A SUSTAINABLE FUTURE IN AGRICULTURE:

AN INVESTIGATION INTO SUPPORT SYSTEMS FOR NATURAL AND ORGANIC FARMERS IN MOROCCO

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A Sustainable Future in Agriculture:

An Investigation into Support Systems
for Natural & Organic Farmers
in Morocco

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Abstract

With the assistance of Ribat Al Fath this project identified the relationships that natural and organic farmers form within the Moroccan agricultural sector and how these relationships influence the farmers' abilities to combat agricultural challenges. The team conducted interviews with farmers, and governmental and non-governmental organizations and analyzed the commonly mentioned themes in these interviews. The team used these themes to determine shortcomings in the support system for natural and organic farmers in Morocco and possible solutions to the farmers' challenges. Based on the results, the team developed a set of recommendations to improve this support system and created a prototype booklet that compiles useful networking data to distribute to farmers throughout Morocco.

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Executive Summary

In the face of rising populations and increased food scarcity, agricultural sustainability continues to rise in importance for countries worldwide. Morocco, is one such country, whose arid climate puts high stress on the success of the agricultural sector. From its mountains to its desert, and from its raining season characterized by floods and mudslides to its dry seasons where the soil erodes and crops struggle to survive, Morocco must continue to adapt within the agricultural sector. Fifteen percent of the Morocco's gross domestic product comes from the country's agricultural sector (International Trade Administration, 2017). This vital piece of Morocco's economy is in constant threat due to the increasing effects of climate change. It is important now, more than ever, for the country to focus on sustainable practices to protect the future of the agricultural sector.

The sponsor for this project, Ribat Al Fath, is a non-profit, non-governmental organization that strives to improve the lives of the Moroccan people through supporting different social and environmental initiatives. Ribat Al Fath strongly supports sustainable environmental practices by voicing concerns on environmental issues and contributing to governmental policies pertaining to the environment. Throughout the course of this project, the team and Ribat Al Fath worked together to establish the projects' main focal points within Morocco's agricultural sector.

Within Morocco's agricultural sector, this project studies natural and organic farming. Natural farming is a practice that forgoes the use of harmful chemicals and pesticides. Organic and natural farming are similar; however, natural farming often focuses on permaculture[1]. Done successfully, natural and organic farming methods can protect Morocco's biodiversity and promote sustainable practices for the long term success of the agricultural sector. Figure 0-1 is an example of these methods in action.

Figure 0-1: Natural Permaculture Plot

[1] Permaculture: A farming method that aims to mimic a natural ecosystem by allowing different plants and animals to live in unison with each other.

In addition, this project delves into the socio-economic divide within the agricultural sector to understand farmer's existing challenges and social dynamics. Small-scale natural and organic farmers make a long-term investment in their land. It takes more time for small-scale natural and organic farmers to make a reasonable profit than it does for conventional farmers because non-conventional methods require more care and patience to execute well. Due partly to this time commitment, small-scale farmers often fall into the 19% of rural residence living in poverty (Canli, 2016). Literature suggests the perpetuation of this poverty is from small-scale farmers' lack of new technologies, susceptibility to drought, and vulnerability to other environmental factors (Baccar, et al., 2016). On the other side of the agricultural sector are the large-scale farmers who grow massive fields of monoculture[2] produce. Their main goal is to export their products to other countries such as Spain, France and Italy for high profits (The Observatory for Economic Complexity, 2016). Large-scale farmers can purchase modern technologies that small-scale farmers cannot afford, allowing them to maintain and improve their farms' production capacity.

Keeping the socio-economic divide within the agricultural sector in mind, the goal of the project was to understand the relationships that natural and organic farmers form within the Moroccan agricultural sector and how these relationships influence the farmers' ability to combat agricultural challenges. In order to reach this goal, the team aimed to meet the following objectives:

1. To understand the challenges that natural and organic farmers face.
2. To examine existing Moroccan agricultural organizations and the resources that they provide to natural and organic farmers.

[2] Monoculture is the technique of growing large plots of one crop, and most large-scale farmers choose one crop that is profitable for exportation to grow in this style (Flah, 2013)

Figure 0-2 below outlines the methods that the team used in order to meet the project objectives and ultimately, the project goal:

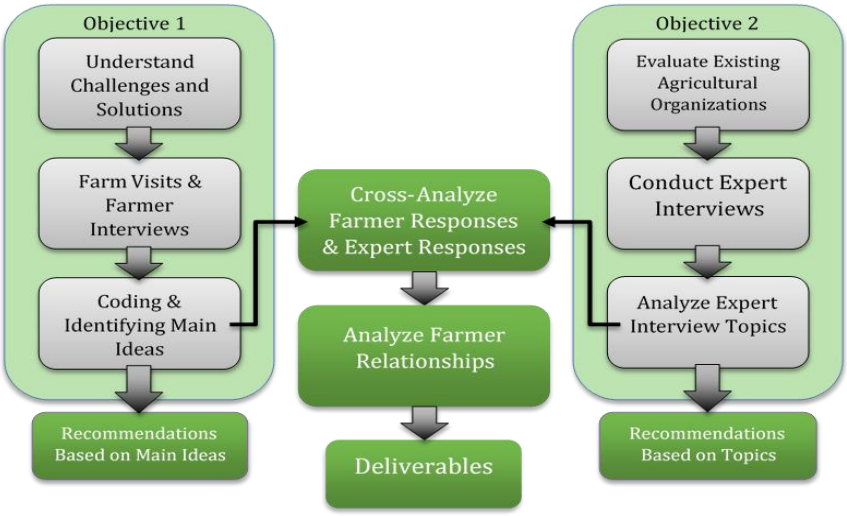

Figure 0-2: Methodology Synopsis

The left side of Figure 0-2 details the steps the team followed to meet objective 1. The team began to appreciate the challenges faced by Moroccan farmers through farmer interviews. To conduct farmer interviews, the team visited eleven farms located sixty kilometers outside Rabat and one farm outside the radius in Azemmour. At each farm visit, team members received a tour of the farm and after, enjoyed tea and conversation, and listened intently to learn and appreciate each farmer's story. Figure 0-3 depicts one of the team's visits.

Figure 0-3: Students Visiting Farming Community

Interviews focused on farming techniques, farming challenges, marketing and available resources. These interviews facilitated the formulation of specific recommendations to aid small-scale farmers in combating their challenges and improving their farms. As this project only interviewed eleven farmers, our findings may not be fully representative of the total set of small-scale farmers in the greater Rabat-Region and throughout Morocco.

Once the team collected all of the data from farmer interviews, team members organized the main ideas of the interview into themes. Figure 0-4 depicts the number of times farmers mentioned farming themes and the specific information that interviewees discussed within each theme.

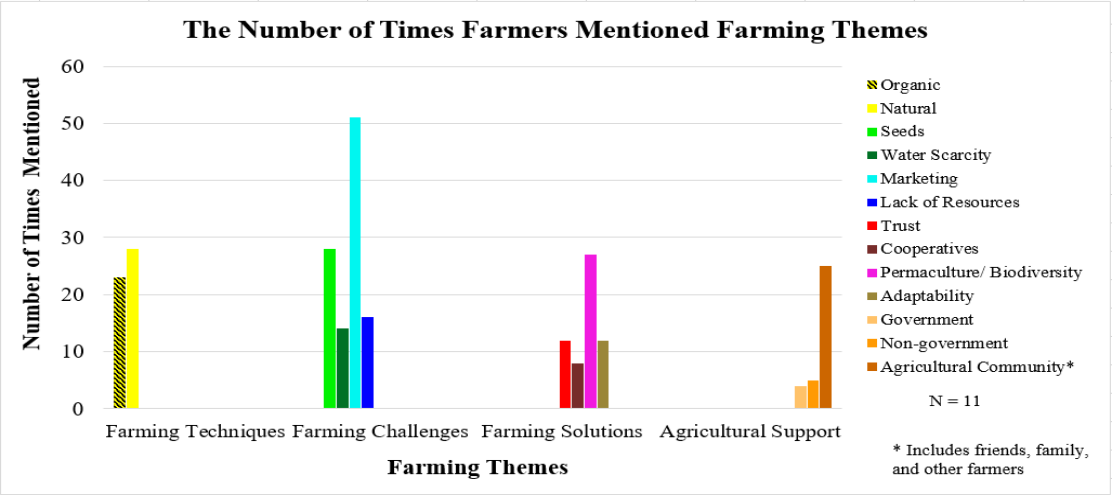

Figure 0-4: The Number of Times Farmers Mentioned Farming Themes

Each bar on the graph corresponds to a subject that farmers frequently discussed in their interviews. The subjects that farmers articulated in their interviews shaped our final recommendations. A notable observation from this analysis is that out of eleven farm interviews, there were just four instances where a farmer mentioned governmental support, five instances where a farmer mentioned non-governmental support and twenty-five instances were a farmer mentioned support from their agricultural community. Despite there being numerous non-governmental organizations and entire government ministries dedicated to the agricultural sector, farmers' recognition of support from them was minimal and not always positive. This observation placed even more importance on the team's expert interviews designed to address objective 2.

To meet this objective, our investigation took the steps detailed on the right side of Figure 0-2. The team interviewed experts from governmental and non-governmental organizations to evaluate the organizations' roles in the agricultural sector. The interviews concentrated on small-scale organic and natural farmers.

Experts from governmental organizations included employees of the Ministry of Territory Planning, Water, and Environment, and the Inter-Professional Federation of the

Moroccan Association of Bio. Experts from non-governmental organizations included members of Crossroads of Agro-ecological Initiatives and Practices, and the head of the Management of Irrigation of Water Resources and Payment of Ecosystem Services project established by the Moroccan Regional Science Association**.** Team members analyzed each expert interview independently to draw conclusions and then used them to formulate additional recommendations.

To fully grasp the relationships and interactions between farmers and organizations, the team cross-referenced interview answers from objective one and objective two. The project members then conducted final relationship analyses of farmers to governmental organizations, non-governmental organizations and the farming community.

This study yielded five recommendations to improve the plight of small-scale farmers and the overall agricultural sector in Morocco. First, the team recommends that Morocco creates its own organic seed distributor, so farmers have access to cheap, readily available organic seeds. Second, the development of an organic labeling system to promote natural and organic farming in a more affordable manner. Third, further promotion of cooperatives throughout Morocco. Fourth, the development of agricultural resources in Arabic. Fifth, training classes that specifically focus on organic farming practices.

Due to the importance of the agricultural community to each farmer, the team developed the following deliverable (see Figure 0-5). This deliverable contains each farmer's story, practices, and difficulties in the form of a booklet which organizations can distribute to farmers. This booklet will provide farmers with new connections and access to resources that could directly impact their farming practices. This page represents one of the potential formats that NGOs in the Rabat region can utilize as a medium to connect farmers together and expand their agricultural communities throughout Morocco.

Figure 0-5: Prototype of the Deliverable

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1 Introduction

The global agricultural industry is continuously thriving as crops are a staple necessity to many people's daily lives around the world. With rising populations and increasing food scarcity in many areas of the world, agricultural sustainability increases in importance for countries worldwide. As a country with rich native spices, essential oils, and a wide variety of crops, Morocco's agriculture is vital to providing for both its local inhabitants and international consumers. However, Morocco's agriculture is continuously threatened by rural poverty, water scarcity, and climate change. Morocco's agricultural sector must become more sustainable in order to adapt to the uncertainty of the future's growing population, drought conditions, and global warming effects.

Morocco relies on its agricultural sector for 15% of the country's gross domestic product (GDP), (International Trade Administration, 2017). The agricultural sector consists of both large-scale commercial farms and local small-scale farms, each accounting for approximately 50% of the total agricultural GDP. Large-scale commercial farmers contribute to the GDP by exporting large portions of their crops, such as citrus fruits, tomatoes, beans and pumpkin, and by practicing monoculture[3]. Not only does this mindset of farming perpetuate the problem of food scarcity by sending a large volume of crops out of the country, but it also harms Morocco's biodiversity[4] by limiting the variety of plants grown in Morocco. Small-scale farmers contribute to the GDP by growing produce using various methods and selling it on a local scale for a much lower profit. This lower profit is attributed to the difficulties small-scale farmers experience in finding successful and profitable paths to market and sell their produce. Morocco must import more agricultural produce than it exports because its native agriculture does not provide ample food to feed the total population, much less warrant feeding other countries through mass exportation.

Throughout Morocco, farmers and organizations are concerned about the decreasing level of biodiversity within their local regions. Many of them strongly support

[3] Monoculture: The technique of growing large plots of one crop, and most large-scale farmers use this farming style by choosing to only grow one type of profitable crop per growing season (Flah, 2013).
[4] Biodiversity: "Biological diversity in an environment as indicated by numbers of different species of plants and animals" (Biodiversity, n.d.).

farming through the use of permaculture techniques to increase the variations of crops that they grow. Permaculture farming is a method of designing a farm to mimic a natural ecosystem by allowing different plants and animals to live in unison with each other. This helps to make the land self-sufficient, resilient to environmental changes, sustainable, and biologically diverse.

While permaculture techniques are widely successful throughout wide-ranging climates in Morocco, small-scale farms are not always able to prioritize the health of the land over being able provide for themselves and for their families. Many of these small-scale farmers are living in poverty and work hard just to have any amount of produce left to sell after feeding themselves. It is hard for farmers, both small and large, to see the benefit of long-term investment in the land through natural farming practices while simultaneously struggling to support themselves. This leads many farmers to focus on immediate monetary gain rather than on the sustainability of their farming practices. This disconnect between the farming mentalities perpetuates a large socio-economic divide in the agricultural sector throughout Morocco.

In Morocco, there are multiple governmental and non-governmental organizations (NGOs) that assist farmers in making their practices more sustainable and modern through financial and social initiatives. Each of these organizations has a different level and type of involvement in the agricultural sector. Governmental organizations primarily focus their resources on aiding large-scale farmers, due to these farms' high profit margin. Due to this governmental focus on large-scale farms, the government offers minimal resources and services to small-scale farmers. Although many governmental agencies exist within Morocco to provide farmers with information and training sessions that address their agricultural challenges, this training does not emphasize natural and organic techniques. This lack of emphasis stems from the fact that organic farming is a relatively new concept within the Morocco, but it leaves many farmers without the resources that they need to overcome their challenges (Bilali, 2013). Non-governmental organizations have tried to fill this information gap for small-scale natural and organic farmers and spread knowledge of natural and sustainable farming practices to farmers in their respective regions.

NGOs also connect small-scale farmers to one another and assist them in learning new innovative techniques in a personal face-to-face manner. This inter-farmer network is

a vital community for the continuation of natural farming and serves multiple purposes. Since Morocco still does not have a source within the nation where farmers can legally purchase organic seeds[5], many farmers who wish to use non-genetically modified organism (GMO) seeds with a known source must obtain these seeds from foreign countries or by relying on their network to share and trade healthy and resilient seeds. This link between small-scale farmers also serves as an opportunity to share information regarding marketing and the pricing of produce. In some cases, with the help of NGOs, these relationships can develop into cooperatives. Cooperatives are organized groups of individual workers that collaborate with one another in order to increase the profits of their work. Within a cooperative, each farmer contributes to a supply chain[6] of produce where they are fairly compensated for their work. Both governmental and non-governmental organizations view cooperatives as a favorable method to fight rural poverty within the country.

This project originally aimed to assist small-scale Moroccan farmers in increasing the profits of their crops with the potential to do so through organic certifications. However, after learning more about the role of governmental organizations within this industry, the lack of Moroccan organic certifications, and the desires of these small-scale farmers, this project shifted dramatically. The goal of this project is to understand the relationships that natural and organic farmers form within the Moroccan agricultural sector and how these relationships influence the farmers' ability to combat agricultural challenges.

Our sponsor, Ribat Al Fath, is a Moroccan non-governmental organization (NGO) that works to enhance the overall quality of life for Moroccan farmers. They believe that the application of sustainable farming practices within the agricultural industry may reduce the future impact of global warming and environmental shifts in Morocco. With Ribat Al Faths' collaboration, this project team interviewed small-scale natural and organic farmers as well as experts from various governmental and non-governmental organizations. This report sheds light on the challenges that natural and organic farmers face, their communal

[5] Organic Seeds: "Organic seeds are seeds that have come from plants grown strictly without the use of synthetic fertilizers and pesticides" (MaximumYield, 2018).
[6] Supply Chain: "A supply chain is the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user" (Rouse, 2013).

relationships and how both governmental and non-governmental organizations can aid in dealing with agricultural challenges.

Through this project, the team presented five recommendations to Ribat Al Fath for the improvement of the agricultural sector in Morocco. These recommendations target updates to organic laws and methods to communicate information on natural and organic farming techniques. If the agricultural sector implements these recommendations, the collaboration between farmers and organizations has the potential to improve.

2 Background

This chapter provides information to facilitate understanding the current constraints of the agricultural sector in Morocco. The team details the external factors influencing this project, as well as the potential implications for working within the political and economic climate of the Kingdom of Morocco.

2.1 Agency Profile

Ribat Al Fath is a non-profit, non-government organization located in Rabat, Morocco ("Ribat Al Fath," 2014). Since its creation in 1986, Ribat Al Fath has a mission to improve the living conditions and quality of life for the population, and to increase the sustainability of natural resources in Morocco (Ribat Al Fath for Sustainable Development, n.d.). Adhering to this mission, the organization uses its finances to fund medical and dental campaigns across Rabat. These campaigns occur twice per year, with a focus on children and citizens in need of financial support. Ribat Al Fath also donates wheelchairs, prostheses, and medical equipment to Moroccans that live in isolated areas, like the Atlas Mountains, where medical treatment is less available. In addition to medical services, Ribat Al Fath offers free legal advice, distributes informational books and magazines, helps authors publish books while providing training courses for various trades including computer science, culinary arts, and crafts (Ribat Al Fath for Sustainable Development, n.d.). Through these services, Ribat Al Fath strives to improve the lives of Moroccans.

One of the main focuses of the organization is sustainability, both in Morocco and worldwide. Ribat Al Fath strongly supports sustainable environmental practices by voicing concerns on environmental issues and contributing to governmental policies pertaining to the environment. The organization participated in the twenty-second United Nations Climate Change Conference (COP22) Summit in Marrakech and held eight preCOP meetings (see Figure 2-1) to discuss conference themes (Ribat Al Fath for Sustainable Development, n.d.). Ribat Al Fath works to lessen the impacts of climate change, manage water, protect biodiversity, and reduce chemical use in Morocco.

Figure 2-1 Ribat Al Fath Hosted PreCOP (Ribat Al Fath, 2016)

The team worked with Ribat Al Fath to gather information directly from farmers to help these causes. The project focused on identifying the main challenges farmers face, what practices farmers use across the county, and what information and services would be beneficial for them to receive.

2.2 Responsible Organizations

Organic farming is a relatively new concept within the country of Morocco. Public knowledge of farm-to-table produce and sensitization towards pollution and chemical impacts has increased in recent years. A number of organizations, both government and non-government, have been working towards increasing this knowledge. These organizations work to provide information to farmers and consumers of natural produce, while they financially support environmentally friendly initiatives. Overall, these organizations are spearheading a new mindset within Morocco; to be conscious of healthy and sustainable practices.

2.2.1 Governmental Organizations

Since agriculture is vital to Morocco's economy, the government aims to target the industry with a plan for improved sustainability and success. The Green Morocco Plan is a government strategy that works hand-in-hand with Ribat Al Fath's initiative to make Morocco a more sustainable country. The plan's main goal is to increase food security in Morocco and reduce the harmful effects of climate change, while also bettering the economic and political power of Morocco. The Green Morocco Plan contains two main pillars that directly benefit agriculture or farmers. The first pillar pertains to how ministry officials want to invest in agriculture to increase productivity and value. The second pillar focuses on "investment in social initiatives to combat rural poverty" (Badraoui and Dahan, 2011, p. 61). This pillar is intertwined with the agricultural sector because the majority of rural farmers are living in poverty. These pillars manifest themselves in initiatives to improve irrigation, provide advice and resource centers, redesign and overhaul ministry structures, and label agriculture.

The Moroccan government has since identified improvements in this plan that are necessary for the remainder of its implementation. From 2018 to 2020, government officials and policy makers will pursue a stronger innovation system in the agriculture industry and provide better financial services for these systems. The Moroccan government promotes this improvement with the goal of strengthening professional associations and organizations related to agricultural extension services. A second major improvement proposed in the Green Morocco Plan is to encourage farmers to move towards being a "Climate-Smart Agriculture Sector" (Canila, 2016). This is an attempt by the Moroccan government to create a more resilient infrastructure as a hedge against the current climate change effects occurring in Morocco.

Although the Green Morocco Plan brings more focus towards solving issues within water management and agricultural practices, there are already ministries within the government responsible for solving these issues. Two of these ministries are the Ministère de l'Equipement, du Transport, de la logistique et de l'Eau—in English, the Ministry of Territory Planning, Water and Environment (Ministry of Water)—and the Ministère de l'Agriculture, de la Pêche Maritime, du Développement Rural et des Eaux et Forêts—in English, the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests

(Ministry of Agriculture). The Ministry of Water is responsible for water use and management within Morocco. This organization collects data on rainfall, water usage, and water quality and uses this data, along with input from citizens and other offices, to create plans to ameliorate issues caused by lack of infrastructure and to support water management. This ministry is also responsible for remedying issues caused by natural disasters, such as floods and droughts. They created a large water distribution system run by the L'Office Régional de Mise en Valeur Agricole du Haouz—in English, the Regional Office of Agricultural Development of Haouz—that delivers water from the multiple dams, located throughout Morocco, through a series of canals and towards cities and farms in rural areas (see Figure 2-2). This series of canals supplies water to Marrakech, a city in southern Morocco, where inhabitants' water demands are met through water purification and irrigation systems utilize any additional water. The government offers the owners of these farms subsidies that provide 90-100% of the instillation fees for drip irrigation in order to decrease the farmers' water consumption. Due to a drought in 2016, the canal and dam water levels are severely low. Since drinking water in cities is a priority over water for agriculture, the Ministry of Water is not currently providing water to the farmers through their large-scale irrigation system, however this is a temporary situation. Farmers that benefit from the Ministry of Water's management system include both large-scale conventional farmers that export most of their produce and small-scale farmers that may not be able to provide as many resources for themselves.

