the least powerful groups. The challenge to achieve equality has now shifted to ensure thorough policy implementation (even in the most remote areas), assess policy outcomes and implications, and introduce corrective measures as required.

In this sense, considering all these information and reflections on the importance of women in agroeconomics in the Sahel Region and the important case of women entrepreneurs, it is possible to develop and think the idea that the Business Model Canvas could definitely help women in building structured works in agri-food sector

making them feeling part of something completely far from them because of all the constraints they face every day because of problems that they cannot afford.

### **4.3.2 LIMITS TO THE INNOVATION**

At the end of the day, after developing the idea of a Business Model Canvas suitable also for small realities, in small rural villages in Sahel's region with the promotion of NUS, it is important to underline that there are some limits to the innovation in sustainable business model's field. For example, one of the most important, is the limited access to financing, that is a significant problem for Sahelian agriculture. Many banks in the area lack the expertise necessary to evaluate the risks involved for developing new businesses, which deters them from wanting to offer loans. For instance, official data from Burkina Faso (The World Bank Group – International Finance Corporation 2019) shows that agricultural only receives less than 4% of bank loans, although making up 27% of the nation's GDP. In the meanwhile, entrepreneurs frequently struggle to expand their firms despite their commitment because they lack the collateral required to get a loan. But, in this sense, governments are taking steps to promote access to finance considering these obstacles, but additional changes are required, particularly to take advantage of possibilities provided by digital financial services and boost the presence of financial service providers in rural regions.

Infrastructure is another significant issue in the Sahel region, as four of the five nations are isolated. Food production and transportation in the Sahel are threatened by inadequate road systems and persistent access problems to energy, which raise prices and lower competitiveness. For instance, development partners collaborate with governments to enhance the business climate, expand grid access, and power generation, upgrade the transportation system, and promote digital infrastructure and commerce and it is important to underline that the Sahel is in grave danger from climate change, with temperatures rising 1.5 times faster than the world average and an alarming cycle of severe droughts and catastrophic floods.

At the end of the day, as a result, there are already negative effects on migration, conflict, and food security and, additionally, there are serious dangers to the

effectiveness and resilience of the food systems, which highlights the need for better management of the region's natural resources that could come using easy and ready-to-use tools that can help the economic development where it is already hard, for the country, to emerge in the global agri-business scenario.

## FINAL REMARKS

For supporting this thesis, the precious conclusion that it has been necessary to reach, following the questions developed in the introduction, is if it is possible to define and apply innovative methods as a new paradigm for the preservation and utilization of agricultural biodiversity of neglected and underused plant species that might result from altering consumption habits with the aim of increasing quality of life.

Starting from the point that it is necessary to support the world's population and guarantee that no one will ever again be hungry by utilizing cutting-edge technologies and equitable distribution strategies, this will be possible by applying useful and simple tools helping regional knowledge emerging even the lowest level of HDI: in this sense, the use of sustainable food value chain framework and the application of business model canvas can be extremely useful for small realities (in this specific case, starting from small villages) where it is hard to transmit knowledge even the low education level that affects the population and so, declining the purpose, of the thesis, that was, at first, to demonstrate that it could be possible to create business and reducing levels of food insecurity.

Arriving at the very end of this research, and after several topics discussed and an in-depth analysis, other questions emerged, following the ones presented in the introduction and still strictly related to the use and the promotion of NUS, but others came up in the writing process of this thesis taking the stage on the other hand, and giving us the possibility to develop the topic in other different ways.

“How to reduce food insecurity by promoting the use of selected NUS in the Sahel region, by restoring agri-food value chains through innovative and sustainable business models?”, this was the question from it has been developed the research work here presented and not only answers, but mainly questions born after.

Starting from the analysis of what SustLives is, the project took as example for the use of NUS that aims to foster the transition towards sustainable and climate-resilient agricultural and food systems in Burkina Faso and Niger through the enhancement of the heritage of local crops and their income-generating value chain in the Sahel region, helped in reflecting several interesting topics, such as:

1. The role and the use of NUS in the agri-food business as an important element that could help reducing levels of food insecurity through an important literature review analyzing effectively how important they are,
2. The analysis of what are concretely the Sustainable Food Value Chains and how much they are different from the basic Value Chains we know: the difference between, also, the Sustainable Food Value Chains and the ones specifically theorized in the promotion on the use of NUS,
3. The importance of sustainable business models for improving the agri-food sector in the Sahel region and, specifically, the application of the Business Model Canvas as a ready-to-use and useful visual tool for stakeholders, adapted to a chosen target (differently from the Triple Layered Business Model Canvas that, even if it is sustainable and suitable for agri-food business, it is not so adaptable to any circumstances that the stakeholder could face in his business life),
4. And last, an important socio-economic and political analysis through the PESTEL and the stakeholder ones for understanding West Africa, and better Sahel, and reflecting on the fact that NUS are important in the agri-food sector, but what about people?