Figure 2-2: Canal Supplying Water From Dams to Cities

The Ministry of Agriculture is the second government organization that works to create a more sustainable future for the agricultural industry in Morocco. This ministry is responsible for data collection and problem solving in multiple environments within the country, including forests, fisheries, and rural areas. This organization preserves the natural resources that are local and native to Morocco through the creation of public policy and projects. The Ministry of Agriculture manages a system of organizations, agricultural advice centers (AACs), located throughout Morocco that aim to offer resources and advice to rural farmers. AACs were previously named agricultural extension centers, but they changed their names to properly describe how they function. The AACs offer assistance and information on conventional farming methods to farmers, but they have sparse information on organic farming techniques.

Inspired by the initiatives of the Green Morocco Plan, in 2016, the Ministry of Agriculture created the organization FIMABIO, the Moroccan Interprofessional Federation of the Organic Sector to provide support for Moroccan organic farming. This organization is a formation of smaller associations that focus on different aspects of the agricultural industry as they pertain to organic farming. These associations focus on topics such as the community surrounding organic producers, the valorization, or work to increase the value of, organic produce, and the distribution and exportation of organic products. As a whole this organization is a strong supporter of cooperatives to improve the success of organic agriculture. This organization is still in development, but is already working with farmers throughout Morocco. This organization is one of the first explicit support systems for organic farmers that created by the government. Its creation is significant not only because of the benefits it can provide for the organic community, but because this type of work has only been done by non-governmental organizations in the past. In general, there has been significant progress by the government to prioritize sustainability and environmentally friendly legislation in recent years.

2.2.2 Non-Governmental Organizations

Morocco is a country in transition and has been working towards a more sustainable future. The Moroccan government is developing numerous programs and projects to promote improved water conservation and agricultural practices. Many non-

governmental organizations (NGOs) are supplementing these governmental programs with their own projects. In addition to our sponsor, Ribat Al Fath, that works to enrich the lives of the people of Morocco, there are other organizations that focus on societal developments. Two relevant NGOs are the Réseau des Initatives Agroécologiques au Maroc (RIAM)—in English, the Agricultural Resources and Initiatives of Morocco—and the Carrefour des Initiatives et des Pratiques Agro-écologiques (CIPA)—in English, the Crossroads of Agro-ecological Initiatives and Practices. RIAM works with many small-scale farmers surrounding Rabat to connect them with one another and share ideas and techniques on natural farming. The workers at RIAM have strong personal connections with these farmers and have a good understanding of organic farming legislation in Morocco and how it fits into the reality of farming for small-scale farmers. CIPA also provides support, with a focus on permaculture techniques to organic and natural farmers. CIPA has an organically certified farm located in El Kelaa Des Sraghna that uses permaculture techniques (see Figure 2-3). The center frequently hosts groups at their farm, such as students, NGOs, and different farmers. They conduct various agricultural workshops for the farmers in their community as well as farmers from all over Morocco. CIPA is a private organization that requires compensation for its services in order to continue developing its training programs and connecting the farming community.

Figure 2-3: CIPA Farm for Training Classes

There are a large number of private NGOs that share similar goals as RIAM and CIPA. These groups often collaborate with each other and the Moroccan government. One example of a partnership is the GIREPSE Project, created in 2015 and directed by Abdellatif Khattabi, a professor at the Ecole Nationale Forestière d'Ingénieurs (National Forestry School of Engineers) in partnership with multiple NGOs, governmental organizations, and research and engineering institutions. This project analyzed the Tensift Basin, an area affected by forest deterioration, erosion, and vulnerability to flooding. The goal of this project was to gain an in-depth understanding of climate changes' impact on the land and to provide suggestions for a strategy of integrated water resources management while simultaneously strengthening vulnerable ecosystems (Tafraouti, 2016). It concluded in February, 2018, after analyzing the area of the Tensift Basin, and created suggestions for soil erosion and water management techniques to help Morocco adapt to climate change.

2.3 Economic Stability for Moroccan Agriculture

The agricultural sector in Morocco accounts for about 15% of nation's Gross Domestic Product (GDP). Throughout the last decade, there has been an apparent correlation between the GDP of the agricultural GDP and the growth of Morocco's GDP ("Morocco GDP from agriculture", 2017). Although environmental factors often cause fluctuations to the agricultural GDP, there has been a steady increase in Morocco's GDP, about 7.7% between 2008 and 2014, with projections for continued growth through 2018, as seen in Figure 2-4 below.

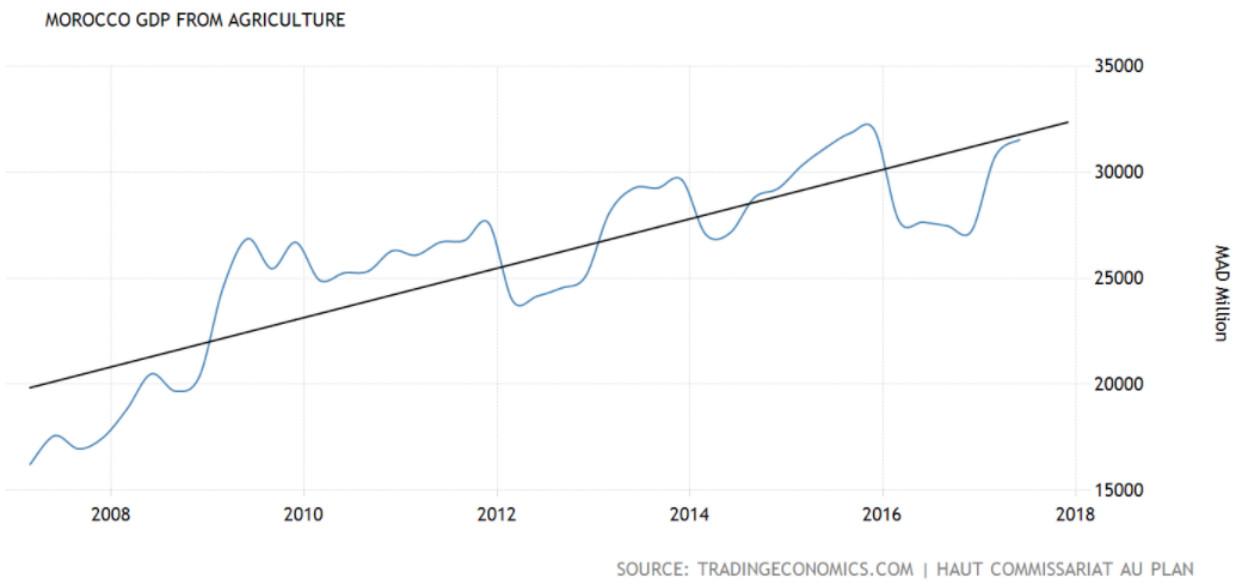

Figure 2-4: Morocco's GDP from Agriculture from 2008 through Predictions for 2018 with a TrendLine ("Morocco GDP from Agriculture", 2017)

Part of the reason for this increase is the implementation of reforms and an increase in government investment in the sector (International Monetary Fund, 2015). Specifically, the growth occurred after the implementation of the Green Morocco Plan in 2008, which supported an increase in investment by 1.7 times the amount previously invested into the sector (Canli, 2016). Plans and policies like the Green Morocco Plan have the potential to have lasting and vital effects on the agricultural sector if policy makers can continue to provide accurate information. Morocco cannot sustain its economic growth by policy and funding alone. It is imperative that both farmers and educators take farming practices into consideration in combination with awareness towards the increased negative impact on agriculture due to climate change. This puts more pressure on Moroccan citizens, governmental and non-governmental organizations to ensure they are continually implementing best practices in environmental sustainability. Sections 2.5 and 2.6 provide further information on these practices and detail changes in water management and farming techniques in Morocco.

Although the agricultural sector in Morocco is seeing a monetary increase in profits and contribution to the country's GDP, rural poverty, urbanization and overall population growth present the sector with increasing challenges. The population growth rate for Morocco is at an estimated 1.27% with a total population of 36.19 million inhabitants as

of 2018 (Morocco Population, 2018). As a result of the population increase, Morocco must continue to produce more agricultural products or face a greater dependence on agricultural imports. In 2016, Morocco's imports and exports differed by 1 billion dollars, meaning the more products the country imports, the greater cost to sustain the country (International Trade Administration, 2017). Despite Morocco's necessity to import agricultural products, large-scale farms export 75% of their crops (Canli, 2016). With large-scale farmers exporting the majority of their products, the Moroccan agriculture sector must find a method to aid small-farmers, who make up 70% of agriculture landholdings, in producing and transporting their goods (Department of Communication, 2013). The sector must determine how to supply produce to city markets, as the country faces an urbanization rate of 2.1% (Morocco Population, 2018).

2.4 The Market for Moroccan Agricultural Products

Produce in Morocco is sold in a variety of ways and places, each catering to a different demographic. Large-scale farmers sell the produce that they do not export in Moroccan supermarkets. These supermarkets, which often sell imported goods, are for the more affluent of Moroccan citizens who may frequently purchase produce (Agriculture and Agri-Food Canada, 2017). Depending on the location, personal ability, and the quantity of their harvest, small-scale farmers have several different options for the sale of their produce. Throughout Morocco, many major cities and large towns have souks, which are markets where merchants sell a variety of products (see Figure 2-5). Each souk has a section that sells agricultural products daily by registered vendors. Low-income citizens are able to shop at souks because the prices of products in souks are lower and more affordable than the prices of products at supermarkets. The small-scale farmers who sell their produce in souks often cannot get into the cities to sell directly. As a result, these farmers must rely on middlemen[7] who buy the farmers' produce and resell it at a higher price to make a significant profit. This method of sale also applies to rural markets where farmers are unable to leave their farms unattended to sell the products directly. Middlemen

[7] Middlemen: "an intermediary or agent between two parties; *especially*: a dealer, agent, or company intermediate between the producer of goods and the retailer or consumer" (Middlemen, n.d.).

can put small-scale farmers at a large disadvantage, making it harder for them to earn a substantial profit from their produce. Since most of these farmers do not have the means to travel to the markets themselves, some are unaware of their crops profitability. Those who are able to attend have to pay taxes and fees in order to legally sell their produce.

Figure 2-5:Moroccan Marketplace

Around 19% of Morocco's rural population dependent on agriculture is facing poverty (World Bank, 2016). The profits that small-scale farmers make from their harvests become the difference between providing for their families and becoming more impoverished. However, the increasing effects of climate change make the quality and quantity of the crops unpredictable, making farms' profits subject to extreme variability. Small-scale farmers should take action to maximize their profits and have better access to markets.

One method to assist small-scale farmers increase their profitability and gain access to more information is through cooperatives[8]. Agricultural cooperatives can help farmers "build social cohesion and overcome problems such as depressed markets and stagnant production" in Morocco (Yossef, 2014). Small-scale farmers can organize into cooperatives that allow them to sell their produce together for more competitive prices. Cooperatives also promote collaboration between the farms to improve farming techniques, share farming equipment, and allow for external organizations to assist multiple farmers at once**.** Organizations that work to create cooperatives possess the knowledge necessary to form sustainable cooperatives. Having these external organizations assist in creating the cooperatives makes them more likely to be successful. The organizations also have the means to connect cooperatives to other groups, creating a larger and stronger support system.

2.5 Farming Practices

Extensive amounts of farmland, great mountain ranges, vast expanses of desert, and a long coastline characterize Morocco as a country. Farmers have learned how to adapt to the varying climates that Morocco encompasses in order to be agriculturally successful. Depending on whether the producer wishes to export internationally, to create a sustainable environment, or to increase the biodiversity within their farm, they will use different farming methods.

2.5.1 The Integration of Permaculture

Permaculture is a farming technique that farmers are slowly integrating in countries concerned with creating a symbiotic relationship between plants, animals, and humans. A symbiotic relationship is a relationship where all living organisms benefit from living together. The method of permaculture integrates natural ecosystems into a man-made cultivated area of land in order to promote self-sufficiency and symbiosis. Since the creation of permaculture in the 1970s, over one million people use permaculture techniques

[8] Cooperative: "an enterprise or organization owned by and operated for the benefit of those using its services" (Cooperative, n.d.)

(Nierenberg, n.d.). As an effective system in conserving energy, water, and resources, permaculture eliminates the wastefulness of byproducts. It aims to increase the biodiversity in a region by placing a variety of ecosystems in close proximity to one another. In this way, farmers can construct pesticides and fertilizers naturally rather than needing to rely on harmful chemicals. By having the ecosystems work together in harmony, it lessens the workload on the farmer. Figure 2-6 below depicts an example of natural farming in action.

Figure 2-6: Natural Farming in Action

Permaculture is ideal for small-scale farmers, as it is economically feasible and conserves water (Akter, 2015). These farmers synthesize an environment where fruit trees benefit from the pest-control properties that aromatic plants release, chickens roam around freely grazing and fertilizing the land, bees naturally pollinate flowers, and water-purifying plants allow household water to be re-used. Farmers will also compost food waste (see Figure 2-7) from their homes to later apply to their crops for extra nourishment. This allows farmers to maintain plots of land without employing a multitude of workers or machinery. Tending to the land every day is not a necessity with permaculture; farmers are able let the land naturally run its course with minimal human intervention (Akter, 2015). Permaculture allows small-scale farmers to create a sustainable living environment on their farm. Filters purify water and then the farmers use the water for irrigation, solar panels convert sunlight into energy, and clay and hay provide building materials for insulated structures. These farmers must conform to their surroundings. For example, if the farm resides on a vertical

slope, the farmer must adapt and figure out a natural technique to entrap water for each individual plant (FOSRIN, 2010). Permaculture in Morocco is more than just agricultural sustainability; its overarching goal is to figure out mechanisms where all living organisms can best benefit each other.

Figure 2-7: Natural Composting Practice

2.5.2 Organic vs Natural vs Conventional Farming

Organic farming is an agricultural method that dismisses the use of pesticides and fertilizers. The overarching goal of organic farming is to allow crops to grow naturally, without the use of any harmful chemicals. By definition, organic involves "the use of food produced with the use of feed or fertilizer of plant or animal origin without employment of chemically formulated fertilizers, growth stimulants, antibiotics, or pesticides" (Organic, n.d.). Typical agriculturally organic techniques include crop rotation, green manure, and compost. These techniques promote the usage of plant-to-plant therapy in solving all problems, whether it be a pest infestation, an attack of infectious diseases, or the inability to replenish the soil's nutrients. Organic techniques aim to use biologically grown or raised products instead of bringing in unknown and potentially harmful chemicals.

While many people eat organic for the health benefits, farmers use it to ensure the health of people, the land, and the future of their produce. While organic food has a global reputation as a healthy food option, third world countries see it as the cheapest, and sometimes only option. In more developed countries, organic produce has become a luxury

that only the middle and upper classes can experience. By adding status to this produce, consumer accessibility declines. It becomes a high-priced item that only the wealthy can afford and others wish to have access to (Cohen, 2012). The contrast of organic food in developed versus non-developed countries is drastic. Third world countries, such as Morocco, are able to appreciate organic for being wholly natural and not for being a crop that only the wealthy can afford.

Despite the slow spread of organic farming across the country, Morocco's agricultural sector is thriving. Organic farms are yet to grow as large as conventional and commercialized farms in Morocco. However, many large organic farms are aiming to grow in size and grandeur along with their organic certification and opportunity for exportation (International Society of Organic Agriculture Research, 2018).

While the health and environmental benefits of organic farming are advantageous, Morocco faces difficulties with its organic sector. Firstly, there is no Moroccan organic certification. Farmers who wish to certify their farm as organic must do so through another country's certification process. Some of the most commonly used countries are Italy, Germany, and Switzerland (see Figure 2-8). Secondly, organic certification is an expensive investment for small-scale farmers that struggle to make adequate profit. Since organic certification is such a costly option, this automatically limits many small-scale farmers from partaking in any aspect of the certification. This restricts illiterate people and those from rural communities in favor of wealthier, more privileged farmers. The main purpose of organic certification is to export produce internationally. While this improves the economy of Morocco, these farmers do not focus on the importance of food security within Morocco. Especially for large-scale farmers, their primary concern is producing crops that other countries demand, not ones to fill the locals' needs.

Figure 2-8:Italian Organic Certification Label (Woodford, 2018)

Many small-scale farmers in Morocco that cannot afford organic certification or choose not to certify their farms classify their farm as natural. Natural farming follows the same guidelines and techniques as organic farming; however, natural farmers do not receive organic certification. Natural farming adapts many of its techniques from permaculture in order to promote self-sufficiency and increase biodiversity. Small-scale farmers in Morocco commonly use natural farming techniques because owning a natural farm is a cheap alternative to possessing an organically certified farm. This type of farming is more accessible and appealing to a greater number of farmers since it does not require a pricey certification. These small-scale natural farmers primarily focus on providing for local consumption. The farmers sell their produce to their community at their farm, within markets, or through baskets[9]. Most of these farmers have a direct producer-to-consumer relationship, as local customers are their main source of revenue. While the selling of baskets to regular customers provides a source of stable income, these natural farmers experience difficulties with selling their produce for a fair value within markets. In order to make ends meet, these farmers must succumb to the bargaining demands from consumers, lowering the value of their crops.

[9] Basket: A program that allows people to pay a set price and receive weekly or monthly deliveries of a basket full of fresh, locally grown produce.

The different types of farms that represent Morocco's agricultural sector have varying importance to the country. Organic farms provide a source of international revenue, natural farms provide local residents with healthy and sustainable food, and conventional farms provide the economy with a large amount of outside profit. The combination of these farms promotes stability in the agricultural sector and improves food security in Morocco.

2.6 Water Management

Morocco is an arid country with strained water resources. As Morocco's demand for water increases, Moroccans are seeking out methods to improve their supply of fresh water through the implementation of water conservation techniques and the creation of new, fresh water sources. Farmers have achieved notable successes in decreasing water scarcity through the application of drip irrigation systems on farms, the construction of dams, and the implementation of water desalination units.

2.6.1 Water Scarcity

More than 97% of the water on Earth is seawater, making only 3% freshwater. Glaciers contain 80% of the world's freshwater, leaving only 0.5% percent of the world's water available for human consumption. This means that only about 0.5% of all the water on earth is ready for consumption, and due to the rising of global population and higher water requirements for industrial countries, the demand for fresh water is rapidly exceeding the supply (Kucera, 2014, p.4). The World Health Organization estimates that by the year 2025, the world-wide demand for fresh water will be 56% higher than the global supply (Kucera, 2014, p.7). Due to this, water scarcity will impact 2.8 billion people by 2025 (Kucera, 2014, p.6).

A region suffering from water scarcity lacks sufficient sources of fresh water to meet its current water demands. The water demands of areas can vary drastically: The United States of America uses 400 liters per person per day, while Africa only uses 20 liters per person per day (Kucera, 2014, p.7). This means that the inhabitants of the United States of America consume 20 times the amount of fresh water that the inhabitants of Africa

do each day. When analyzing the consumption of water by various countries, the World Health Organization determined that the freshwater consumption necessary to sustain human life is about 15-20 liters per person per day and that the necessary amount of water requirements per person per day to support basic infrastructure, such as hospitals and schools, is approximately 50 liters (Kucera, 2014, p.7). Africans are already consuming less than the minimal levels to support basic infrastructure, with their per capita water consumption in the range of minimal requirements to sustain life.

With Africa on the cusp of dropping below minimal like-sustaining water consumption requirements, water scarcity poses a high level of risk to the continent. The continent of Africa has a wide variety of weather conditions and ecosystems, causing some areas to be a higher risk than others. As illustrated in Figure 2-9, the northern and southern regions of Africa are very stressed regions when it comes to water availability. As a country located in northern Africa, Morocco is one of the numerous countries with very strained water availability. In order to lessen the impact of water scarcity, Morocco must reduce its fresh water consumption and increase sources of fresh water.

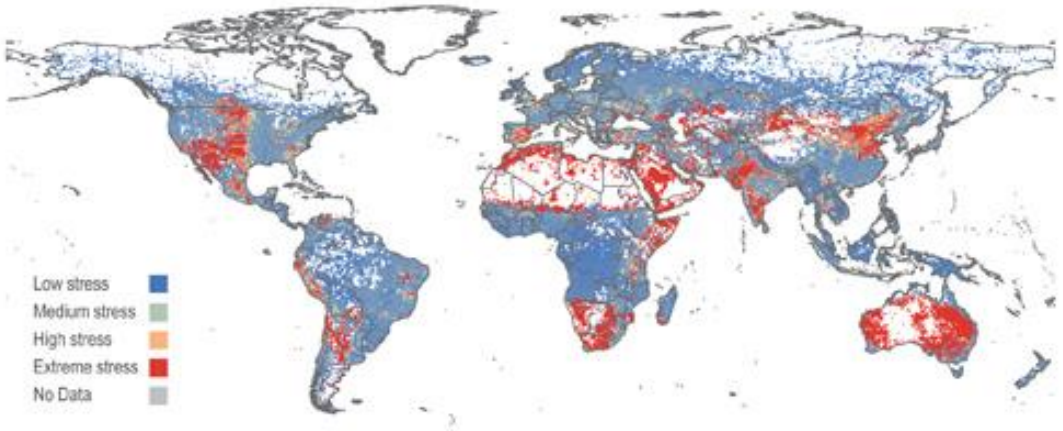

Figure 2-9: Water Availability Estimates for 2011 (Day, 2010)

2.6.2 Sustainable Irrigation

In Morocco, farmers use approximately 85% of all available water resources to irrigate land. Despite this immense water consumption, only about 15% of the country's lands receive the benefits of irrigation (The UN Department of Economic and Social Affairs, 2015). Fresh harvested crops, namely vegetables, require more water than dry

harvested crops such as grains. This causes water accessibility to dictate which crops farmers are able to cultivate on specific farms (Brouwer & Heibloem, n.d.). As surface water shortages become more common around Morocco, many farmers are turning to groundwater wells and drip irrigation systems (see Figure 2-10) which are "the most water saving method of irrigation for areas with limited water resources" to irrigate their farms (Bhuiyan et al., 2013). Drip irrigation systems apply water directly to the roots of plants, rather than spraying an entire field at one time. This process uses as little as one third as much water as traditional sprinkler-like irrigation systems, making it ideal for locations with water scarcity issues (Legrouri et al., 2012).