Starting from the agro-economics analysis, one of the most important critics to be done is the one related to the documents found and the related research made by Bioversity International: in one of the most “complete” reports published (Padulosi et al. 2013, p. 37 – 50), the first thought that emerged is that, by the classical economic theory on the classification of goods, how are considered NUS? In this sense, continuing the research, no one asked that, and no answers emerged, except from some examples where:

“NUS are proven to be strategic allies in fighting food and nutrition insecurity, including hidden hunger in Burkina Faso, highly nutritious fruits, such as *Diospyros mespiliformis* (jackalberry), *Balanites aegyptica* (desert date or soap berry tree) and *Ziziphus mauritania* (jujube), are eaten regularly.”

Going further, there are no references on the dietary bases of Burkinabé, as an example, that – if it has taken into consideration how it is extended Burkina Faso and

how it is different the landscape (or simply, how it is different the quality of life from the capital Ouagadougou compared to the others), it is evident that it is not possible to have a specific answer to that and how are displaced supply and demand curves.

By the way, still in the same chapter, it has been underlined (El Bilali 2020, 7) that, despite the benefits of orphan crops in addressing a variety of issues, including climate change, livelihood vulnerability and poverty, food and nutrition insecurity, and biodiversity loss and ecosystem degradation, the capacity to promote and exploit these crops in both countries<sup>34</sup> is currently limited by research and knowledge gaps. In this sense, El Bilali become aware of the fact that there are several constraints to consider when we speak and imagine that NUS are an important and sustainable instrument that could help in reducing the levels of food insecurity, but it is still uncertain if they should be considered virtuous in certain regions, both economically and dietary speaking.

Then, moving to in the second chapter, it is interesting the analysis and the proposal that FAO does with its Sustainable Food Value Chain Framework. In fact, starting from the assumption that the sustainable food value chain paradigm starts from the point that food insecurity is a symptom of poverty, it is possible to define the condition for whom is crucial to understand that families that consistently have access to sufficient funding are the ones who create the actual demand that drives the supply of food and, a more competitive food system, will reduce consumer food product costs or increase their advantages on the supply side. Of course, what is important in this case, is the value added that salaries, earnings, taxes, food supply and the net influence create together, and the related value addition discussed is essential for establishing three key chain reactions connected to social, economic, and environmental sustainability, all of which have an influence on hunger, poverty, and food security. Of course, also this framework has its constraints, as the need to understand the underlying problems, key leverage points, and best practices for a certain value chain in a particular country, on the other hand, then, how to forge effective partnerships across the public, corporate, and civil society spheres that would ultimately put money

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<sup>34</sup> Burkina Faso and Niger, the ones taken as targeted countries from the SustLives project.

in the pockets of the rural poor and food on their tables: two important topics that are developed in the last chapter and that will be explained later.

An important reflection, then, has been made on the application of the Sustainable Food Value Chain related to the NUS: a value chain development strategy for NUS is theoretically the same as for a commodity because the same value chain development processes and tools may be used for both. NUS value chains do, however, have a few peculiar characteristics. The Ansoff matrix, which was initially developed to aid people in better understanding market or value chain development plans and to distinguish between them based on whether they are aimed at current or new markets and goods, respectively, provides the most concise explanation of how a value chain development approach for NUS differs from that for commodity crops. In this sense, again, the same constraint as the first chapter appears: considering only fewer of the indicators necessary for developing a market based on the NUS in the Sahel region, is not as useful as it seems.

The third chapter, then, is probably the crucial component of the work: after analyzed the importance of the NUS, and the feasibility to insert them in the Sustainable Food Value Chain scenario (that, even the constraints, it has been assumed that the practicability is possible (Padulosi et al. 2014), it has been tried to answer the question on how it is possible to contribute to the improvement and the realization of this SFVC in Sahel region promoting the use of NUS?

When we are referring to sustainability, of course, it is not intended only the environment: in fact, with the adoption in 2011 in Gothenburg (Sweden) of the European Union Strategy for Sustainable Development, a long-term plan for the coordination of policies for sustainable economic, social, and environmental development, concrete measures are provided that affect all dimensions of development. Economic sustainability concerns the ability of an economic system to produce income and work in a lasting way; environmental sustainability concerns the protection of the ecosystem and the renewal of natural resources; social sustainability is the ability to ensure that the conditions of human well-being are equally distributed. In this sense, it is defined also the importance of the social sustainability and, taking a cue from the composition of the HDI where, its composition is made by three indicators, such as the one related to knowledge and education, and referring to the

fact that only 12% of pupils can read and understand an age-appropriate paragraph by the end of elementary school. In each Sahel nation, fewer than 50% of adult females are literate, compared to 59% in Sub-Saharan Africa (World Bank n.d. 2021), the idea developed was the possibility to give everyone the access to the capability of doing business through a visual tool, and so, the Business Model Canvas.

What is important to say is that the mapping of an existing business model plan differs from a novel and creative business model. The top business model concepts need to be chosen from a large pool of prospective ideas using an innovative methodology and, the process in question is ideation, and creating effective new business models necessitates understanding ideation techniques. In the past, most industries were governed by a single, prevailing business model. These changes are significant and now there are many more alternatives accessible now for developing new model businesses.

In this sense, differently from the sustainable version of the BMC – the Triple Layered Business Model Canvas that is much more structured and, for certain aspects, limited and it is almost impossible to be adaptable to different contexts, the basic version of the Business Model Canvas is a good idea to use since it is mostly visual, and there is no need to have such higher levels of education to use that, and easily adaptable for everyone, starting from the assumption that stakeholders are protagonists and they can create – guided from the BMC itself and its default scheme – the business model more convenient to the environment they live every day.

Finally, in the fourth and last chapter, a different analysis has been done: how is it possible to try to do sustainable business in Sahel? At first, the most natural answer to give is – as it is in reality – by the help of external actors and governments, through specific program of cooperation, of course. But then, other thoughts came over.

The Sahel has come to be associated with instability and unease during the last 10 years. The combination of three key sources of instability that still dominate the Sahelian landscape from 2015 has led to the background of political unrest, armed conflicts, and deteriorating security that exists in the region where, of course, there are several hotspots of social, political, ethnic, and religious conflict that have grown in recent years without showing any genuine signs of resolution. It has been noticed that Burkina Faso, Chad, Mali, Mauritania, and Niger are the G5 Sahel countries, although

they have enormous development and security challenges. Problems in the area include numerous conflicts, bad governance, inadequate service delivery, low levels of human development, and quick population growth so, it is vital to understand that the current instability in the Sahel is a product of the interaction between bad governance and low development, even if the security situation is typically the focus of attention and conversation when addressing the region—and appropriately so. Climate change also threatens the region's food security and farmer-herder interactions with high rates of poverty and ecological reversals. Each of the three requires attention because both have affected the area for a long time.

But since demographic data can help a lot in developing new business methods for economic growth, UNDP tells us that population, in Sahel, is classified as increasing by roughly 3% annually and is projected to reach 340 million in 2050. The area is also among the youngest in the world, with around 64% of its inhabitants under the age of 25, and women employ 43% of all agricultural workers globally (and up to 70% in some countries), making up the majority of the sector's workforce. 80% of Africa's agricultural production is produced by small farmers, the majority of whom are rural women.

Facing the reality, sadly, rural women's poor socioeconomic status prevents them from being actively involved in agricultural production, but other factors, such their assigned roles as housewives, careers, and child bearers, also play a role in this restriction. These women likely put in more hours than their male counterparts since they also perform these home tasks on top of their agriculture job. Also, when we refer to small enterprises' women activities are constrained at the base and fall short of reaching the level of organized business; and for medium sized, women frequently lack knowledge about business options that would help them decide what to do.

At the end of the day, after looking at the questions in the introduction and the ones in final remarks, one thing is clear: before moving in the sense that it is – of course – possible to change habits and improving quality of life through specific programs and important founts, let before us ask ourselves what are the basic necessities for people that are in parts of the world where their level of HDI is lower than ours, let us understand what are the primary needs of these people that face political instability, an unclear govern feasibility, why it is impossible to get loans for

starting a business in the agri-food sector when it is demonstrate that is one of the prosperous sectors that guarantee economic growth.

In addition to the serious threats to the effectiveness and resilience of the food systems, there are already negative effects on migration, conflict, and food security. This emphasizes the need for better management of the region's natural resources, which could come from using simple, ready-to-use tools that can aid in economic development where it is already difficult for the country to emerge in the global agribusiness scenario.

In certain countries people do not ask themselves what sustainability is. They ask themselves if it is sustainable a life like this.

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