Figure 2-10: Drip Irrigation System

Farms with little-to-no access to water often practice low-risk agriculture, such as growing cereal crops and olives, as these crops do well even without access to water (Kuper et al., 2012). Farms with slightly more access to groundwater have a tendency to diversify their horticulture to include crops like onions, chili peppers, and carrots since their

irrigation systems are able to moisturize crops without significantly depleting water reserves (Kuper et al., 2012). In areas with easy access to groundwater, farmers typically cultivate citrus crops due to their high exportation value (Kuper et al., 2012). The economic returns of producing more water-intensive crops are so significant that the disparity between annual revenues is nearly twenty times higher for farms with access to groundwater compared to farms without access to groundwater (Kuper et al., 2012).

Access to water can drastically improve the revenue, diversity, and productivity of farms. One method for improving farm productivity in Morocco is to increase the number of drip irrigation systems, therefore reducing water usage. The World Bank Board of Executive Directors approves using drip irrigation and noted successes in 2015 (World Bank, 2015). This approval allows for a 150-million-dollar project to improve the irrigation infrastructure in Morocco by providing 9,300 farmers with access to drip irrigation systems that enable them to increase their diversification and annual revenues. Although irrigation systems, in any form, are currently only accessible to approximately 15% of the arable lands, this percentage is on the rise as farmers seek to reap the benefits of irrigation.

2.6.3 Dams

With increasing concerns for climate change and water scarcity, water conservation becomes increasingly important. The construction of dams has become a common method for conserving water and increasing the supply of fresh water. A dam is a barrier constructed on a river or lake that prevents water from flowing past it, allowing the liquid to amass and create a reservoir. People can then distribute water for these reservoirs into the appropriate areas to meet their needs (see Figure 2-11). The purpose of dams is to protect against floods, to increase drinking supply, to create hydropower and to serve as one of the primary sources for irrigation. With more than 45,000 large dams in existence around the world, dams are able to provide 30-40% of the global water requirements for irrigation while simultaneously producing 19% of the world's energy supply (Minoia & Brusarosco, 2006).

Figure 2-11:Water Management Plant Outside of Marrakech

Morocco is an arid country with regions that experience different amounts of rainfall and has a variety of climate zones. In Morocco, the vast majority of annual rainfall occurs during the winter months, while the rest of the year is arid. These weather patterns cause floods during winter and dry soil for the remainder of the year (Morocco floods of 2014, 2014). This puts lives, property, and agriculture at risk. The Moroccan government has turned to the implementation of dams as a mechanism to decrease the risks of floods during the winter months. These dams act as a reservoir, providing water to farmers allowing them to irrigate their farms during the dry months of the year (Morocco floods of 2014, 2014). In the region of Marrakech alone, these dams provide approximately 843 million cubic meters of water for irrigation each year that was previously unusable (Regional Office for Agricultural Development of Haouz). This increased water availability for irrigation allows farmers to increase their productivity and alleviates the strains of water scarcity on Morocco.

2.6.4 Water Desalination

With only 0.5% of the Earths' water available for human consumption, the demand for water is increasing past the current capacity for fresh water. In order to meet their demands, humans must seek previously untapped water sources. If humans could harness and clean the other 97% of water, they could easily meet their water requirements. One technique to clean water is desalination. Water desalination is the process of removing salt and other dissolved minerals from water. There are currently two main methods for water desalination; thermal desalination and membrane desalination.

The most common form of thermal desalination is multi-stage flash distillation. In multi-stage flash distillation, water containing salt and other minerals is heated to the point of evaporation, leaving behind the minerals. The vapor is then collected and condensed, yielding fresh water. Due to the requirements necessary to evaporate great quantities of water, this process can be quite energy and cost intensive. An alternative method of desalination that requires less energy to operate, is a form of membrane desalination known as reverse osmosis desalination. The process of reverse osmosis desalination occurs when water is pumped through a series of filtration membranes that allow small water particles to transfer through them, whilst preventing larger particles, such as salt and other minerals, from doing so. This process separates the minerals from the water, yielding fresh water (Heimbuch, 2010).

Morocco, like many other countries facing water scarcity, has turned to the creation of desalination plants to increase their supply of fresh water. Morocco's largest and most effective desalination plant, located in Laayoune, operates using reverse osmosis. In 2012, the plant was capable of producing 40,000 cubic meters of fresh water per day, the majority of which supplies Moroccans with drinking water (Azhar et al, 2012). Having noted the success of current desalination plants in Morocco, in 2017, the Moroccan government announced plans to create the world's largest salt water desalination plant near Agadir. This plant will cost 2.6 billion MAD and will turn previously unusable saltwater into an addition 275,000 cubic meters of clean water per day for irrigation and drinking (Lahsini, 2017). Through facilities such as this, the Moroccan government has found desalination practices to be a viable and significant means of improving the supply of fresh water to more easily accommodate its' growing demand.

2.7 Stakeholders and Beneficiaries

The stakeholders in this project are:

- Small-scale Moroccan farmers, with attention to organic and natural farms
- Moroccan Non-Governmental organizations operative in the agricultural sector
- Moroccan Governmental Officials
- Moroccan plants and animals.

This project focuses on small-scale Moroccan farmers who primarily reside outside of Rabat, Marrakech and Al Jadida. These farmers want to farm with sustainable practices to promote job security and food security. They also wish to use these practices to become financially stable while being able combat various agricultural challenges. The Moroccan farmers interviewed in this project are organic or natural farmers and they already prioritize sustainability while valuing the benefits of these practices.

Moroccan Non-Governmental Organizations (NGOs) value the wellbeing of Moroccan farmers. These organizations also value environmental sustainability and development and see small-scale farmers as a key aspect in preserving this value. In aiding Moroccan farmers, especially small-scale farmers, these NGOs help protect biodiversity and the overall wellbeing of the Moroccan population. Non-Governmental organizations provide connections to farmers and other forms of assistance to improve small-scale farmers' farms.

Moroccan governmental officials want to see economic growth and sustainability for Morocco. The government has the ability to create new laws and policies to protect the environment, improve infrastructure and provide resources to farmers in the sector. In helping the agricultural sector, one of the primary sources of the nation's economy, Morocco's overall GDP will continue to grow. Growth in the agricultural sector means growth in job creation and increases job security.

Plant and animals throughout Morocco also benefit greatly from positive changes throughout the agricultural sector. Farmers and organizations alike can influence the wellbeing of plants and animals and their effective resistance to climate change. In working to promote organic and natural farming, plants and animals will face less biological damage

from environmental contamination. Furthermore, crops could more naturally adapt to climate change, and specifically droughts, if more Moroccan farms are successful in organic and natural farming.

The following methods describe the techniques the project utilized to interact with its primary stakeholders and meet the project goal.

3 Methodology

The goal of this project is to understand the relationships that natural and organic farmers form within the Moroccan agricultural sector and how these relationships influence the farmers' abilities to combat agricultural challenges. The team identified the following objectives in order to reach this goal:

1. Understand the challenges that natural and organic farmers face as well as the solutions that they employ to overcome them.
2. Examine existing Moroccan agricultural organizations and the resources that they provide to natural and organic farmers.

Figure 3-1 shows the methodology flowchart for this project, which displays each objective and the steps that the team completed in order to reach these objectives. After analyzing both the 11 farmer interviews and the 4 expert interviews, the team was able to supply Ribat Al Fath with recommendations for changes within the agricultural sector that would assist farmers in overcoming their agricultural challenges and strengthening relationships to various Moroccan organizations. This analysis led to the development of a prototype deliverable which is further explored in the results chapter.

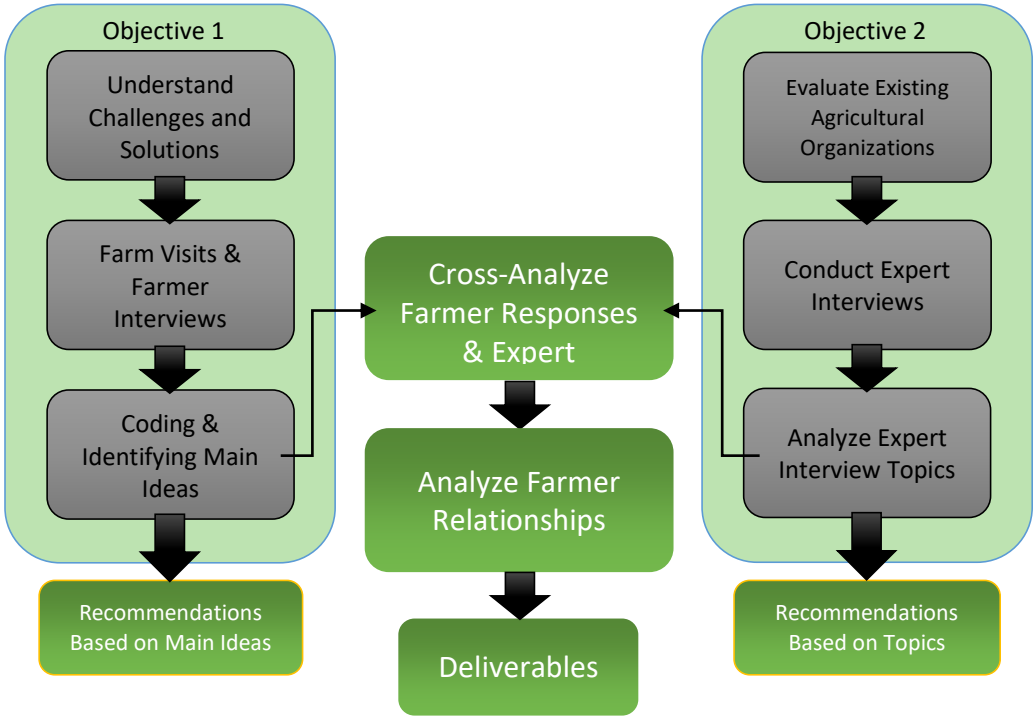

Figure 3-1: Methodology Synopsis

3.1 Understanding challenges that natural and organic farmers face as well as the solutions that they employ to overcome them

Ribat Al Fath and partnering organizations selected natural and organic farms for the team to visit and interview farmers. These farms are located in the rural areas within 60 kilometers of Rabat, with one farm being located outside of this radius in Azemmour. These visits helped the team gain an understanding of the key issues that natural and organic farmers in Morocco presently confront. The team focused the interview questions on the challenges that these farmers encounter, the practices they use to mitigate these challenges, and how the relationships they have formed with other farmers or organizations benefit their farms.

3.1.1 Interviews with the Farmers

The team conducted a mixture of semi-structured and unstructured interviews with farm owners or lead farm technicians with the aid of numerous translators (see Appendices E through O for translator names). Figure 3-2 displays the farms located outside of Rabat and in Azemmour and their approximate locations. The team conducted interviews at 10

farms located within 60 km of Rabat during the week of January 21st, 2018. The team visited the farm in Azemmour on February 6th and 7th, 2018.

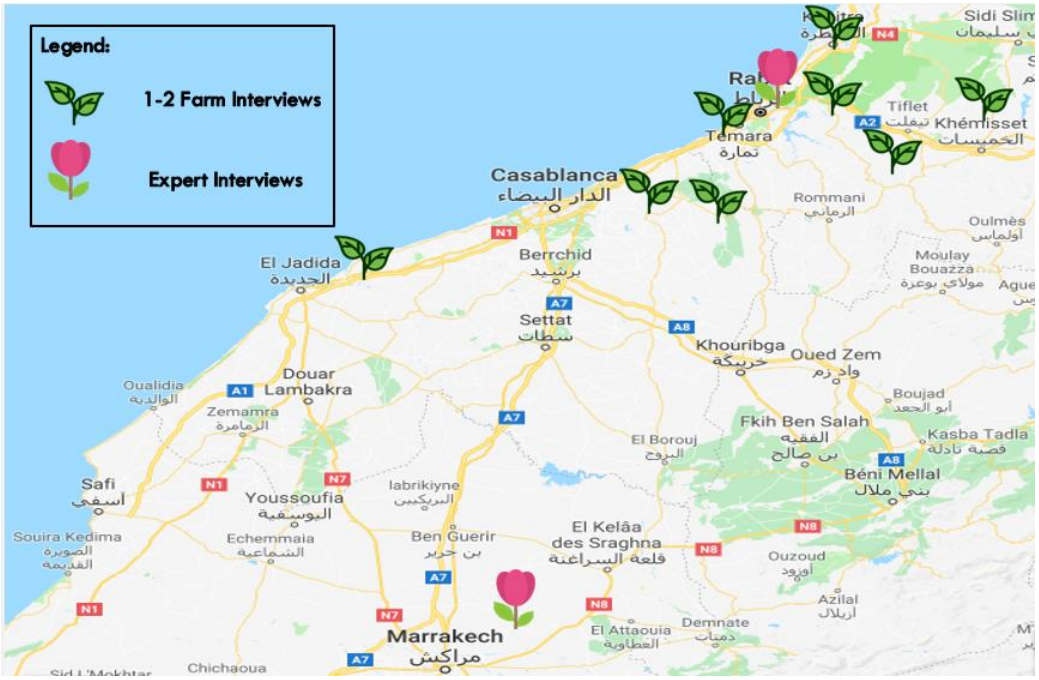

Figure 3-2: Locations of the Moroccan Farm Visits

The interview officially began when the farmer gave the team a tour of the farm. One student recorded audio of the interview on a smart-phone while another student conducted the interview. The remaining students took written notes (see Figure 3-3) on the interview answers and assisted the interviewer if necessary. Numerous translators (as listed in this project's acknowledgments as well as on each interview transcription) explained answers after each response when the interviewee answered in French, Arabic, Darija. Appendix A exemplifies how each interview began with an introductory statement to explain the reasoning behind the interview, and to ask permission to record the interview and use the interviewee's name in this report. The team also read a statement of confidentiality to provide the interviewee with the opportunity to remain anonymous and ensure their privacy in the final report.

Figure 3-3: Student Documenting Interview Responses

The interview questions, listed in Appendix A, were split up into four sections- farming methods, farming challenges, marketing, and resources and educational opportunities. The first two sections of interview questions (questions 1-13) address the agricultural practices farmers employ and the difficulties that they face in regards to man-made or environmental stress. The third section of the interview questions (questions 14-21) addresses the commercialization tactics that the farmers use to sell their produce. The last section of the interview questions (questions 22-29), addresses methods in which farmers prefer receiving advice, resources, and information related to their challenges. The goal of the interviews was to understand the various perspectives of farmers, their community relationships, and the current challenges that farmers encounter in regards to the environmental, economic, and political aspects of the agricultural sector in Morocco.

Initially, the team intended to use structured interviews; however, upon completing two interviews, team members realized that the interview style needed to change in order to accommodate opportunities to build personal relationships with farmers. Consequently, the team transitioned to using a mixture of semi-structured and unstructured interview styles. On most farm visits, after the tour portion of the interview, the team sat down with the interviewee and the translator over a full table of food and tea - the Moroccan way. Figure 3-4 displays an example of one of these feasts, which typically included food made fresh from the farm's produce, bread and tea. The interview then continued with asking the remainder of the unanswered questions from Appendix A. The unstructured interview style

allowed the farmer to share their personal stories and explain their relationships with other farmers and organizations while the semi-structured interview component addressed the questions which farmers did not answer during the tour of the farm and during the traditional Moroccan tea time conversations.

Figure 3-4: The Feast Students Were Given During a Farmer Interview

3.1.2 Coding Interviews with Farmers

In order to properly draw results from the farmer interviews, the team used coding to identify common ideas within the four overarching themes of farming techniques, challenges, solutions, and support. Two members of the team read through each interview transcript and using a key (see Figure 3-5), highlighted sentences and phrases that corresponded to each of these themes.

Codes

- Farming Techniques
  - **Organic *bolded**
  - Natural *not bolded
- Challenges
  - Seeds
  - Water scarcity
  - Marketing
  - Lack of resources
- Solutions
  - Trust
  - Cooperatives
  - Permaculture/Biodiversity
  - Adaptability
- Support
  - Government
  - NGO
  - Agricultural Community (Parents, farmers, friends, etc.)

Figure 3-5: Interview Coding Key

Farming techniques were split into two subthemes: organic farming techniques and natural farming techniques. The team wished to uncover whether or not organic and natural farmers focus on using their farming techniques as a marketing strategy or whether they used their farming techniques because of the environmental benefit. In addition, the research aimed to discover the stigmas or reputations that these types of farms have in Morocco.

Farming challenges were split into four subthemes: seeds, water scarcity, marketing, and lack of resources. The team chose these subthemes using the challenges that farmers mentioned the most frequently during the interviews.

Solutions to the aforementioned farming challenges were split up into four subthemes: trust, cooperatives, permaculture/biodiversity, and adaptability. Farmers mentioned building both trust with customers and the participation in cooperatives as successful mechanisms for improving their ability to sell produce. Farmers stated that adaptability is a solution to the extreme weather fluctuations, such as droughts and floods, which are characteristic to Morocco and are perpetuated by climate change. Throughout the interviews, the topic of adaptability arose within the context of being a coping mechanism for the difficulties farmers face. Farmers spoke about permaculture quite often and explained it as being not only a technique, but as a solution as well. The practices

involved in permaculture provide a solution to various hardships that farmers frequently endure and the team believed this facet of permaculture was the most important for this study to focus on.

Farming support included three subthemes: governmental support, NGO support, and support from the agricultural community. This agricultural community category included family, friends, other farmers, and any other form of support that did not come from an organization.

Throughout the coding process, if a certain comment applied to more than one subtheme, the group would write the comment twice in the interview coding section and then highlight each one with the appropriate subtheme color. Figure 3-6, below, shows an example of a case where one comment contained multiple subthemes and the team marked it in two separate colors to indicate how it relates to both subthemes.

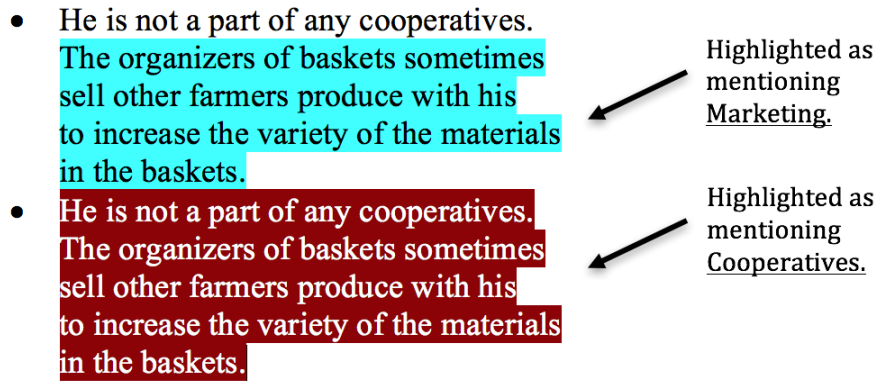

Figure 3-6: Example of Coding Within Farmer Interviews

After highlighting the interviews by subtheme (marketing, cooperatives, etc.), the team grouped together all the comments by their highlighted color. The bulleted comments in each of these groups counted as instances that interviewees mentioned the given subtheme. The total number of mentions for each subtheme assisted the team in developing quantitative results for each theme. The team used the quantitative results shown in Appendix S to determine which subthemes were the most to farmers.

The team then created one table for each subtheme (see Appendix R) to organize the information and anecdotes that the subtheme contained. Table 3-1 below depicts one

of the subtheme tables in Appendix R. The main ideas in these charts serve as the primary focuses of the results section of this report.

Lack of Resources Main Ideas	Example 1	Example 2
Lack of accessible information pertaining to farming in Morocco specifically.	Taha's biggest challenge is having lack of available information on natural farming and permaculture specifically applying to Morocco.	Rim highlighted the fact that there are very few books on permaculture and organic farming in Arabic.
Lack of trainings offered by organizations.	Madrani stated that there is a lack of support for organic farming in Morocco and he would like there to be an organization that could offer training courses to him.	Mohammed would like training on transforming their produce into other products as well in order to improve their cooperative and its business.
Lack of workers that respect organic practices.	When Taha's workers initially start working, they desire instant income, and they do not take the time to understand the value of long-term investment in his farm.	Farm Owner Tourya wishes that she had more workers that were educated specifically in organic and natural agricultural practices.

Table 3-1: Lack of Resources Main Ideas

3.2 Examination of existing Moroccan agricultural organizations and the resources that they provide to natural and organic farmers

This study investigated both governmental and non-governmental organizations that have different roles within the agricultural sector to deduce the impact that agricultural organizations have on natural and organic farmers. The team conducted these expert interviews in Rabat and Marrakech. Through the expert interviews, the team gathered specific information on how these organizations operate, the types of interactions that they have with farmers, and the organizations' views on the future of agriculture in Morocco.

3.2.1 Expert Interviews

With the assistance of Ribat Al Fath, the team interviewed experts from various Moroccan agricultural organizations including the Ministry of Territory Planning, Water, and Environment (Ministry of Water), the Inter-Professional Federation of the Moroccan Association of Bio (FIMABIO), Crossroads of Agro-ecological Initiatives and Practices

(CIPA), and Management of Irrigation of Water Resources and Payment of Ecosystem Services (GIREPSE). The team used semi-structured interviews to gather information concerning the types of resources and services that these organizations offer to natural and organic farmers as well as how the organizations interact with the natural and organic agricultural sectors. The expert interview questions in Appendices B, C and D address expert opinions on both the current and future states of the agricultural sector and its related constituents.

The team prepared a set of expert interview questions (see Appendix B) for the Ministry of Water to ascertain the scale and severity of the droughts in Morocco and the droughts impact on farmland. The team completed a semi-structured interview with Mahmoud Zemzami, a postdoctoral scholar working at the Ministry of Water on January 18th, 2018. One team member asked the interview questions to the interviewee while the remaining students took written notes. As part of the interview, Zemzami gave a PowerPoint presentation on the water sector in Morocco. It included information on all current and future legislative initiatives, financial and technical problems, and statistics. After his presentation, the team had the opportunity to ask him any remaining unanswered questions (see Appendix T for interview transcription).

The next step in the study was to prepare a set of expert interview questions (see Appendix C) for FIMABIO to gather material on the government's role in providing resources and services to natural and organic farmers. The team completed a semi-structured interview with the executive director of FIMABIO on January 30th, 2018. One team member asked the interview questions to the interviewee while the remaining members took written notes. The FIMABIO director gave a presentation to the team regarding the role of the Moroccan government in aiding organic farmers. After the presentations, the team asked the interviewee any remaining, unanswered questions. The team had a member of Ribat Al Fath translate for the interview in order to completely record and understand the representative from FIMABIO. A full transcription can be found in Appendix U.

. The next interview took place with Boujemaâ Gueghlan, the manager of CIPA outside of Marrakech at CIPA on February 9th, 2018. Questions (found in Appendix C) inquired as to the services that CIPA provides to farmers and other organizations

throughout Morocco. Two team members ran the interview while both asked questions and took notes as well as recorded audio of the interview on a smartphone. Yannis, a student at CIPA, helped translate the interview questions and answers during the interview. See Appendix V for the full interview transcription.

The final expert interview took place over email after meeting the expert, M Khattabi in Marrakech on February 14th, 2018. Since M Khattabi was particularly busy running a conference to conclude his project, GIREPSE, the team emailed him the set of interview questions on February 14th, 2018 (see Appendix D) which he responded to on February 19th, 2018. The purpose of this interview was to learn more about GIREPSE, the ways their project had helped small-scale farmers, and how the project could have a lasting impact on the agricultural sector. See Appendix W for full transcription.

Initially, this project's methods for objective two were structured interviews of experts; however, in order to accommodate for questions that the interviewee answered during their presentations, the team transitioned to the semi-structured interview approach. This proved to be a more efficient and holistic approach to the expert interview and yielded more information from the teams' interactions with these governmental and nongovernmental organizations.

3.3 Formulation of Recommendations and Deliverables

After coding farmer interviews and analyzing expert interviews, team members characterized relationships between the two sets of interviews. This analysis focused on the main themes and topics of farming techniques, challenges, solutions, and support from the agricultural sector that both farmers and experts mentioned during their interviews. After analysis, the team used the information relating to the four main themes that interviewees mentioned to formulate recommendations for Ribat Al Fath.

After examining the relationships that farmers form with these organizations, the team also assessed the importance of relationships that farmers hold within their community. The results chapter discusses how the team designed a deliverable (found in Appendix X) that aimed to strengthen the relationships that were most vital and important to the interviewed farmers.

4 Results and Analysis

This chapter details the results and analysis of this project. Section 4.1 examines the results gathered from analyzing the farmer interviews. Section 4.2 addresses the information gained from conducting expert interviews with four different organizations. Section 4.3 explores how the results from both types of interviews draws connections between the relationships that farmers have with various groups. The results and analysis in this section contributed to the team's ability to create suggestions and deliverables in the Recommendations section of this paper.

4.1 Farmer Interviews

The team reviewed their 11 interviews with natural and organic farmers and coded them according to four overarching themes: farming techniques, farming challenges, farming solutions, and farming support. The following sections contain information from the farmer interview transcriptions in Appendices E-O.

4.1.1 Farming Techniques Theme

The team counted the instances that farmers mentioned each concept within the overarching themes throughout the coding process. As seen in Figure 4-1, there were 51 total instances that farmers mentioned techniques which included topics on natural and organic farming.

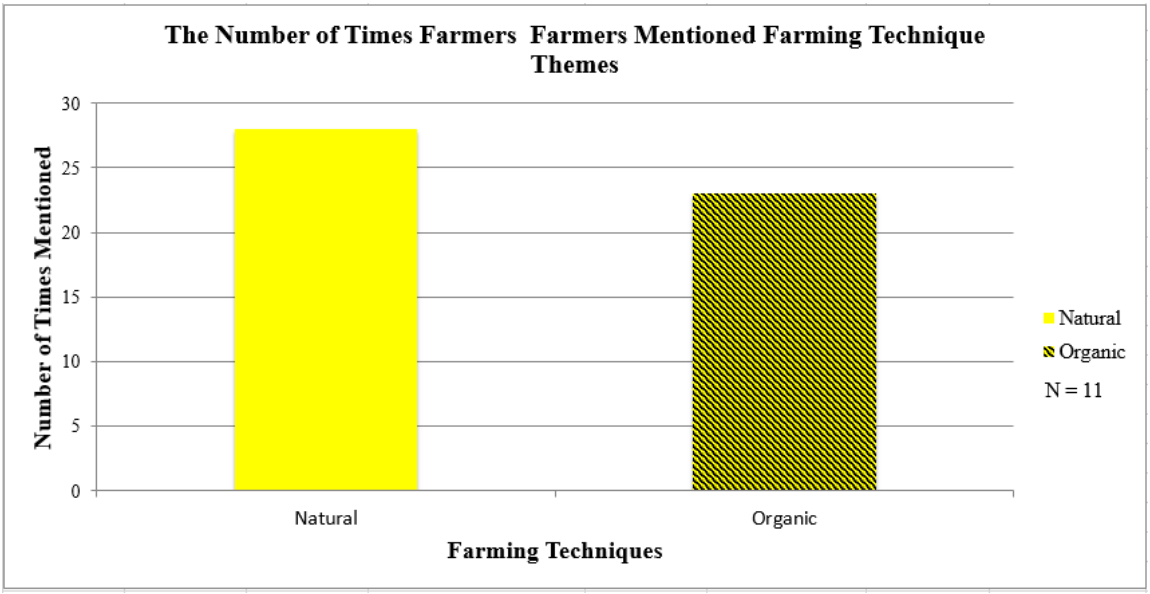

Figure 4-1:Graph of the Number of Times Farmers Mentioned Farming Technique Themes

Comments about natural farming related more to natural practices that both natural and organic farmers tend to use, whereas comments about organic farming highlighted the certification process and the limitations of being certified. This suggests that for this set of interviewees, natural farmers stressed the environmental benefits of their practices. Conversely, organic farmers emphasized the commercial benefits of having an organic label.

4.1.1.1 Natural Farming Techniques

Throughout the interviews, many of the farmers stated that they choose not to organically certify their farms. However, these farmers still use methods that would qualify their produce as organic. By being natural instead of certified organic, it is easier for these farmers to promote biodiversity. Since these farmers do not have to track their crops in detail for organic certification, they can more easily plan for natural growth in their crops. Instead of getting rid of weeds, they allow the land to develop without human interaction. Farm owner Aymar stated that by avoiding monoculture and not spending the time necessary to ensure that his land had only his desired crops, he was able to save time that

he could then apply elsewhere. Farm owner Taha prefers to grow different varieties of crops each year to see which crops are the best adapted to his farms' environment. He then mimics natural selection by saving the seeds of the most successful plants and uses them in subsequent years.

These farmers turn to natural farming as a technique to battle agricultural challenges. Farm Owner Aymar utilizes an application on his phone that informs him of which crops he can plant together to create symbiotic relationships. This enables his plants to support each other in the face of environmental challenges. Additionally, Aymar uses black soap, an African soap that is made from the ash of locally harvested ingredients such as plantain, palm tree leaves, shea tree bark, and chili powder as natural pesticides instead of treating pests with traditional chemical methods (Underwood, 2008). Farm owner Rim adopts essential oils to treat her plants and animals. Rim also employs aromatic and medicinal plants to keep the digestion systems of her chickens clean. Like other farmers who use these techniques, Rim believes that by promoting natural remedies, instead of harsh chemicals, she keeps both her crops and her customers healthy.

Finally, several of the natural farmers interviewed for this project let their animals graze on the same land where they grow their crops (see Figure 4-2). The animal's excrement helps to naturally enrich the soil and promote better crop growth. Farm owner Zineb allows her chickens to graze and naturally fertilize her land instead of relying on chemical fertilizers. Similarly, cooperative owner Mohammad keeps his soil rich by permitting his sheep and chickens to roam through his crops. By allowing animals to fertilize the crops, the farmers decrease their dependency on any additives and remain chemical free.

Figure 4-2: Rim's Farm Where Biodiversity is Integrated

4.1.1.2 Organic Farming Techniques

Throughout the interviews with farmers, they brought up the subject of organic farming in three key instances. The first was in the context of monoculture. Farmers who practice monoculture are able to more easily certify their crops as organic. This is in part due to the regulations of organic farming, in which farmers need to closely document what they grow on their farms. It is also more economically successful to practice monoculture when there is a large demand for one product, such as in the case of Farm B. Farm B practices monoculture and gets each crop organically certified. This farmer keeps the farm as organized as possible to make being organically certified as easy as possible. Rim, one of the organic farmers, stated that she only certified her plums at the beginning stage of her farm because the trees occupied a large portion of her land. However, she is working to incorporate permaculture throughout her farm, while continuing to certify her crops as organic.

The next context in which farmers brought up organic farming was while discussing the commercialization of their products. Since organic certification is expensive, it is often only advantageous in the case of commercialization. Farm B is a large international exporter of their organic produce used for essential oils and cosmetic products. The organic certification enables them to be successful commercially and to more easily export their products. Touya's farm is also organically certified with the purpose of exporting internationally, while still selling some of the produce locally. Farms that do not organically certify their crops often do not have the desire to commercialize their farms to the extent necessary to make possessing an organic certification advantageous for them.

The final instance that farmers discussed organic farming concerned the various types of organic certification. Currently, Morocco does not have its own organic certification mechanism, so any farm that wants to certify their crops must use an international certification. Farm A chooses to use the Italian organic certification for all of its crops. Farmers stated that they chose this certification because it is one of the easier certifications to obtain. It is also more financially feasible compared to some of the other European organic certifications. Farm B on the other hand uses multiple certifications depending on the location of their target market. Farmers may require different certifications depending on the laws of the countries where the farmers are selling their

produce. Since Farm B is successful in their commercialization, it is financially feasible for them to obtain multiple certifications.

4.1.2 Farming Challenge Theme

This section details the subjects that farmers frequently mentioned during the team interviews, concentrating on the overarching theme of farming challenges. The four main concepts discussed are challenges with marketing, seeds, a lack of resources and water scarcity.

For the overarching theme of farming challenges, the team counted the number of instances when farmers mentioned this concept within the farmer interviews. The farming challenge theme yielded a total of 109 instances (see Figure 4-3).

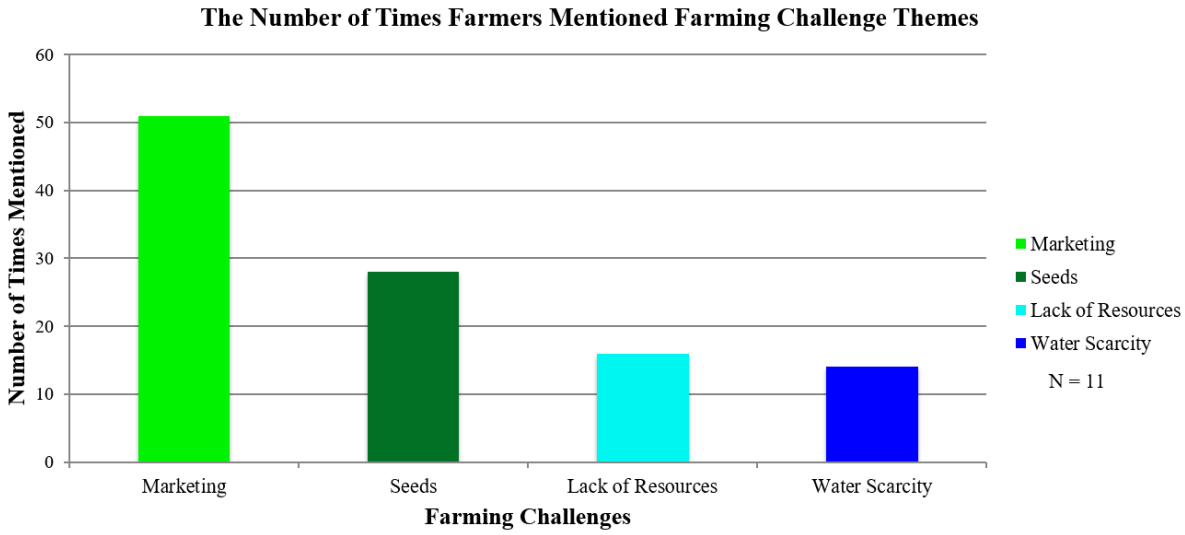

Figure 4-3: Graph Representing the Number of Times Farmers Mentioned Farming Challenges Themes

4.1.2.1 Challenges with Marketing

Throughout Morocco there are a variety of target markets where farmers can sell their produce. At Mohammed's women's cooperative for lentils and couscous in Bashua village, people come from all around Morocco to buy products. This cooperative also

attracts tourists from outside the country who want to see the Bashua village, an ecotourism site, which helps the cooperative thrive.

A local school asked farm owner Said to sell his produce at the school. However, the school desired a larger quantity of potatoes than Said's farm was able to supply, so the school canceled the deal. Now, Said works with Hasna, a local contact, who organizes the farmers together and helps them sell their produce. Said's connection to Hasna allows Said's produce to be sold for him in Rabat, while he stays on his rural farm working.

Similar to the conversation with Said, our conversations with other farmers indicated that they do not have the resources to travel to markets to sell their produce. Consequently, they must use middlemen who often take advantage of the farmer's situation. Farmers in Figure 4-4 are preparing their produce for a middleman to pick up and bring to market.

Figure 4-4: Farm Workers Preparing Their Own Crops For the Market

Farm owner Hamid spoke about the problems of middlemen taking money from small-scale farmers. He explained that the government prioritizes farms that export more produce than they sell within Morocco, for financial purposes. Due to the government's emphasis on larger exporters, governmental organizations have not fully developed strategies to protect small-scale farmers. Farm owner Taha also spoke about how easy it is for middlemen to take advantage of farmers in the countryside that do not go into market and therefore do not have a true concept of how much their produce is worth.

For Moroccan natural farmers, the method of selling their produce in baskets to loyal customers is a stable option. On Aymar's farm, his customers come to pick up baskets that have a set price. He gains customers for his baskets through word-of-mouth with his existing customers. Farmer Said provides his local contact, Hasna, with his produce. Hasna takes Said's produce and other local farmers produce and combines them into baskets to improve the diversity of each individual basket, and then she sells the baskets. Hasna then gives money to each of the farmers that gave her produce for the baskets, allowing farmers like Said to make a profit from what he grows and harvests seasonally.

4.1.2.2 Challenges with Seeds

Similar to organic certification, there is no Moroccan organization that sells organic seeds to farmers. Hence, organic and natural farmers must look internationally for their organic seeds. Taha chooses to get his seeds from California, USA because the seeds adapt to a climate similar to the climate of his farm in the region near Rabat, Morocco. Farm owner Said buys his seeds from Mexico and Mauritania so that the seeds are more resilient to extreme weather conditions. Since Taha, Said and other farmers must buy their seeds from foreign countries, the seeds they buy are more expensive, less accessible, and come in a smaller quantity than they would be if the farmers could buy them directly from a seed distributor in Morocco.

Within Morocco it is illegal to buy and sell organic seeds, forcing farmers to build communities around individual seed stocks. In Morocco, the Ministry of Agriculture and Land Reform has the authority to issue all laws and regulations regarding seed production, inspection and the certifications of seeds. The Ministry of Agriculture and Land Reform also works jointly with the Ministry of Treasury to set the prices associated with the laws and regulations. Before ministries can approve the selling and buying of organic seeds in Morocco, they must first examine the existing Moroccan regulations pertaining to farmer-to-farmer trading. This is a long process that also requires all seeds to be properly entered into the Official Catalogue of Species and Varieties of Cultivated Plants (Bombín-Bombín, 1980). These policies are put in place not only to regulate prices, but also to protect the land. Unfortunately, since there is no place for farmers to buy organic seeds in Morocco, the current laws and regulations become ineffective. Farmers obtain organic seeds their

own way and disregard the full legal process to protect their natural and organic farming practices.

Another way that farmers preferred to get seeds is by exchanging them in their agricultural communities. Taha trades his seeds with other farmers, such as farm owners Rim and Aymar to develop a wider variety of organic seeds (see Figures 4-5 and 4-6). Aymar pointed out that accumulating sufficient seeds to grow a full harvest of produce is a very slow process that sometimes requires years of cultivation.

Figure 4-5: Taha's Seed Bank

Figure 4-6: Zineb's Seed Bank

4.1.2.3 Challenges with Water Scarcity

Water scarcity is a two-sided challenge throughout Morocco. During the dry season, farmers face water shortages characterized by little to no rainfall. In contrast, there are some months where severe rainfall threatens crop survival and farmer mobility. Farmers must find creative approaches to help their crops better adapt to this unpredictable water supply, while still being able to harvest crops. Madrani's biggest challenge is figuring out a water management system that enables his farm to function year-round. Due to the seasonal fluctuation of rainfall frequency and intensity in his region, Madrani's soil becomes cracked in dry months (see Figure 4-7), and muddy and hard to work on in rainy months. The severity of these extreme weather conditions also affected another farmer that the team interviewed, Zineb. Zineb is a natural farmer whose farm resides on the side of a hill near a highway. Due to the lack of rainfall, her soil became dry and lightly packed. An

unexpected flood overly-saturated this dry soil, resulting in mudslide that destroyed all of Zineb's fig trees.

Figure 4-7: Farm Owner Madrani's Cracked Soil

One method that Moroccan farmers use to conserve water is drip irrigation (see Figure 4-8). Farm Owner B's drip irrigation system is what allows him to grow crops that would otherwise wither up and die in the face of climate change. To conserve water, farmers only turn on their drip irrigation systems when there is a severe or lengthy dry period.

Figure 4-8: Said's Drip Irrigation System

Another method that farmers employ to conserve water is the utilization of water-retaining plants such as cacti (see Figure 4-9). These plants retain water for longer periods of time, both for themselves and for other plants in the surrounding soil. Madrani uses this method to reduce his farms' water consumption.

Figure 4-9: Said's Cacti Act as Both Water Retaining and Pest Control

4.1.2.4 Challenges with Lack of Resources

One of the most pressing challenges for small-scale Moroccan farmers is their lack of resources. The first resource that farmers lack is accessible information pertaining specifically to farming in Morocco. Taha's biggest challenge is finding information on natural farming and permaculture that pertains to the Moroccan climate and biodiversity. Rim also highlighted the fact that there are very few books in Arabic on permaculture and organic farming. Although most farmers interviewed in this project spoke English and French, books should be available in Morocco's primary language so that this information can be accessible to everyone. Since this is a largely untapped market, publishers or non-governmental organizations have an opportunity to impact the agricultural sector while even making a profit to put back into their work.

The next resource that farmers need is training sessions offered by governmental and non-governmental organizations. Madrani stated that there is a lack of support for organic farming in Morocco. He wishes that there was an organization that could offer training sessions to him about organic farming. For Mohammed's cooperative, Mohammed would like there to be training about the transformation of produce into other products.

Since transformed produce increases the variety of products that can be sold, Mohammed feels this would be the next step in improving his cooperative. Several of Morocco's most successful cooperatives concentrate their efforts on the transformation of argan oil into products for cosmetics and cooking. Since Moroccan argan oil is well known worldwide, cooperatives already have an endless market. Mohammed's cooperative is already becoming well known throughout Morocco despite that they only sell non-transformed products. Mohammed knows that once his cooperative begins to transform products, he will have a market to sell.

As with the lack of information available on organic farming practices, there exists in Morocco an inadequate availability of workers who respect natural and organic farming practices. When Taha's workers originally started on his farm, they were more interested in quick financial gain instead of a long-term investment in the farm. The workers did not initially see the value in Taha's natural farming because the process started slower than if they followed conventional farming methods. Farm owner Tourya wished that she had more workers who were specifically educated in organic and natural techniques. This would reduce the time needed to train workers each time they arrive at the farm.

4.1.3 Solutions Theme

This section investigates the concepts that farmers frequently mentioned during the farmer interviews with respect to the overarching theme of farming solutions. Figure 4-10 features the four solutions to agricultural challenges which interviewees most commonly mentioned.

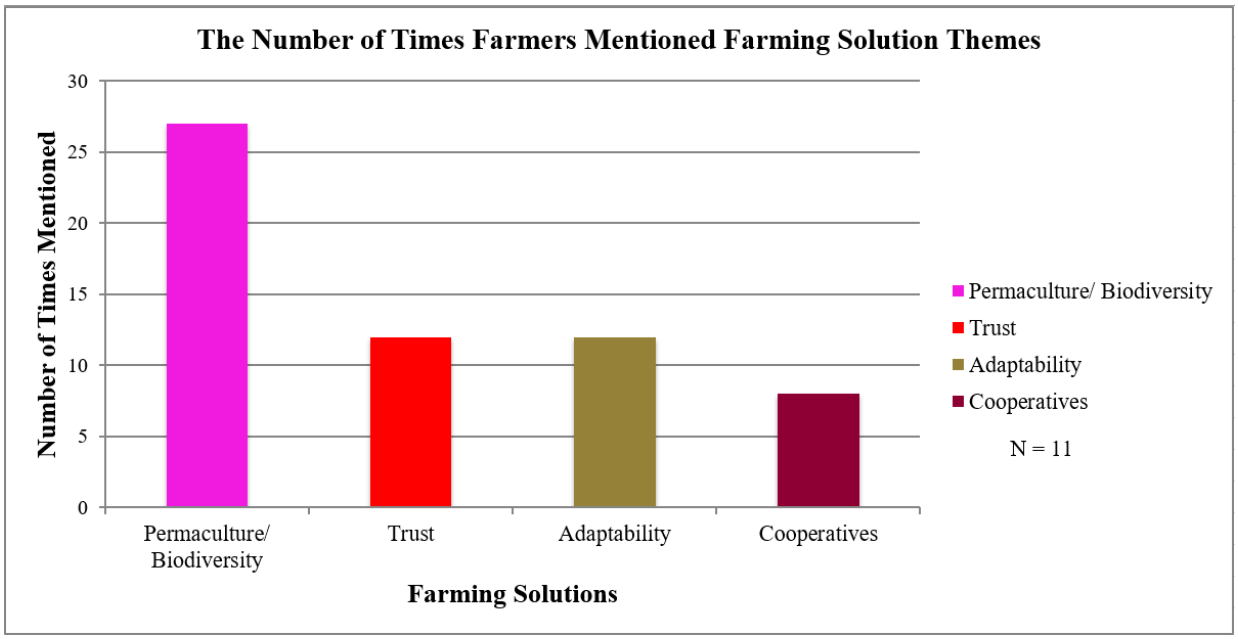

Figure 4-10: Graph Representing the Number of Times Farmers Mentioned Farming Solution Themes

4.1.3.1 Permaculture/Biodiversity

Farmers mentioned permaculture at almost every single natural farm and at two of the organic farms that the team visited. Farmers utilize permaculture as a solution to seasonal temperature and rainfall fluctuations in Morocco. Taha and Aymar both promoted permaculture as a natural method of combating climate change through the large variety of plants that they incorporate into their farm. Aymar mimics a natural ecosystem by allowing his plants to work together to increase their efficiency and survivability in the face of water shortages and drastic temperature fluctuations (see Figure 4-11). Taha explained that biodiversity in plants provides various root lengths in the soil in any given area, which works against soil erosion that frequently occurs in Morocco when heavy rainfall suddenly saturates dried out land.

Figure 4-11: Said's Farm Featuring a Variety of Plant Types

All of the farms that utilized permaculture methods created an ecosystem with specific types of plants and animals. Farmers had fruit trees for shade and root length, vegetables for a shorter root length, plants for retaining water during the dry season, chickens and other animals to naturally fertilize the land, and bee farms to pollinate their flowering plants. One of the most important plant types that all permaculture farmers had were aromatic and medicinal plants. As previously mentioned in the natural farming sections of this chapter, these plants act as a natural system to ward off pests and diseases. For example, on Aymar's farm, he plants aromatic species near the rest of his crops to prevent disease spreading from one plant to another. Aromatic flowering plants have the added benefit of providing nectar for bees on the farm. Plants such as lavender, rosemary, nettle, and oregano contribute to a healthier life for the biodiversity on Aymar's farm.

The benefits to this type of farming are multidimensional. In addition to dealing with pests and diseases by letting plants help each other, Rim uses natural remedies like essential oils to treat both herself and the animals on her farm. Moreover, Aymar believes that there are many health benefits to the people that consume the farm's produce when the farm uses permaculture and has a high level of biodiversity.

4.1.3.2 Trust

Morocco is a country that largely emphasizes the importance of personal relationships and hospitality. When the team traveled to these farms, members received warm welcomes from farmers and introductions to everyone at the farm. These farmers provided a plentiful amount of food and openly shared his or her story. Trust is an integral part of why farmers have a regular pool of returning consumers. The farmers value trust with customers more than a certification or a label. Farm owner Taha wants people to buy his produce based on the trust and confidence that they have in him and his farm. He thinks that a piece of paper does not mean much to his consumers. The reason behind these returning customers is due to the exuberance and knowledge that Taha provides for his customers about the type of produce he grows and why he grows it naturally. Since Moroccan culture relies on the spread of agricultural knowledge through word-of-mouth, gaining trust is imperative to expanding the farmer's population of consumers. For example, farm owner Zineb does not have to mark her produce (see Figure 4-12) as being grown naturally or through the use of permaculture. Zineb's reputation of having high quality crops precedes her. Consumers have the confidence in continuously buying from her, and she ensures that she is selling high quality produce that is healthy to consume.

Figure 4-12: A Variety of Zineb's Packaged and Marketed Produce

Gaining this trust from customers is not a quick and easy task; it takes time and openness from the consumer. Farm owner Taha dedicates himself to develop trust with his customers (see quote in Figure 4-13). He wants to sell produce to consumers that trust him in terms of his natural farming techniques and that do not question the organic nature of his farm. Farm owner Zineb welcomes her customers to come to her farm and take the time to understand how permaculture works and the exact techniques that she employs. Using this style, she creates a community of trusting consumers who spread positive recognition about her, her farm, and the techniques she uses.

"I feel it is hard to convince and sell but I really want to find a world where I am going to live where people will start to trust each other. This is where I am looking to sell my product." -Taha

Figure 4-13: Taha's Quote About Trust

A challenge with selling of organic and natural products is that consumers are not always willing to trust farmers and may be unaware of the benefits of organic practices. Many consumers try to bargain down the price of organic produce to a low value making it difficult for farmers to profit from their labors. Farm owner Taha finds it difficult to get a good price that both the consumer and producer can agree upon. For him, he will take the time to explain more about his practices to customers so that they understand the labor that goes into his produce.

In the beginning, Taha experienced difficulties with proving that natural farming methods were more efficient and sustainable than conventional farming methods. His workers were skeptical about his natural method of farming. However, he challenged their skepticism by letting his workers farm two plots of land, one with his method and one with their own. From experimentation, Taha's workers were able to see the advantageous results that came from natural farming.

4.1.3.3 Adaptability

Throughout the team's discussions with farmers about topics such as climate change and farming practices, the theme of adaptability came up numerous times. The importance of having an adaptable farm in Morocco became apparent through these interviews and led to the identification of two main points about adaptability. The first

point is that a farm can adapt to changes in its environment without chemicals. Although Zineb works to adapt to conditions caused by climate change, she would never change her natural farming approach. Rim grows different crops based on the climate and carefully considers the design of her farm to ensure that she can continue to use organic and permaculture practices. The second main point is that farmers can actually mimic natural selection with their crops in an effort to adapt to climate change. In Taha's interview, he explained that he pays careful attention to how well each of his individual plants fare each season. For each season, he selects his seeds only from the plants that thrived previously. Madrani also grows a wide variety of crops in order to determine which ones are the best adapted to survive within the specific environment at his farm.

4.1.3.4 Cooperatives

During the interviews with small farmers, the topic of cooperatives came up multiple times. In general, the tone that interviewees used to describe cooperatives suggested that they perceive involvement in cooperatives in a positive manner. Farm owner Said, amongst other farmers, expressed that he is actively looking to get involved in a cooperative with one of his other friends who is a farm owner. Mohammed who organizes the women's couscous and lentils cooperative, like the one in Figure 4-14, also expressed that his cooperative members would love to start more partnerships within their group. This reveals that cooperatives are not a competitive or exclusive group and that both existing members and new members would benefit from cooperative growth.

Figure 4-14: Women Working in a Cooperative to Make Couscous (Gdah, 2018)

Many economic and environmental benefits of being a part of a cooperative came up throughout the team's interviews. Mohammed explained the benefit of being able to share land and properly rotate crops even if farmers only have a few areas of land to plant on. He also spoke about how members of his cooperative have more time to focus on the technical matters of their farming practices since they do not have to worry about their marketing strategy and price management. Farm owner Said mentioned that although he is not currently a member of a cooperative, he understands the benefits of being in one. He combines his produce with crops from other farmers in an effort to collaborate and offer a basket with a high variety of produce to his costumers. This is a similar concept to the benefit of collaborating with other farmers within a cooperative. Overall, farmers spoke highly of cooperatives, despite the fact that most of them are not official members of one. This seems like a promising solution to many sales and marketing problems for small farmers. Going forward, cooperatives would need an entity to be responsible for organizing initiatives to raise interest in cooperatives and gain more farmer involvement.

4.1.4 Farming Support Theme

This section describes the results of the team's interview with farmers pertaining to support available to farmers from their communities, non-governmental organizations and the government. Throughout the coding of the team's farmer interviews, there were 34

instances where interviewees mentioned sources of support for themselves (see Figure 4-15).

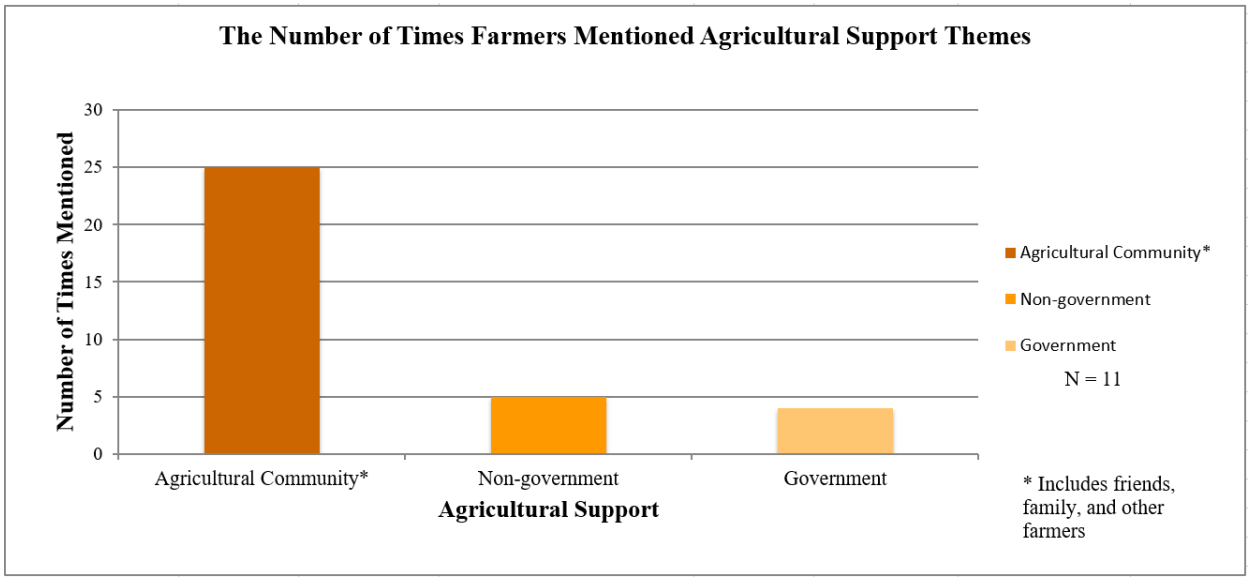

Figure 4-15: Graph Representing the Number of Times Farmers Mentioned Agricultural Support Sub- Themes

Although farmers seldom mentioned governmental organizations, they expressed criticism of existing resources or a lack thereof. Farmers elaborated on a few non-governmental organizations (NGOs) relating to their assistance to connect farmers with one another and providing resources. Farmers mentioned support from the agricultural community (friends, family, and other farmers) five times more than either of the other two categories, suggesting that support from their agricultural community is the most valuable and plentiful resource that the farmers rely on.

4.1.4.1 The Community

The farmers interviewed obtained their farming techniques through a variety of methods including knowledge passed down from family members, from other farmers, from the Internet, and in some cases, from a formal education. Several of the farmers interviewed, including Hamid and Said, stated that they grew up on farms and that their family members educated them about farming practices. Farmers who were unable to learn from their families often turned to other farmers and members of their community for

advice (See Figure 4-16). Farm Owner Madrani explained that he lacks farming experience and that he learned his techniques through networking with the farmers in close proximity to his farm. These farmers provided him with the information he needed to get his farm up and running. The interview with Taha depicts another example of this community-based learning. When Taha started his farm, he had no experience working as a farmer, so he began to learn at Zineb's farm, where she taught him permaculture techniques. Taha then utilized these techniques to begin cultivating his own crops. The farmers interviewed stressed the importance of community-based knowledge and the importance of sharing information, techniques, and even organic seeds with people to aid them in overcoming the challenges that they face.

Figure 4-16: Farm Owner, Hamid and his Workers Collaborating

Only a few of the farmers interviewed received formal training courses in agricultural practices. Farmer Hamid attended college in France where he studied agriculture. He uses the information that he learned to improve the productivity of his farm. Additionally, farmer Rim studied Agro-Food Industry Engineering in Madrid. She applies this knowledge to her farming techniques, although occasionally, she will come across a problem that she cannot solve using her background in Agro-Food Industry. In instances like this, Rim will research where she can take training courses about that topic and then she will fly to wherever the classes are so she can participate in them. Despite the fact that

farmers benefit from these technical training courses significantly, many farmers must seek free, easily accessible information because they are unable to afford or attend these courses.

Farmers commonly use the Internet as a means of attaining easily accessible information. Taha uses informational farming web pages as a resource to supplement his gaps in knowledge. When Taha does not know how to do something, he merely looks it up online. Farmer Aymar also expressed his reliance on the Internet to provide the information he lacks. Aymar watches agricultural YouTube videos, reads online articles, and uses phone apps to learn about more about his plants and about permaculture techniques. Several farmers explained that the Internet is a vital research tool that they can utilize to educate themselves about effective and useful farming practices.

4.1.4.2 Non-Governmental Organizations

Multiple farmers mentioned support from non-governmental organizations (NGOs) in their interviews with the team. Mohammed and his cooperative workers mentioned that they receive help from the Modern Agriculture Organization. This organization had not come up in any of the other interviews, or any of our background research. This suggests that knowledge of this organization does not reach many farmers. Aymar mentioned that he receives help from RIAM, an NGO previously detailed in the background. Several of the farmer interviews in the Rabat-Sale region frequently mentioned RIAM.

Multiple farmers mentioned getting help from The World-Wide Opportunities on Organic Farms (WWOOF) workers who are colloquially referred to as WWOOFers (see Figure 4-17). These workers are a valuable resource for small farmers in Morocco. Taha explained to the team that WWOOFers are international organic farm workers that work on a farm for a few hours each day in exchange for room and board. This is a valuable approach to share information regarding farming and culture around the world. Aymar hosts WWOOFers on his farm and it is a great opportunity to exchange farming knowledge with them as they live and work on his farm for a given amount of time. There are other NGOs in Morocco (not mentioned by the interviewees) that aim to help small farmers in their sustainable and natural practices however interviewees did not mention them to the team.

Figure 4-17: WWOOFer Working with A Farmer at CIPA

4.1.4.3 The Moroccan Government

Throughout the interviews, farmers voiced their opinions that agricultural advice centers are a poor resource for organic and natural farmers. Agricultural advice centers focus their efforts on sharing information and techniques about traditional farming practices, and they lack the expertise to support the natural and organic farming communities in Morocco. Despite the fact that farm owner Taha has been farming in Morocco for two years, he had never heard of agricultural advice centers until the team inquired about his interactions with them. Unlike Taha, farmer Said stated that he was aware of the existence of three agricultural advice centers near his city, but that the advice centers only understand how commercialized agriculture works and the centers are unable to educate him on non-chemical-based agricultural techniques. Similarly, farm owner B suggested that the government should train specialized technicians in organic and natural farming practices and that these technicians should then take their knowledge and educate the farmers. These farmers all expressed their interest in utilizing the agricultural advice centers, but only if the centers begin to provide services and techniques specific to natural and organic techniques. The farmers interviewed did not express receiving any other form of governmental support, leading the team to conclude that the Moroccan government does not offer much support to organic and natural farmers.

4.1.5 Addressing Potential Bias of Farmer Interviews

Ribat Al Fath put the team into contact with a variety of farmers. The team realized that the set of farmers that they interviewed do not fully represent all of the different types of small-scale farmers within the greater Rabat region. A majority of the small-scale farmers the team interviewed had access to Internet and innovative technology. The team understands that this is not the case for all small-scale farmers. Some small-scale farmers in rural and geographically isolated areas may be illiterate or lack many common resources that are easily accessible to other farmers and this is an additional area of research that would be valuable to investigate moving forward.

4.2 Expert Interviews

This section examines the team's expert interviews of governmental and non-governmental organizations. Table 4-1 displays the interviewees and organizations that the project team interviewed.

Organization	Full Organization Name	Interviewee	Interviewee's Position
Ministry of Water	Ministry of Territory Planning, Water and Environment	M Mahmoud Zemzami	Geographical Engineer Post-Doctoral Ministry Worker
FIMABIO	The Moroccan Interprofessional Federation of the Organic Sector	M Hammoutou El Mekki	Executive Director of FIMABIO
CIPA	Crossroads International Agro-Ecological Practice	M Boujemaâ Gueghlan	Manager of CIPA
GIREPSE	The Management of Irrigation of Water Resources and Payment of Ecosystem Services Project	M Abdellatif Khattabi	Director of the GIREPSE project

Table 4-1:Expert Interviewees and Their Organizations

4.2.1 Expert Interview with M Zemzami of the Ministry of Water

On January 18, 2018, the team interviewed Mahmoud Zemzami, a member of Morocco's Ministry of Water. Zemzami has a Ph.D. in Geological Engineering and maintains multiple publications in hydrology, the branch of science concerned with the properties of the earth's water, and especially its movement in relation to land (Perlman, 2012). The majority of his research focuses on using statistical modeling and algorithms to predict and understand rainfall patterns in Morocco. The team's interview questions addressed current farming practices in Morocco and the opportunities available to farmers in the form of government subsidies. Appendix B contains the team's interview questions and Appendix T is the transcript of this interview. Through this interview, the team gathered information about Morocco's water system specifically pertaining to how it intertwines with the agricultural sector.

To quantify the decrease in water availability in recent years, Zemzami presented trends connecting the past and current water supply in Morocco. In 1960, the water supply was large enough that each citizen in Morocco could consume 3,000 cubic meters of water per year. By contrast, today Moroccans can only consume 650 cubic meters of water. To follow this trend of the decreasing water consumption over the years, the lack of rainfall over the previous two years has similarly decreased the capacity of dams from 70% to 35%. This sharp decrease in water supply has detrimental effects on farmers and their production of crops. Zemzami described that droughts are dependent on the distribution of rainfall throughout the entire season and not just one month. For example, if a region of Morocco experiences a large quantity of rainfall one month, but little to no rainfall in the remaining 11 months, the situation would still be a net drought. Zemzami emphasized the inefficiency of the current water system in Morocco. Morocco's water system loses approximately 40% of due to various weaknesses in infrastructure such as by leaks and cracks in the pipes (see Figure 4-18). The Ministry of Water would like to reduce this inefficiency down to 20%. The security and regulation of the water supply is also a source of water loss in Morocco. Since the current water system is open and exposed to the elements for hundreds of miles, people are able to freely take or contaminate it at the government's expense (see Figure 4-19). While this water is not free to take, the government does not have a strict security

system in place to protect this channel of water. Zemzami painted a bleak image of the current status of the water supply in Morocco and stressed the need for improvement.

Figure 4-18: Leaking Pipe at Water Filtration Station

Figure 4-19: Canal System Carrying Drinking Water

This dangerous state of water supply has damaging effects on farmers in Morocco, but the Ministry of Water has plans and initiatives aimed at mitigating the situation. Currently, farmers use 90% of all surface water to irrigate their farms. Large farms consume a lot of water so they can produce crops to export out of the country. These large farmers justify their water consumption by pointing to the amount of money they bring into Morocco's economy and the number of jobs that their farms create. However, Zemzami

stressed that the country wastes water by growing crops that Moroccans do not get to consume, thus limiting the availability of drinking water. One method to combat the water scarcity with farmers in Morocco is through the use of drip irrigation. Mahmoud informed the team that the Ministry of Water offers subsidies to farmers that cover 40-60% of the installation fees for drip irrigation systems, and sometimes up to 100% of the fees depending on the situation. The Green Morocco Plan, an environmental government initiative, has also aided in the conversion of approximately 50,000 hectares of farmland per year to using drip irrigation.

This interview covered similar topics as discussed in the farmer interviews and reaffirmed the information that was gained from them. Zemzami touched upon the concept that water issues in Morocco go beyond just water scarcity. There is a two-sided challenge, just as farmers stated, where the water-related issues present in the dry season and the rainy season are very different. The interview strategically addressed these issues and detailed current measures the government is taking to combat them. However, the team noticed some conceptual differences between the mindset of farmers and of this expert on the topic of water scarcity. While farmers are struggling to find techniques to better adapt their crops to an unpredictable water supply, in both dry and rainy seasons, the Ministry of Water fixates on problems only relating to water scarcity and not issues on unexpected flooding. Their programs mostly pertain to water sources and management within the country. Although this is an important intention, this translates to resources for farmers purely through drip-irrigation subsidies. Zemzami explained that the governmental subsidies for drip-irrigation are available to all farmers; however, many small-scale farmers do not trust the government enough to accept the assistance they need to gain these subsidies. Many farmers need guidance on conserving water during droughts as well as managing the overabundance of rain that comes with the rainy season. These unexpected floods compromise farmers' mobility and crop well-being. The Ministry of Water's lack of solutions to this re-occurring challenge makes farmers susceptible to more ongoing water issues.

4.2.2 Expert Interview with M El Mekki of FIMABIO

Figure 4-20: Logo of FIMABIO

On January 30, 2018, the team interviewed Hammoutou El Mekki, the executive director of FIMABIO, the Moroccan Interprofessional Federation of the Organic Sector (see their logo in Figure 4-20). As the executive director of FIMABIO, Hammoutou El Mekki is the second in command after the president of the company. Hammoutou explained that the government created FIMABIO to help organic farmers connect with one another in order to succeed in the agricultural sector. The federation consists of three organizations, ANAPRO BIO, VAL BIO, and ANADEX BIO, which focus on the production of organic produce, the validation of value for the organic produce, and the marketing of the produce respectively. The team's interview questions address the current issues among the organic farming sector in Morocco and asks what services and resources FIMABIO provides to farmers to help them overcome these challenges. Appendix C contains the interview questions and Appendix U is the transcript of the interview. The goal of this interview was to gather information about the current state of organic farming in Morocco and to determine how the government is aiding organic and natural farmers.

In this meeting, the team learned about the importance of organic farming as a tool to combat climate change and about the services that FIMABIO provides to farmers. Hammoutou explained that climate change and the lack of fresh water are motivating factors behind the services FIMABIO offers because proper farming practices can improve the ability for farmers to grow produce while simultaneously conserving water. The federation offers in-person, hands-on training sessions to promote these farming practices. FIMABIO provides these demonstrations in French, Arabic, and Amazigh and they occur one to two times a month in various locations throughout Morocco. The topics they cover include: drip irrigation, crop rotation, composting, harvesting, and numerous other farming techniques. Any farmer who wishes to attend, whether they are traditional, organic or

natural may do so. The federation is willing to pay for and organize the housing and transportation costs for farmers who are willing to attend their training sessions but cannot afford to do so on their own. Although the government created FIMABIO just one year ago, the training courses that they offer do not have the reach to benefit as many farmers as they could. Hammoutou stated that FIMABIO was only able to offer its aid to approximately 600 farmers over the last year, although they do offer other services and advice and have new programs designed to aid the organic farming sector in Morocco.

Due to concerns over climate change and the diminishing supply of fresh water in Morocco, the government is seeking out methods to decrease water consumption. Hammoutou mentioned the same irrigation subsidy program that Zemzami of the Ministry of Water spoke of. The team learned that these irrigation subsidies are available for all types of farmers, but additional subsidies are exclusively for organic farmers. The federation is currently attempting to create a subsidy that will provide between $400 and $600 USD per hectare per year exclusively to organic farmers to promote the transition to organic practices.

During the interview, FIMABIO confirmed that currently the only avenue for legally receiving organic seeds, if a farmer wishes to become organic, is to spend 2-3 years developing their own organic seeds by replanting seeds from plants that were originally non-organic in an organic environment. The federation acknowledged that this is a big challenge for farmers and stated that the government is currently looking into the topic; however, it could take upwards of ten years to create an organic seed distributor in Morocco. The interviewed natural farmers did not believe in the use of non-organic seeds, so instead of committing to the three-year process, they simply smuggle organic seeds in from another country. When queried about the lack of organic markets in Morocco, a topic that came up in numerous farmer interviews, Hammoutou became confused and informed the team that there were many markets, such as La Vie Claire and Les Domaines in Rabat and Casablanca where organic farmers can sell produce. He then stated that the markets in Morocco favor large-scale farmers and he believes that small-scale farmers should join cooperatives and work together if they want to receive a fair price for their produce (see Figure 4-21). He said that this would prevent middlemen from taking advantage of small-scale farmers.

Figure 4-21: Small-Scale Farmer's Crops to be Sold in the Nearest City

The interview with Hammoutou El Mekki informed the team about the different challenges that organic farmers face in Morocco and about the services, both informative and monetary, that the government can provide them. FIMABIO aims to assist organic farmers in reducing the risk of water scarcity by equipping farmers with the knowledge and techniques that will enable their farms to be as productive and financially profitable as possible.

4.2.3 Expert Interview with M Gueghlan of CIPA

On February 9th, 2018, the team interviewed Boujemaâ Gueghlan, the manager of the Crossroads International Agro-Ecological Practice (CIPA). In 2015, the Association of Earth and Humanism in Morocco created CIPA with the mission to take care of humans and the environment, while simultaneously creating a surplus of food to feed the world's population. In order to meet these goals, CIPA aims to promote agro-ecological and permaculture practices, which supply food without depleting soils' vital nutrients. The team's interview questions address the logistics and motivations behind obtaining an organic certification and the services and resources that CIPA presents to farmers. Appendix C contains the interview questions and Appendix V is the transcript of this interview.

In this meeting, the team learned about CIPA's reasoning behind getting an organic certification and about the services that CIPA provides to farmers in Morocco. Boujemaâ

explained that CIPA uses practices such as permaculture to cultivate their crops because in an arid country like Morocco, it is important to keep the impact that farming practices have on the environment in mind. When CIPA established their farm (as seen in Figures 4-22), they had to direct the majority of their attention on designing and cultivating it, and were thus unable to network together with other farmers to share their techniques. After three years of growth, the farm was able to thrive and upon hearing the success of CIPA's farm, people began to reach out to them for information and suggestions on farming techniques.

Figure 4-22: CIPA Center Permaculture Farm

Many farmers currently come to CIPA with specific project ideas in mind and then CIPA administers necessary training courses to make the projects successful. The center requires financial compensation from farmers for these courses. However, if a farmer cannot afford this training, the center will circumstantially waive the fee to allow them to benefit from the centers' services. Boujemaâ spoke of farmers repeatedly returning for additional beneficial and relevant courses (see Figure 23). To ensure that farmers are truly benefiting from these services, the center communicates with its previous clients to gain feedback via email about their experiences with CIPA's training courses. In this way, CIPA analyzes the benefits of the training course to the farmers in overcoming current agricultural challenges.

Figure 4-23: Community of WWOOFers and Students at CIPA Center

During this interview, Boujemaâ elucidated the purpose behind CIPA obtaining their organic certification. As an organization that promotes permaculture, they stated that receiving a certification can be quite difficult for farmers with similar practices to theirs. Boujemaâ clarified that if you do not have any commercial purpose as an organic farmer, the farmer's organic certification is virtually useless other than the fact that it makes a farm more reputable. Companies such as FIMABIO are more likely to assist organically certified farmers than non-certified farmers, which explains CIPA's primary reasoning behind seeking an organic certification. CIPA is attempting to use its certification to form relationships with organic-specific associations in an effort to convince these associations to provide their services inclusively to all types of farmers. Through this interview, CIPA confirmed that in the face of climate change, small-scale natural farmers should focus more on improving their individual farming practices than on attempting to receive organic certification.

Through CIPA's actions and advocacy for the benefits of agro-ecological practices, the association hopes to set a precedent for other organizations to follow. CIPA aims to have their association, along with others, provide services and assistance to farmers, thus facilitating their adaptation to their agricultural trials. CIPA is genuinely concerned about the difficulties that impede farmers progress, so the purpose of these services is to make farmers as successful as possible.

4.2.4 Expert Interview with A. Khattabi of GIREPSE

On February 14th, 2018, the team emailed Abdellatif Khattabi, the coordinator of the GIREPSE project, a set of interview questions. He emailed back his answers on February 19th, 2018. Khattabi, has a background in agronomic engineering from the Institut Agronomique et Veterinaire Hassan II in Rabat, and from the ESB Business School in Paris. He has an MS and a Ph.D. in economics from the University of Idaho and an MS in information and communications technology from the University of Louis Pasteur in Strasbourg, France. He is a researcher on natural resource management and he developed the GIREPSE project to promote a resource management plan in the Tensift Watershed outside Marrakech. Appendix D contains the interview questions and Appendix W is the transcript of the interview. The goal of this interview was to gather information on the current effects of climate change in Morocco and determine how the GIREPSE program supports farmers.

Khattabi's answers reaffirmed that droughts are becoming increasingly frequent and long lasting in Morocco and that they have adverse effects on farmers regardless of their accessibility to irrigation systems. The majority of farmers use rainfall to irrigate their crops, so as the frequency of droughts increases, the farmers' ability to grow crops diminishes. Khattabi informed the team that Morocco's water supply fluctuates in an unpredictable fashion. When droughts occur, the reserves of water in dams and in underground water sources become depleted, which reduces the amount of water that farmers can use for irrigation. This puts pressure on citizens to move to cities for work and to have better access to resources. Khattabi has noticed an increase in the overall rate of urbanization and a decrease in the availability of important products, such as medicines with plan-based ingredients, due to these decreasing water reserves.

The GIREPSE project analyzed Morocco's Tensift Watershed region's vulnerability to climate change through the analysis of both the land characteristics as well as the peoples' reliance on the land. The GIREPSE project then created suggestions and training courses specifically tailored to the needs of different locations within the Tensift Watershed region to help people deal with issues pertaining to water scarcity and flooding. Khattabi explained that the GIREPSE project's training workshops included information about individual farming practices as well as the benefits of participating in an association

or cooperative. The team learned that the project offered subsidies to create fortified terraces for farming and supplied farmers with fruit tree seeds, to plant on these terraces. GIREPSE workers would guide the farmers with cultivating their seed to fruition. In addition to helping farmers on an individualized scale, the GIREPSE project assisted a group of women to create an organic farming cooperative and provided them with organic-specific training courses that allowed them to begin organic cultivation of their own produce. Khattabi urges organizations to adapt and incorporate the GIREPSE project's suggestions into their own programs in order to create a noticeable dent in the severity of climate change's impact on Morocco.

4.2.5 Addressing Potential Bias of Expert Interviews

Ribat Al Fath put the team into contact with a variety of experts. The information the experts imparted on the team during expert interviews may not fully represent the whole scope of governmental or non-governmental organizations' role in assisting farmers. Organizational experts may have supplied the team with a more positive outlook on how farmers benefit from their services without critically analyzing their own shortcomings.

4.3 Analysis of Relationships

This section analyzes the various sources that farmers in the Rabat region, Azemmour, and Marrakech region turn to for support. These sources include the agricultural community that a farmer interacts with, non-governmental organizations, and governmental organizations.

4.3.1 Agricultural Community to Farmer Relationship

The previous results sections 4.1 and 4.2 identified key resources for natural and organic farmers that are neither governmental organizations nor non-governmental organizations. This category, labeled "agricultural community," originally served as an "other" category while coding farmer interviews detailing the support and resources that farmers' utilized. This category became much more than a catch-all, but rather contained the most vital and important resources for natural and organic farmers. Many farmers

mentioned in their interviews that members of their agricultural community were their main resource, whether they were family members, friends, or fellow farmers. Relying on one another for information on natural and permaculture practices as well as seed sharing, farmers in this region are the most informed and helpful resources available to each other. For example, Zineb acted as a teacher for Taha and helped him start his natural farm. This support enabled him to become a competent and self-sufficient farmer. Other farmer relationships can fill the gap in resources that was previously identified in the results section.

Many farmers have to look for advice from experts in other countries, however, farmers that operate in the same local area as one another are able to provide guidance to one another that is relevant to their specific climate. The team determined that creating materials and programs that strengthen this community would greatly benefit small-scale farmers in Morocco as a whole.

4.3.2 Non-Governmental Organizations to Farmer Relationship

Throughout the analysis in this chapter, the team noticed a disparity between known NGO support and NGO support mentioned by farmers. There was not adequate information throughout this project to fully deduce the exact reasons for this disparity. However, the team expects that there may be specific problems that hold NGOs back from reaching farmers, such as having limited avenues for making contact with farmers or not sufficient resources to interact with as many farmers as they would like to support. In the expert interview with CIPA, Boujemaâ explained that their organization, although it had valuable resources, did not have a large human resources department. Overall, they had issues building new relationships with farmers that are in isolated areas of Morocco. This could potentially be a characteristic shared with other agricultural-related NGOs.

While NGO support for natural and organic farming is a valuable resource that the agricultural community underutilizes, our cross-analysis of farmer and expert interview answers suggests that NGOs do not supply the impact needed to meet the supportive needs of small-scale farmers throughout Morocco.

4.3.3 Government to Farmer Relationship

Throughout expert interviews with governmental organizations, the team uncovered existing relationships between the farmers featured in this report and the government. Section 4.1.4.4, Governmental Support showed that farmers mentioned governmental resources five times less frequently than the agricultural community. These results suggest that this is due to a lack of support for natural and organic farmers in the Moroccan agricultural sector.

By comparing responses to farmer interviews and the Ministry of Water interview with M Zemzami, the team noticed that each party approached problems related to water scarcity from different angles. In terms of water scarcity, the issue does not stop with being able to irrigate properly during the dry season. This issue continues into the rainy season as the cracked and lightly packed earth is susceptible to floods and mudslides that can threaten crops. Although drip-irrigation subsidies are important for farmers that cannot afford this technology on their own, these subsidies only solve one problem relating to rain level fluctuations. CIPA also brought up governmentally funded drip-irrigation subsidies in their interview. Although CIPA is an NGO, it also has a farm that it uses to hold training sessions. This farm is currently approved to get government-subsidized drip irrigation; however, CIPA is still waiting to actually get the funding. This sheds light on another issue, receiving these subsidies may take a long time even after having the subsidy approved. This decreases the subsidy's effectiveness at ameliorating water scarcity difficulties in a timely manner.

Governmental organizations could better assist farmers by providing trainings specific to the conditions that the farmers find locally (e.g., an arid climate, seasonal flooding, soil content and nutrients, etc.). Organizations should cover techniques on how farmers can deal with these conditions year-round. Permaculture techniques and a higher level of biodiversity on farms are two mechanisms that interviewed farmers apply to their land to help combat these issues. However, farmers learned these mechanisms through experimentation and resources from entities other than the government. The team addresses this gap in resources in the recommendations section.

While the government faces difficulties in forming individualized relationships with niche groups of farmers within the agricultural sector, it has created entities, laws and

regulations that can benefit individuals. For example, the creation of FIMABIO was a step the Ministry of Agriculture took to support organic farmers in Morocco. Although the intention behind creating FIMABIO was to create a resource for all natural and organic farmers, the governmental organization is only able to have a limited scope. Consequently, they design their services mostly for large-scale organic certified farmers due to the economic benefits that these farms bring to the Moroccan economy.

FIMABIO, along with other governmental organizations, need to be aware of the importance of small-scale farmers' contribution to the Moroccan GDP and the country's food security. Based off the stories that farmers shared during farm visits and interviews, the team deduced that current government initiatives to support organic and natural farmers in Morocco are not accessible or well-known. Governmental organizations meant to support farmers need further development in order to properly promote sustainable agriculture in Morocco.

5 Recommendations

This study investigated the challenges that farmers in Morocco face and the resources at their disposal to overcome these obstacles. Based on the results of this investigation, the team devised a list of recommendations for our sponsor, Ribat Al Fath. These recommendations provide guidelines and key focal points for organizations in Morocco striving to benefit its agricultural sector

5.1 Organic Seed Distributor in Morocco

Governmental and non-governmental organizations in Morocco are attempting to promote organic farming practices due to the benefits they bring to the land and to the economy; however, the lack of an organic seed distributor hinders this movement. Farmers must attain seeds through three different means - from local farmers, from their own crops, or from other countries. If farmers wish to classify their farms as organic while only having access to non-organic seeds, they must spend three years cultivating these seeds without the use of chemicals before the seeds become organic. This long and arduous task makes farmers less likely to alter their routine farming practices. Through our farmer interviews, a recurring theme the farmers brought up was the desire for organic seeds inside Morocco. The team recommends that organizations unite and establish the creation of an organic seed distributor in Morocco in order to potentially increase the use of organic farming practices.

Creating a seed distributor would not only benefit the farmers, but it would also bring more revenue into Morocco. The lack of an organic distributor in Morocco causes many farmers to spend their money on organic seeds from other countries. By purchasing foreign seeds, the farmers remove money from the economy that the country could easily retain by creating an organic seed distributor.

5.2 Organic Labeling System

Currently, farmers in Morocco who desire to label their produce as organic must purchase organic certifications through another country. This is often a difficult, time consuming, and expensive process that prevents farmers from using organic practices and from obtaining the monetary increase that they could receive from labeling their produce organic. The team recommends that the government, or non-governmental organizations create a Moroccan organic labeling system for the benefit of farmers and to Morocco as a whole. If Moroccan organizations created a labeling system, they could regulate the certification price to make the organic sector more accessible and inclusive to Moroccan farmers. By reducing the cost and difficulty inherent with becoming organically certified, the number of organic farms is likely to increase. These farmers could then apply the organic labels to their produce and sell it for a higher price than if they did not possess a label, which would increase the farmers return on investment for their farming practices. This organic produce could then either be sold in the local markets to consumers who would receive the health benefits of cultivation without the application of chemicals or exported to other countries where the organic label would increase the produce's value.

5.3 Promotion of Cooperatives

While there are market places throughout Morocco where farmers can sell their produce, the markets are not accessible for all small-scale farmers. This research uncovered the fact that many farmers cannot afford the transportation and entrance fees into the markets, which means they must rely on middlemen to sell their produce. The use of middlemen often hampers the farmer's profits. Our study suggests that participation in cooperatives may help farmers avoid their reliance on middlemen and provide them with the access needed to sell their produce in the market place. By joining a cooperative, the farmers would be able to receive a fair value for their produce increasing their profit margin.

The research uncovered that many farmers have a desire to join cooperatives, but have not yet taken this action. Farmers direct their time and energy into sustaining their farms rather than into creating a cooperative. The creation of a cooperative takes time and

often requires help from an external organization that can assist busy farmers. The team recommends that organizations in Morocco promote cooperatives by spreading information about the benefits of participating in a cooperative, and by assisting farmers in creating new cooperatives. Increasing the farmers' participation in cooperatives in Morocco should raise their profit margin and increase the quantity and availability of locally grown food in Morocco.

5.4 Educational Resources in Additional Languages

Morocco is diverse country composed of a variety of cultures that speak dialects distinctly different from one another. Even though Morocco's main languages are French, Amazigh and Arabic, many informative and educational books, pamphlets, and websites about agriculture are solely written in French. Offering these resources in primarily one language does not benefit the whole population of Morocco. The team was made aware of the need to translate resources and services into commonly used dialects of Arabic such as Modern Standard and Darija, as well as into Amazigh. The team recommends that organizations provide translations of educational material about agriculture in several languages to make innovative farming techniques and technology more accessible to rural farmers that only speak a dialect of Arabic or Amazigh. As Moroccan farmers become better-informed about new, more sustainable farming methods, Morocco can reduce water consumption through efficient irrigation and self-sufficient farming.

The information that organizations translate into various languages to distribute should also cover information relating to the value of produce in the market and about the dangers of relying on middlemen. Rural farmers who cannot get to markets or understand the languages that information is available in, are often unaware of the true value of their produce. Middlemen take advantage of this fact by buying the farmer's produce cheap and then bringing it to the market and selling it for significantly more than they bought it for. This allows the middlemen to profit at the farmers' expense. If farmers had access to information about the current market prices for the types of produce they grow, they would know how much to charge middlemen for their produce. This information would reduce the likelihood of middlemen taking advantage of farmers and allow the farmers to maximize their profits.

5.5 Organic Training Classes

Although governmental organizations are encouraging farmers to transition from non-organic to organic practices, there is still a lack of organic training sessions available for farmers in Morocco. In the seven weeks prior to visiting Morocco, the team's research focused on the roles of agricultural advice centers in Moroccan organic agriculture. However, upon interacting with organic and natural farmers in Morocco, the team realized that agricultural advice centers had little impact on the agricultural sector and provided minimal assistance to organic farmers. These advice centers primarily offer training courses and information tailored specifically for conventional farmers due to their commonly known and used practices. The team recommends that governmental and non-governmental organizations provide farmers with resources and services about innovative organic techniques. Currently, one of the most common methods for farmers to learn about organic and permaculture techniques is by networking with other farmers. Since some farmers have little to no access to instruction about these techniques, if organizations provide farmers with information on non-conventional practices, it could significantly decrease the agricultural sectors' reliance on chemicals in Morocco.

The team suggests that training should occur at a variety of locations - at model farms, at agricultural advice centers, and at farmer's farms. The main purpose of the model farm training sessions is to show farmers that natural farming practices have the potential to make farms thrive. Agricultural advice centers are distributed throughout Morocco, so if they host organic specific training session, they can reach and impact a large quantity of people. These training sessions should focus on providing farmers with cultivation techniques and the instructors should attempt to tailor their courses to the attending farmers. During the training classes on farms, the instructors can witness the farmers' individual practices and suggest strategies for them to adapt and integrate new techniques into their current farming practices. The combination of these services would improve Moroccan farmers' accessibility to organic and natural farming practices and would help Morocco's agricultural sector improve its sustainability.

5.6 Deliverable

This project identified the real-world problems that small-scale Moroccan farmers confront and investigate solutions for these hurtles. After observing how much relationships and trust influence Moroccan culture and life, the team decided to synthesize a visual representation of the farmers' stories to create a booklet that Ribat Al Fath can distribute to the participants of this study. This booklet will enhance the collaboration and communication of ideas between farmers in the region of focus as well as connect them with farmers outside of the Greater Rabat Region in the future. The team designed these graphics using the most important and unique information about farmers, pictures taken at the farmers' farms and quotes spoken by the farmers themselves. The team created two sample pages from this booklet to inspire future students and members of the agricultural community in Rabat to continue a similar initiative. The two examples of booklet pages are shown below in Appendix X with the recommendation that Ribat Al Fath or any similar organization completes this booklet with the assistance of the farmer interview questions and answers in Appendices A and E-O. The information presented in this booklet will inform farmers about the overarching themes that the team deduced from coding such as: whether their farm is organic or natural, challenges they face, solutions they employ, and the type of assistance that they attain from different organizations. The goal of this booklet is to create a compilation of all the farmers located within the greater Rabat region and to provide these farmers with useful networking information about agriculture.

Going forward, the team suggests that a future collaborative project occur which expands upon this booklet. The future research should be to continue to interview new farmers that this project team was unable to interview due to the projects' time constraints and then to compile this information and represent the farmers' stories using similar booklet pages as those shown in Appendix X. Future project teams or a Moroccan non-governmental organization should then translate these booklets into a variety of languages and distribute them in printed copies and publish them online. Farmers could then use this booklet to find other farmers facing similar challenges. and collaborate to overcome their obstacles.

6 Future Work

This section proposes recommendations for future project teams that work with Ribat Al Fath to improve the project processes' efficiency.

6.1 Schedule interviews and trips prior to being in Morocco

Upon arrival in Morocco, Ribat Al Fath provided the team with the contact information for several organizations in Morocco that would influence the project. The team then had to contact them to schedule interviews and visits. Reaching out to the organizations and determining the logistics of these visits was quite difficult due to the projects' seven-week constraint. The optimal time frame to conduct interviews is weeks two through four; however, the interviews did not occur until weeks three and five because of scheduling difficulties. Due to the interviews' lateness in the project process, the team was unable to complete the booklet deliverable containing the farmer's stories. In the future, teams working with Ribat Al Fath should request that the NGO provides the team with the project's primary stakeholders contact information during the preparatory course. Future teams can then contact their stakeholders and construct a tentative schedule before arriving in Morocco. This schedule will optimize the timing and frequency of their interviews upon their arrival in Morocco.

6.2 Understanding and preparing for the language barrier

During the duration of this project, the language barrier was a major obstacle for the study. Without prior knowledge of French or Arabic, the team found it difficult to understand data documented online (typically in French) or what the people interviewed were saying. This led the team to rely heavily on human and online translators, which although effective, causes the team to waste time and energy that they could have applied

to other aspects of their project. Understanding that there is a language barrier present and working to learn some French or Arabic, especially key words and phrases relating to the project, before arriving in Morocco would allow future teams to be more productive with their time and gather a larger data pool.

7 Conclusion

The project's goal was to collaborate with Ribat Al Fath to identify the challenges that Moroccan farmers face and to propose recommendations for governmental and non-governmental organizations to improve their ability to aid farmers in overcoming their obstacles. The projects' initial purpose was to evaluate strategies to promote organic farming practices through agricultural advice centers. However, upon interviewing farmers, the team concluded that this was an implausible goal given the current state of Morocco's agricultural sector. Via the interviews with farmers and experts in different agricultural fields, the team quickly learned that Morocco lacked an effective support system for non-conventional farming practices. The data from the team's interviews identified key areas where organizations could improve the services that they offer to farmers. There is a demand for organizations in Morocco to create an organic seed distributor, create an organic labeling system, promote participation in cooperatives, provide information in both French and Arabic, encourage participation in cooperatives and the community, and provide training courses specifically for organic and natural farming practices in Morocco. Although these recommendations may not remove all of the difficulties that natural and organic farmers face in Morocco, the team hopes these suggestions will help improve the overall productivity and sustainability of Morocco's agricultural sector. The project team also hopes that a future team or organization applies these recommendations to the agricultural sectors of areas with similar demographics in order to improve the global state of agricultural sustainability, one step at a time.

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Appendices

Appendix A: Questions for Farmer Interviews

- Introductory Statement: Thank you for agreeing to be interviewed by us. We are a team of students from an American university that is researching natural and organic farming in Morocco. In this interview we hope to learn about your farm, farming techniques, the challenges that you experience as a farmer and how you sell your produce. We will ask a series of questions and if any of these questions make you uncomfortable, you do not have to answer that question.
- Confidentiality Statement: We would like to use your name and the name of your farm to give you credit for aiding in this data collection. If you do not wish for us to share this information we will omit your name and only use it as a reference for ourselves.
- Do we have your permission to share your name and your organizations name?
- Do we have your permission to use an audio and/or video recording of this interview?

Farming Techniques:

1. Name of farm: _____
2. Size of farm (in hectares): _____
3. Type of farm: _____
4. Type of Irrigation (if any): _____
5. What types of crops do you currently grow?
6. How long have you been growing these crops?
7. How do you decide what crops to grow?
8. How do you deal with pests, insects, weeds, and diseases?
9. Do you use fertilizers and/or chemicals? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)
10. Where did you learn your farming techniques?
11. Where do you get seeds for your crops?
12. Do you know if your seeds are genetically modified organisms (GMOs)?
13. Do you employ crop rotation?

If Natural:

12a. Why are you not certified as an organic farm?

12b. What benefits do you think there are to running a natural farm?

If Organic:

13a. How did your farm go about receiving an organic certification?

Farming Challenges:

14. As a farmer, what challenges are you facing?
15. What solutions do you employ to combat these challenges?

Marketing:

16. Where do you sell your produce and who are your buyers?
17. How do you decide the price at which you sell your produce?
18. Are you ever asked if your produce is "Organic"? "Natural"? "Pesticide-free"?
19. Do you export your crops?

Resources and educational opportunities:

20. What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?
21. Would you find written documents, visual representations, or in-person meetings to be the most effective means of conveying information about resources and services regarding agriculture?

Appendix B: Questions to Expert Interview with Morocco's Ministry of Water

- Introductory Statement: Thank you for agreeing to answer some questions for us. We are a team of students from an American university researching natural and organic farming in Morocco. In this interview we hope to learn about your organization, the projects that you work on, and how you interact with and support small farmers. We will ask a series of questions and if any of these questions make you uncomfortable, you do not have to answer that question.
- Confidentiality Statement: It would be beneficial to our team to be able to use your name and this organization's name, although if you do not wish for us to share this information we will omit your name and only use it as a reference for ourselves.
- Do we have your permission to share your name and your organizations name?
- Do we have your permission to use an audio and/or video recording of this interview?

1. How much water goes towards agriculture in Morocco?
2. How much is the government of Morocco willing to aid in the adoption of drip irrigation by farmers?
3. How accessible is it for small farmers to obtain irrigation subsidies?
4. Our team heard that in the 1960s, each person had about 3,000 cubic meters of water available for their use each year, what is the current amount of water available to Moroccans?
5. How have increased droughts affected the country's ability to irrigate?
6. What are the social implications of a drought?
7. What classifies something as a drought?
8. How do aquifers work in Morocco?
9. Why has the north-south water transfer system not been implemented?
10. How efficient is your water system?
11. How many hectares of farmland are being equipped with localized irrigation systems each year?
12. How has the lack of rain impacted the amount of water reserved in dams?

Appendix C: Questions to Expert Interviews with Non-Governmental Organizations (FIMABIO and CIPA)

- Introductory Statement: Thank you for agreeing to answer some questions for us. We are a team of students from an American university researching natural and organic farming in Morocco. In this interview we hope to learn about your organization, the projects that you work on, and how you interact with and support small farmers. We will ask a series of questions and if any of these questions make you uncomfortable, you do not have to answer that question.
- Confidentiality Statement: It would be beneficial to our team to be able to use your name and this organization's name, although if you do not wish for us to share this information we will omit your name and only use it as a reference for ourselves.
- Do we have your permission to share your name and your organization's name?
- Do we have your permission to use an audio and/or video recording of this interview?

1. What is your role at this organization?
2. Do you offer resources to small farmers?
3. How many small farmers utilize these services?
4. What types of crops do the farmers that you work with grow?
5. Are these natural or organic?
6. What resources or services do you offer?
7. Do you charge people to use these services?
8. What form(s) are these services offered in?
9. In what languages?
10. Do farmers have to come to your center to receive these services or does your organization send people out to the farms themselves?
11. Out of all of the resources that you offer, which are utilized the most?
12. Do you track how your resources and training sessions affect farming outcomes for the farmers that turn to your organization for support?
13. If so, would you mind sharing this data with us?
14. Does your organization promote organic practices?
15. How do you market your advice and resources to farmers?
16. How does climate change affect your organization?
17. Where do you think you could improve the assistance that you offer to farmers?
18. What do you think you do really well with the assistance that you offer to farmers?

Additional FIMABIO-Specific Questions

1. General overview of organization and what they do.
2. What is most important for us to understand?
3. How do your program offerings differ for large farmers and small farmers?
4. Do you offer incentives in the agricultural sector?
5. What subsidies are offered? And how many?
6. How do you aid organic farmers since they cannot buy organic seeds in Morocco and what is their opinion on seed smuggling?

7. Our team heard through word of mouth that there are few legal organic markets in Morocco. What is your opinion on organic markets in Morocco and why are there so few of them?
8. What is your opinion on middle-men in the produce market and do you how help farmers survive and ensure their produce is being sold for a fair market value?
9. What is your opinion on cooperatives?
10. How does your federation work with agricultural advice centers? Do you have a relationship with them?

Appendix D: Questions to Expert Interview with Coordinator of GIREPSE Project

- Introductory Statement: Thank you for agreeing to answer some questions for us. We are a team of students from an American university researching natural and organic farming in Morocco. In this interview, we hope to learn about your organization, the projects that you work on, and how you interact with and support small farmers. We will ask a series of questions and if any of these questions make you uncomfortable, you do not have to answer that question.
- Confidentiality Statement: It would be beneficial to our team to be able to use your name and this organization's name in our report, although if you do not wish for us to share this information we will omit your name and only use it as a reference for ourselves.
- Do we have your permission to share your name and your organization's name?
- Do we have your permission to use an audio and/or video recording of this interview?

1. What is your background and how did you become involved in project GIREPSE?
2. Within project GIREPSE, what was your role and which organization did you represent?
3. How have increased droughts affected the country's ability to irrigate?
4. What are the social implications of a drought?
5. How has the lack of rain impacted the amount of water reserved in dams?
6. Has this project involved small-scale farmers as a stakeholder? If so, how?
7. What resources and services did you offer to stakeholders, specifically small-scale farmers, to increase their participation in GIREPSE?
8. In what format were workshops offered to stakeholders? How were the decisions made as to who received workshops?
9. In what ways is payment for environmental services included in project GIREPSE and how might this affect small-scale farmers?
10. How does GIREPSE promote organic and natural farming practices?
11. Can you elaborate on GIREPSE's actions to raise public awareness and sensitization towards environmental issues?
12. How was socio-economic data analyzed and applied to this project?
13. How can Moroccans ensure that they apply the suggestions from this project throughout Morocco and ensure that the project has a lasting impact?
14. Can you describe the governments involvement in this project?
15. Was there a partnership of GIREPSE with the Ministry of Agriculture or Ministry of Water? If so, how so? If not, why not?

Appendix E: Farmer Interview with Farm Technician Mustafa

Interviewee: Mustafa (Lead farm technician of Zineb Benrahmoune Idrissi's Farm)
Interviewers: Shahnaz Ghahremani, Sarah Boecker, Maggie Kuck, Shane O'Dell
Interview Date: Monday, January 22nd, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Annie Mellouki of RIAM
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker
Notes taken by: Sarah Boecker and Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Monday, January 22nd, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Type of farm: Natural - Permaculture

Type of Irrigation: Drip Irrigation

What types of crops do you currently grow?

Mustafa explained that Zineb, the owner of the farm, grows vegetables, fruits, medicinal herbs, flowers, and tropical trees, as well as a local variety of figs and prunes.

How long have you been growing these crops?

He answered that Zineb has had her farm for about 15 years.

How are the crops that will be grown decided?

Mustafa explained that Zineb makes the decisions but she has a team of other people on her farm that work together to decide which crops are to be grown.

How do you deal with pests, insects, weeds, and diseases?

This farm uses permaculture techniques in order to fix these problems. This means that they use other plants or herbs in order to protect their crops. They use compost made in their farm from other trees, plants, fruits, etc. and put it over the land for

natural fertilizers. They also allow the chickens and animals to naturally fertilize the land, decreasing the need for chemical fertilizers.

Where did you learn your farming techniques?

Mustafa informed the team that Zineb learned techniques from her family and parents as well as through experimentation with different techniques. She plants certain crops and waits to see what the results are. She also uses online resources to stay informed on new agricultural techniques.

Where do you get seeds for your crops?

Mustafa answered that they get some of their seeds from Association Kokopelli, a non-profit organization based in France, that sells organic seeds. He mentioned that Zineb also uses seeds from her own crops as well as seeds that she exchanges with other local natural and organic farmers.

Do you know if your seeds are genetically modified organisms (GMOs)?

Their seeds are not genetically modified organisms.

Do you employ crop rotation?

Mustafa answered yes, that they employ crop rotation.

Why are you not certified as an organic farm?

Mustafa explained that Zineb doesn't need or want to get an organic certification because she cares more about peoples' trust. Zineb's costumers are always welcomed to come to her farm so they can see exactly how the produce is being made and understand the natural and permaculture techniques that she uses.

What benefits do you think there are to running a natural farm?

Mustafa answered that natural farms tend to have more biodiversity and organic farms usually have one type of crop in each section of the farm.

<u>Farming Challenges:</u>

As a farmer, what challenges are you facing?

Mustafa explained that during the dry months of the year (July through October) the farm faces issues with water scarcity. He said that the crops that they grow need to be able to adapt to more extreme temperature differences and that they are

currently in a critical condition due to the recent droughts. Zineb lost all of her fig trees to a flood after the cracked soil eroded once being saturated with water and it was very devastating for the farm.

What solutions do you employ to combat these challenges?

Mustafa answered that Zineb believes that a passion and love for farming will help them get through these challenges. He explained that they adapt to the differing conditions due to climate change, however, they do not change their ways of natural farming.

Marketing:

Where do you sell your produce and who are your buyers?

Mustafa explained that Zineb encourages people to come straight to the farm to buy products. The farm sells a lot of jams and olives and they prepare baskets to sell to local people as well.

How do you decide the price at which you sell your produce?

Mustafa explained that Zineb and himself as the lead technician make the price choices for their produce. They choose the price based on the amount of labor needed to create the crop in proportion to their crop yield and also factor in the price of the container. He added that they do not use precise mathematics to choose their prices but they make more of an estimate in order to remain efficient.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

Mustafa answered that Zineb's farm has a reputation for creating high quality produce. Many locals and farmers know of her techniques and often use her as a resource to learn how to improve their own farms. These people are aware of the type of farm that Zineb runs and do not ask about it.

Do you export your crops?

Mustafa answered no, they do not export their crops.

Do you mark your produce as being natural? How?

Mustafa explained that they do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

Mustafa informed that team that Zineb gives training lessons to other farmers about the permaculture techniques that she uses however, more information should be accessible to farmers since not all farmers have the resources or knowledge to travel to another farm or seek out trainings for themselves.

Would you find written documents, visual representations, or in-person meetings to be the most effective means of conveying information about resources and services regarding agriculture?

Mustafa answered that having more written resources could assist the teaching and the spreading of information on permaculture techniques to other farmers. He added that Zineb chooses not to have a website and would rather have solely in-person interactions with other famers. In addition to growing natural produce, Zineb also transforms her produce into high quality products like jams and honey that she also sells.

Appendix F: Farmer Interview with Farm Owner Taha Touijri

Interviewee: Taha Touijri (Farm Owner)
Interviewers: Shahnaz Ghahremani, Sarah Boecker, Maggie Kuck, Shane O'Dell
Interview Date: Monday, January 22nd, 2018
Interview Location: Greater Rabat Region, Morocco
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker, Shahnaz Ghahremani
Notes taken by: Sarah Boecker and Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Monday, January 22nd, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Size of farm: 13 acres/5.26 hectares

Type of farm: Natural – Implementing Permaculture

Type of Irrigation: Drip Irrigation fed by rain with well-water as a backup system

What types of crops do you currently grow?

Taha answered that he grows all different kinds of plants including fruits and vegetables, with each being grown in different varieties. He has 14 different types of fruit trees include apples, pears, apricot, plums, and olives.

How long have you been growing these crops?

Taha informed the team that he has been cultivating his farm for approximately 2 years.

How are the crops that will be grown decided?

Taha explained that he decides what he wants to grow on his farm. He bases part of his decision on the climate and the rest on which plants help to support one another in order to create a sustainable ecosystem (permaculture technique). Taha also said that he enjoys experimenting and trying new plants as well as exchanging and buying seeds that seem less common.

How do you deal with pests and insects?

Taha informed the team that he lets his "vegetables and fruits fight against [pests and insects]. It is a kind of natural selection of seeds. The seed has a memory and is stronger to fight the pest." Taha also told the team that he uses black soap and chili pepper as a natural way to help keep pests away.

Where did you learn your farming techniques?

Taha explained that he started farming by learning at Zineb's farm (Zineb is the first farmer we visited who is well known among natural and organic farmers in Morocco). He added that he also learns from friends that come and share their knowledge with him, and that he also uses the Internet as resource.

Where do you get seeds for your crops?

Taha explained that because organic seeds are not available in Morocco, he has to purchase organic seeds from other countries. He prefers to get them from California in the USA since the climate there is comparable to where he farms and therefore the seeds are better equipped to grow on his farm. He also gets seeds from Europe but finds that they do not always grow as well due to climate differences. He explained that France, for example, is colder than Morocco so seeds from France are not as apt for Moroccan weather. Taha also exchanges seeds with other organic and natural farmers in Morocco.

Do you know if your seeds are genetically modified organisms (GMO's)

Taha's seeds are not genetically modified organisms.

Do you employ crop rotation?

Taha answered yes.

Why are you not certified as an organic farm?

Taha said that in his opinion, organic certification is too commercial. He wants people to buy his produce based on the trust that they have in him and his farm. Taha explained that a piece of paper does not always mean much to his consumers and that even those that have a certification could still be secretly farming in a different way. Taha stated, "I feel it is hard to convince and sell but I really want to find a world where I am going to live where people trust each other and this is where I am looking to sell my product."

What benefits do you think there are to running a natural farm?

Taha explained that having a natural farm gives him more freedom to try new things and not have to operate under the strict requirements that an organic certification requires. Since the farmer needs to certify each individual crop that they grow, it is not worth it to certify his plants since he grows new varieties of plants each year.

Farming Challenges:

As a farmer, what challenges are you facing?

Taha said that the first challenge that he is facing is the lack of available information on natural farming and permaculture specifically applying to Morocco. His second challenge is that when workers initially start working on his farm, they desire instant income, and they do not take the time to try and understand the value of long-term investment in his farm. He explained that this is unfortunate since natural farming allows one to get a higher profit in the end but that it just takes more time to set up the farm and cultivate it. Taha said that his third problem is that middlemen can easily take advantage of farmers in the countryside who do not know how much they should be selling their produce. Like Taha, a lot of these farmers do not actually make it to the market themselves to see how much the produce is selling for there.

What solutions do you employ to combat these challenges?

Taha answered that he works to find as many resources as he can in regards to combating these challenges and that he meets and talks to as many new farmers as he can in an effort to exchange information with them. He also challenges his skeptical workers by having them create one plot using his method and one plot using their own method. He lets them observe the difference in yield between the two plots and they decide for themselves which way is better. They usually realize that his way is better than the conventional way.

What have you done so far to deal with droughts and shortages of water?

Taha explained that he does not have a big problem in regards to his water supply since he covers the ground near his crops with hay. The hay helps to retain water and keep the moisture locked into the soil. He does not have to use a lot of irrigation

and can mostly rely on rainwater. He even removed part of his irrigation system after his first year of cultivating his land. He explained to the team that his plants that die during droughts are not as strong as those that survive them so he selects his seeds from the ones that do survive for his next planting season. Taha also added that he is sure to grow varieties of crops near each other in a strategic way since some plants will help retain water for the other plants around them. This is an important part of permaculture farming and also helps to provide varied root lengths in the soil in any one area. This helps to works against soil erosion, which occurs when the land gets very dry and then suddenly heavy rainfall or a flood saturates the dry soil.

Marketing:

Where do you sell your produce and who are your buyers?

Taha answered that he sells his fruits and vegetables in organic markets or just in a souk (Moroccan market). His most plentiful crop that he sells is lemon and since he has so many of them he sells them in multiple locations.

How do you decide the price at which you sell your produce?

Taha explained that he sets the prices of his produce by checking multiple markets and the going price for any given crop. He then tries to set the price so that it is profitable for him but is still affordable to most Moroccans since he believes everyone should be able to afford organic produce. He told the team that one method that helps to keep his costs down is hosting farmers from around the world. The organization for World Wide Opportunities on Organic Farms (WWOOF) organizes these international organic farm workers (WWOOFers) and puts them into contact with farmers who reach out to the organization in search of workers. Taha explained that you give them room and board in exchange for them working on your farm for a few hours each day. This is another great way to share information regarding farming and culture around the world. Regardless of extra help on the farm, the price of organic produce can fluctuate and based on the supply and demand within the produce market. Sometimes organic produce can be sold at

a higher price than conventionally grown produce, and at other times, it the prices of these two types of produce are similar.

Are you ever asked if your produce is "organic"? "natural"? "pesticide-free"?

Taha told the team that many people ask him whether his food is organic certified or natural. He added that even at organic or natural markets people still ask him questions about his produce and that sometimes they are suspicious that he is using chemicals.

Do buyers try to bargain with you for the price of your produce?

Taha answered, "Yes of course." He explained that the people in Rabat seem to bargain a lot and more so than in other cities, whereas the people in Casablanca are willing to pay the fair price if the food is good for their health. In order to combat this, Taha tells people that they need to pay even more money in an effort to encourage them to bargain to a higher final price. This is his only option to stay on his path with permaculture techniques by allowing him to make a profit. Taha also said that it is difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many customers do not trust the farmer.

Are you a part of any cooperatives for selling the specific crops you are growing?

Taha answered that he is not currently a member of any cooperatives but that he is looking to become involved in one with his other farmer friends. He added that in a cooperative there is a higher level of benefits for crop rotation and being able to concentrate on more technical farm matters without worrying about marketing, sales, or price management.

Do you export your crops?

Taha explained that he does not want to export his produce because he believes that he has a job to create a trusting community in his local area before he can consider trying to find trust in other locations, such as other countries.

Do you mark your produce as being natural? How?

Taha told the team that he does not mark his produce as natural but that he just sells it at natural and organic markets without having to specify that that is what it is.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

Aside from access to local organic seeds and more information on natural farming in Morocco specifically, Taha said that he likes the idea of an agricultural extension or advice center. Before the team's interview with Taha, he did not know what an agricultural extension center or agricultural advice center was.

Appendix G: Farmer Interview with Farm Manager A of Farm A

Interviewers: Shahnaz Ghahremani, Sarah Boecker, Maggie Kuck, Shane O'Dell
Interview Date: Monday, January 22nd, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Farm Social Worker
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker
Notes taken by: Sarah Boecker and Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Monday, January 22nd, 2018

Permission to include organization's name in report: No, permission not granted.
Permission to include interviewee's name in report: No, permission not granted.
Permission to use an audio and/or video recording of this interview: No, permission not granted.

Farming Methods:

Name of Farm: Farm A

Size of Farm: 12 hectares, with only 7 cultivated

Type of Farm: Organic – Italian Bio Certified

Type of Irrigation: Drip irrigation fed by well-water

How does your irrigation system work?

The farm possesses a drip irrigation system and has an automatic system that they program each month that applies different quantities of water to different crops. The system pumps water out of a well and into an open basin. The system then distributes the water to the plants through a series of pipes. A problem with this irrigation system is that the sunlight causes green algae to grow inside the water basin and the algae can block the pipes.

What types of crops do you currently grow?

The organically certified crops are: garlic, artichoke, eggplant, beet, broccoli, carrot, cardon, celery, bruxelle cabbage, cauliflower, cabbage, cucumber, coriander, zucchini, fennel, bean, strawberry, green bean, lettuce, corn, mint, turnip, onion, yam, parsley, pea, leak, pepper, potato, pumpkin, radish, tetragonia tetragonioides, tomato, Jerusalem artichoke.

How long have you been growing these crops?

The organization that houses the farm has been farming since 2016.

How are the crops that will be grown decided?

It depends on climate and the chief of agriculture, who will make final decisions.

How do you deal with pests, insects, weeds, and diseases?

They use certified bio products or they will figure out a remedy that uses plants as the treatment.

Do you use fertilizers and/or chemicals? What is each used for? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

They use certified bio pesticides in combination with aromatic plants for treatments.

Where did you learn your farming techniques?

They learned their farming techniques from ecotourism, other countries they have visited, as well as new experiences such as trial and error of experimentation. Since there is no organic association in Morocco that controls the certification, they learned from other people.

Where do you get seeds for your crops?

They re-use seeds that have already been cultivated and they propagate other plants such as palm trees. It takes more times for pitted fruit with pits to grow but they are very strong.

Do you know if your seeds are genetically modified organisms (GMOs)?

No, the farm does not use genetically modified organisms because it is organic.

Do you employ crop rotation?

Yes, they employ crop rotation based on the season.

How did your farm go about receiving an organic certification?

They attained an Italian certification and they need to be aware of every step in the production process for accountability and documentation purposes.

Farming Challenges:

As a farmer, what challenges are you facing?

Climate change adversely affects which crops can be grown. It's a successful harvest if 80% of the crops are harvestable.

What solutions do you employ to combat these challenges?

They face climate change with different seasonal vegetables.

Marketing

Where do you sell your produce and who are your buyers?

They have a restaurant, a bakery, and other stores that sell their products on-site. They also sell crops by the basket size.

How do you decide the price at which you sell your produce?

Prices depends on market prices. It depends on what is comparable in the market to the same quality. They see that prices are too high in Rabat so they lower them. This makes their food prices comparable to fair market prices. The price is also based on supply and demand.

Do buyers try to bargain with you for the price of your produce?

They will sometimes make the price of the product lower than average market price in order to sell the produce.

Are you a part of any cooperatives for selling the specific crops you are growing?

They collaborate with RIAM, organic markets in Agdal, and the foundation of Mohammad VI.

Do you export your crops?

No, they don't export crops.

Do you mark your produce as being organic and how?

Yes, they mark their produce as being organic using labels.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

Not applicable for this farm. They already have an educational garden for students to learn about agricultural techniques first-hand at the center and many resources.

Appendix H: Farmer Interview with Farm Owner Said Akkif

Interviewee: Said Akkif (Farm Owner)
Interviewers: Maggie Kuck, Sarah Boecker, Shahnaz Ghahremani, Shane O'Dell
Interview Date: Tuesday, January 23rd, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Annie Mellouki of RIAM, Mathilde of RIAM
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker
Notes taken by: Sarah Boecker, Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Tuesday, January 23rd, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Type of Farm: Natural - Permaculture

Type of Irrigation: Drip Irrigation fed by well-water

What types of crops do you currently grow?

Different types of tomatoes, fruit trees (fig trees), vegetables, artichokes, broccoli, cactus, cereals, Brussel sprouts, aromatic and medicinal crops, and wild flowers. He has fields dedicated for wheat for bread and couscous. He has 10 different types of cabbages.

How long have you been growing these crops?

He has been growing these crops for 5-6 year without chemicals. His father and him started the farm 8 years ago.

How are the crops that will be grown decided?

He decides himself what he wants to grow based on climate and personal interest and permaculture.

How do you deal with pests, insects, weeds, and diseases?

He uses aromatic crops that prevent insects and pests from disturbing his crops. He also has a wall of cactus that prevents other pests.

Do you use fertilizers and/or chemicals? What is each used for? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

No, he doesn't use chemicals or fertilizers. He uses roaming chickens to graze and fertilize the land.

Where did you learn your farming techniques?

He learned his farming techniques from his father, farming training, and collaborating with other farmers or organizations.

Where do you get seeds for your crops?

His seeds are organic and come from France. He also uses seeds from his own produce. Recently, he has gotten some seeds from Mexico and Mauritania so that the seeds can be better adapted to the more recent extreme temperatures.

Do you know if your seeds are genetically modified organisms (GMOs)?

No, the seeds aren't GMO.

Do you employ crop rotation?

Yes, he employs crop rotation. He would switch the rows he planted in each year back and forth.

Why are you not certified as an organic farm?

He wants to possess an organic certification, but he has not begun the process. He thinks it will help him become more commercialized.

Are there any resources that would help you overcome this?

Solar panels could cut down his electricity costs so he could afford certification.

What benefits do you think there are to running a natural farm?

He leaves weeds and flowers to work with his vegetables to create an ecosystem and because all of the plants are working together it helps with nutrient balance and increasing humidity of the soil.

Farming Challenges:

As a farmer, what challenges are you facing?

He is facing climate change. This year was more difficult to cultivating because there were two months that were too cold and two months that were too hot and dry. The temperature difference makes it hard for crops to grow and happens too quickly for plants to adjust.

What solutions do you employ to combat these challenges?

He tries to buy seeds from Mexico and Mauritania to have seeds adapted to high temperatures.

Marketing:

Where do you sell your produce and who are your buyers?

He sells 12 baskets of produce each week to people Hasna puts in contact with him. He loses money frequently because he is unable to sell enough produce. The market inside of Rabat is too far away for him to travel to for the sale of his produce. He also attempted to sell his produce to a school, but they wanted specific produce such as potatoes which he did not produce enough of, but he had a surplus of vegetables such as cabbages which they did not want, so he was incapable of sustaining the partnership.

How do you decide the price at which you sell your produce?

He works together with Hasna who sets prices and organizes the commercialization of his crops. In order to ensure that the produce sells well, he raises the price.

How do you prevent yourself from selling your produce at a value lower than it should be sold?

There is more investment in natural farming so he must sell the produce for a more expensive price; however, at the end of the month, he has a larger profit than he would if he was non-natural farmer.

Are you a part of any cooperatives for selling the specific crops you are growing?

He is not a part of any cooperatives. The organizers of baskets sometimes sell other farmers produce with his to increase the variety of the materials in the baskets.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

He informs people that it is chemical free and locally grown.

Do you export your crops?

No he does not export any crops.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

He wishes he had another 1well for ground water. He would like solar panels to decrease the cost of the pumps his well uses to irrigate his crops because the electricity is very costly. He also wishes he had more access to transportation to bring his produce to the markets in Rabat on Saturdays. He is aware that there are three agricultural extension centers located in cities around his, but they only understand how commercialized agriculture works. He would be willing to utilizing the center if he were able to learn more about organic and natural cultivation techniques.

Appendix I: Farmer Interview with Cooperative Owner Mohammed of the Bashua Village

Interviewee: Mohammed
Interviewers: Maggie Kuck, Shahnaz Ghahremani Sarah Boecker, Shane O'Dell
Interview Date: Tuesday, January 23rd, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Mathilde of RIAM
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker
Notes taken by: Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Tuesday, January 23rd, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Size of Farm: 0.1 hectares (multiple)

Type of Farm: Natural - Permaculture

Type of Irrigation: Drip-Irrigation fed by government supplied well-water

What types of crops do you currently grow?

Aromatic plants, eggplant, peppers, artichokes, green beans, potatoes, radishes, zucchini and other vegetables and cereals

How long have you been growing these crops?

About 3 years the villagers have been growing natural crops

How are the crops that will be grown decided?

Each villager has their own bit of land and they can decide what they want to grow in each and have the help of Mohammed and the Modern Agriculture organization

How do you deal with pests, insects, weeds, and diseases?

Like other natural and organic farms, they rely on permaculture. They grow aromatic plants to keep pests away and plant varieties of crops to work together to prevent the spread of disease.

Do you use fertilizers and/or chemicals? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

Everything grown relies on permaculture and so they do not use fertilizers or chemicals. The way they help keep good soil is by composting food and old plants, and also allowing sheep and chickens in their crops.

Where did you learn your farming techniques?

A French permaculture expert named and a Canadian permaculture expert (named Alonzo), came to the village to teach the villagers permaculture techniques. Mohammed became interested and learned enough to become an expert in the village and help the others., also came and worked with the Modern Agriculture organization also hosts classes to teach the latest techniques and aid villagers as they need.

Where do you get seeds for your crops?

They harvest seeds from their own crops to use in the village

Do you know if your seeds are genetically modified organisms (GMOs)?

Seeds are non-GMO

Do you employ crop rotation?

Yes.

Why are you not certified as an organic farm?

The farm does not have the proper facilities to certify their produce and especially couscous from the woman's cooperative. Also, because each farmer has their own smaller plot of land each would need a certification which becomes expensive. In the future, they would like to build facilities to be able to certify the cooperative since it is becoming well known and they wish to be able to export it.

What benefits do you think there are to running a natural farm?

There is not a loss of profit due to high certification crops. This also allows farmers to more freely choose what they want to grow.

Farming Challenges:

As a farmer, what challenges are you facing?

With farming specifically, things are going well and they do not face many challenges. There use of permaculture has been working very well.

What solutions do you employ to combat these challenges?

The idea of permaculture is to be able to adapt, so they combat challenges by continuing to do what they do.

Marketing:

Where do you sell your produce and who are your buyers?

People come from nearby villages and Rabat to buy produce. Because this place is popular in ecotourism they get many people from all around Morocco and other tourists who want to see the village and farms and buy from them. With the women's cooperative, the couscous and lentils are being sold in Rabat and in Casablanca (3 tons a month).

How do you decide the price at which you sell your produce?

For the cooperative, they look at how many women are working, how much the crops and material cost and how much time was put in; more like an enterprise. For the villagers who have their own natural crops, they can each set their price based on work and with the help of the Modern Agriculture organization.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

People who come and visit know the food is natural.

Do you export your crops?

No, but they want to export the woman's cooperative products in the future.

Do you mark your produce as being natural? How?

They market their cooperative products as locally grown and natural.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

More training courses would be most beneficially to the people here. It is very hard to leave the village, especially for the women who must stay to watch their children, so it is best to have professionals come to them. They would also like training on transforming their produce into other products as well. With the training, they really need investments into the cooperative and certifications and the means to do the transformations.

Appendix J: Farmer Interview with Farm Owner Rim Sedraoui

Interviewee: Rim Sedraoui (Farm Owner)
Interviewers: Maggie Kuck, Shahnaz Ghahremani Sarah Boecker, Shane O'Dell
Interview Date: Tuesday, January 23rd, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Mathilde of RIAM
Audio Recorded by: Maggie Kuck
Photographically recorded by: Sarah Boecker
Notes taken by: Sarah Boecker, Shahnaz Ghahremani
Transcribed by: Maggie Kuck, Shane O'Dell
Transcription Date: Tuesday, January 23rd, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Size of Farm: 10 hectares, with 3 of these hectares used for oats, wheat and barley

Type of Farm: Organic Certified

Type of Irrigation: Drip-Irrigation, with a natural underground purification system

What types of crops do you currently grow?

Aromatics, fruit trees (including many plums), vegetables. She also has about 300 organic chickens which she uses for eggs.

How long have you been growing these crops?

Rim told the team that she has been farming using natural and organic techniques for multiple years.

How are the crops that will be grown decided?

Based on climate but mostly careful consideration of design to be able to have organic permaculture and follow bio-geometry

How do you deal with pests, insects, weeds, and diseases?

By letting the plants help each other and by using only natural remedies like essential oils.

Where did you learn your farming techniques?

She studied Agrofood Industry Engineering in Madrid and takes classes in Madrid and other countries when she wants to learn more. She'll purposefully look for information first and then travel to where she needs.

Where do you get seeds for your crops?

Like other organic and natural farmers, she brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.

Do you know if your seeds are genetically modified organisms (GMOs)?

Seeds are non-GMO

Do you employ crop rotation?

Yes, every 3-4 years.

Why did you choose to become organic?

Originally, she had many plums and so it would be easy to certify the large crops. She also got certification on all her crops because it helps with the trust between her produce and the consumer. She does not sell her produce commercially and focuses on it being good quality.

How did your farm go about receiving an organic certification?

She went through the process of getting Italian certification because it is the cheapest and easiest to get for Moroccans. Every week she must send in a report on her crops as a part of the certification.

<u>Farming Challenges:</u>

As a farmer, what challenges are you facing?

When Rim first bought the farm she stopped the use of chemicals immediately. As a result, many of the old trees there died because they were so reliant on chemicals. Her neighbors did not believe in the way she was doing things so they even came onto her land and threw chemicals on her trees. Another challenge she faces is balancing making a profit with taking time to design crops that will be self-sustainable and successful. She also finds it challenging to be able to grow a variety of crops when she wants to be sure they are organic. Since there are no organic

seeds sold in Morocco, it becomes harder to get good quality and gets expensive as well.

What solutions do you employ to combat these challenges?

She prioritizes the quality of her produce and animals and takes the time to try out things before incorporating it into everything. For seeds, Rim seeks out what she can and works with what she has. With organic certification, you need to show a receipt that proves the seeds are organic or prove that they are your own which takes a lot of time.

Marketing

Where do you sell your produce and who are your buyers?

Rim delivers boxes of produce weekly to her customers, which are relatively local. She gains customers through word-of-mouth and it is a way that works best for her.

How do you decide the price at which you sell your produce?

She does some calculation into the time spent and initial cost but it would be hard to fully calculate everything. She ends up selling at a price that works for her and the customer but will adjust prices based on the amount of each product she has.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

Her customers know that she possesses an organic certification.

Do you export your crops?

No, and she doesn't have a desire to.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

For Rim, she wishes there were organic seeds available in Morocco and a Moroccan organic certification. She also highlighted the fact that there are very few books written in Arabic on permaculture and natural and organic farming. She has not heard of extension centers or advice centers before.

Appendix K: Farmer Interview with Farm Owner Aymar at Dar Slaoui

Interviewee: Aymar Slaoui
Interviewers: Sarah Boecker, Shahnaz Ghahremani, Shane O'Dell
Interview Date: Wednesday, January 24th, 2018
Interview Location: Greater Rabat Region, Morocco
Audio Recorded by: Shane O'Dell
Photographically recorded by: Sarah Boecker
Notes taken by: Shahnaz Ghahremani, Sarah Boecker
Transcribed by: Shane O'Dell, Shahnaz Ghahremani
Transcription Date: Wednesday, January 24th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Size of Farm: 20 hectares, with only 2 hectares being cultivated

Type of Farm: Natural -Permaculture

Type of Irrigation: Drip-Irrigation

What types of crops do you currently grow?

He grows a large variety of vegetables and legumes, such as artichokes, brussel sprouts, tomatoes, broccoli, fava beans, and lima beans, aromatic plants such as rosemary, lavender, oregano, and nettle, as well as fruits such as oranges, lemons, olives, figs, and strawberries.

How long have you been growing these crops?

The farm has been developing for the past 10 years however, he is still increasing the variety of the plants he grows.

How are the crops that will be grown decided?

Aymar choses which crops he will grow. He is trying to have as much variety as possible. He doesn't want monoculture (having one type of each crop).

How do you deal with pests, insects, weeds, and diseases?

He plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations. The use of permaculture also naturally prevents the spread of diseases from one plant to another.

Do you use fertilizers and/or chemicals? What is each used for? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

He does not use any chemicals in his farming. He only uses natural remedies for his farming challenges. He uses plants to treat and help his other plants.

Where did you learn your farming techniques?

Aymar initially didn't know where to start with his farm but learned through YouTube and online resources. He also was put into contact with other natural farmers in the area and they were able to give him insights. There was a sense of aloneness in his farming training until other farmers collaborated with him and RIAM helped and provided training sessions. Aymar also hosts WWOOFers (organization that links workers with farmers) on his farm. These are international traveling farmers that share their farming knowledge and will live on the farm for a given amount of time

Where do you get seeds for your crops?

He gets his seeds from other countries, like France and Spain and brings them into the country in small amounts. After ordering seeds, it is easier to collect his own seeds since he can only order small amounts at a time. 2-3 years of cultivating that crop, he would have enough of his own seeds to provide himself with the seeds to create produce. He also exchanges seeds with other small farmers.

Do you know if your seeds are genetically modified organisms (GMOs)?

His seeds are not genetically modified organisms.

Do you employ crop rotation?

Yes, he does.

Why are you not certified as an organic farm?

He does not possess a certification because he does not desire to become certified. In order to obtain certification, you need to pass certain tests that the government

determines and the tests take a year to produce results. If there are traces of chemicals in the soil, you must wait 3-5 years before you are able to organically certify the farm. In addition to this, organic farms are monoculture because there are more regulations on what and how you grow, and Aymar believes that biodiversity is very important when it comes to farming because plants can benefit and aid one another.

Are there any resources that would help you overcome this?

He doesn't desire to become an organic farm because he believes that having a diverse and sustainable farm is more important than a label.

What benefits do you think there are to running a natural farm?

Without having an organic certification, it is easy to avoid monoculture and have a wide variety of plants at his farm. These plants can also be grown in close proximity to one instead of being separated and there are many environmental benefits to this kind of growth because the farm becomes more self-sustaining. There are many environmental benefits to using permaculture as well as health benefits to the people that consume the farm's produce.

Farming Challenges:

As a farmer, what challenges are you facing?

A major problem about organic farming is that some crops are seasonal and without the use of chemicals, they can only be grown for part of the year. The demand for these crops is constant throughout the entire year, so figuring out what to grow and how to market produce that might not be in high demand is a significant issue on his farm. Another significant issue with agriculture in Morocco is transportation and marketing. He needed to pay 200 dollars to have someone transport 3 tons' worth of cucumbers to a market to sell them and upon selling all of them, he had only made 180 dollars. This meant that he lost money from selling several tons' worth of produce after months of cultivating the plants and he didn't even have enough to pay his workers. This is outrageous to him and he believes that getting products to the market, especially as a small farmer is a very significant issue in the

agricultural sector. A third issue Aymar has is that since there is no company that sells organic seeds in Morocco, he has difficulty finding seeds that he can trust to be organic.

What solutions do you employ to combat these challenges?

In order to better sell his goods, he started participating in the basket exchange market, where sells a basket of produce for a set price. He is able to pick and choose what crops he puts in each basket, so it allows him to sell produce that may not be in as high demand as the ones that he cannot grow during certain seasons. This also allows him to have a regular means of selling produce so he does not need to pay expensive transportation fees as frequently. To deal with the lack of an organic seed distributor, he smuggles seeds in from France and Spain in small quantities and then slowly cultivates them and harvests their seeds until he has enough of them to properly grow a large quantity of the plant on his farm. However, this is a very slow process which can take several years. In addition to this, he exchanges organic seeds with other farmers that he has connections to in order to increase the variety of crops on his farm.

How have you been adapting to climate change?

The practices that he uses on his farm such as permaculture promote a natural means of fighting climate change because the farm mimics an ecosystem and therefore the plants can work together to increase their efficiency and survivability in the face of water shortages and drastic temperature fluctuations. He believes that climate change has altered the zones of heavy rainfall in Morocco. Northern cities that used to have little rainfall now receive more than ever, while locations that used to get large quantities of rain are now undergoing desertification. He believes that this can actually be a good thing because some places are experiencing a higher rainfall. He also stated that the King is now trying to implement a water system that could transport water from the north to the south where the water will combat this shift in rainfall.

Marketing:

Where do you sell your produce and who are your buyers?

He sells his produce in baskets to the same people each month, as well as in markets. He also allows people to come to his farm and pick 1 Kilogram of any types of produce from his farm for the set price of 20 Dirham. At one point in time he sold his crops to a restaurant. The restaurant made a dish with a colorful variety of his vegetable and proceeded to name it after him.

How do you decide the price at which you sell your produce?

He determines the price of these baskets based off of what he believes is a reasonable price to sell his produce for in terms of the price of produce sold in markets and by other farmers.

Do buyers try to bargain with you for the price of your produce?

He explained that there is a set price per basket for all crops, so no need to bargain.

How do you prevent yourself from selling your produce at a value lower than it should be sold?

He sells a lot of his produce at a low rate in order to give his consumers the option and opportunity to select vegetables they may not pick if they were more expensive. Aymar explained a story about how in the past he used to have pay more in transportation costs for his cucumbers to get to the market than the amount of profit he would make from selling the actual cucumbers. He had to spend more than he earned.

Are you a part of any cooperatives for selling the specific crops you are growing?

He is not a part of any cooperatives for selling his produce.

Do you export your crops?

He does not export his crops internationally.

Do you mark your produce as being natural? How?

He informs his consumers that his crops are natural by explaining how he prefers to use natural remedies to heal his plants from all diseases and pests that may affect them.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

He wished he had more accessibility to a network of experienced farmers where he could learn innovative and unique techniques from in Morocco. He wished he had access to organic seeds in the country of Morocco. He wished there was a school of permaculture where he and other farmers would be able to take courses that the school would offer in terms of agriculture and specifically permaculture.

Appendix L: Farmer Interview with Farm Owner B at Farm B

Interviewers: Sarah Boecker, Shahnaz Ghahremani, Shane O'Dell
Interview Date: Wednesday, January 24th, 2018
Interview Location: Greater Rabat Region, Morocco
Audio Recorded by: Shane O'Dell
Photographically recorded by: Sarah Boecker
Notes taken by: Sarah Boecker, Shahnaz Ghahremani
Transcribed by: Shane O'Dell
Transcription Date: Wednesday, January 24th, 2018

Permission to include organization's name in report: No, permission not granted.
Permission to include interviewee's name in report: No, permission not granted.
Permission to use an audio and/or video recording of this interview: No, permission not granted.

Farming Methods:

Size of Farm: 3 hectares

Type of Farm: Organic Certified – Model farm for marketing purposes

Type of Irrigation: Drip Irrigation – Fed by well water

What types of crops do you currently grow?

They grow a wide variety of plants because they are a test farm and want to show how to grow many different products. Some such things that they grow are aromatics, vegetables, and essential oils such as olive oil and argan oil.

How long have you been growing these crops?

The farm was just purchased by a new owner in October of 2017, but the majority of crops and practices remain the same as they had been with the previous owner.

How are the crops that will be grown decided?

The farm acts as a show room, for a bigger organization, so they grow a very wide variety of crops in order to demonstrate how to grow them and what they should look like to any other farmers who visit for advice or training programs. In addition, the farm has contract with companies and they provide a list of what they would like the farm to grow and the farm then complies.

How do you deal with pests, insects, weeds, and diseases?

In order to combat pests and insects, they grow aromatic plants throughout their farm and the insects avoid these plants because they do not like the smell. In addition to this, they also use the plants they grow as natural pesticides by boiling them in water and pouring the seeped liquid over their plants as a treatment for plants with diseases and pests.

Do you use fertilizers and/or chemicals? What is each used for? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

No, the farm does not use any chemicals. Instead they use natural fertilization such as the use of chicken poop on some of their crops.

Where did you learn your farming techniques?

The new owner of the farm does not do the farming and they are unsure of where their farmers learned their individual techniques. In some cases, the companies that they sell to give them predetermined cultivation practices that they must adhere to or their contract becomes void.

Where do you get seeds for your crops?

They get their seeds from other organic farms in order to ensure that they are truly organic.

Do you know if your seeds are genetically modified organisms (GMOs)?

No, they do not use any GMO seeds.

Do you employ crop rotation?

Yes, they do.

Why did you choose to become organic?

The owner of this farm recently purchased the farm, so she is unsure on why they chose to become organic in the first place, but she believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques.

How did your farm go about receiving an organic certification?

The owner purchased it in October. When she made the purchase, the farm was already a well-established organic farm.

Farming Challenges:

As a farmer, what challenges are you facing?

A large challenge on the farm is how to deal with pests and diseases. As an organic farm, they are unable to use chemical treatments on their plants, so instead they need to find natural ways to combat pests and diseases. They have difficulty implementing these natural treatments because they find it challenging to gather the relevant information that they would need to understand how to use these treatments. The biggest challenge that they are facing is water scarcity. The owner expressed that Morocco's agriculture relies on the rain, and if there is no rain, it is a very big deal. It reduces the overall GDP and makes farming practices harder.

What solutions do you employ to combat these challenges?

They grow a variety of aromatic plants which act as a natural barrier to protect the plants being grown near them because insects do not like the scent that aromatics release and therefore they stay away from them. Additionally, they boil water and soak medicinal plants in the water and then use the mixture as a medicine that they can apply to plants in order to treat diseases and also as another means of repelling insects. In order to combat the lack of water, the farm relies on the usage of drip irrigation as the primary source of water for its crops

How have you been adapting to climate change?

The most significant way that the farm is adapting to climate change is through the use of drip irrigation to supplement the decrease in annual rainfall. This reliance on drip irrigation allows them to grow crops that would otherwise die in the face of climate change.

Marketing:

Where do you sell your produce and who are your buyers?

They primarily export their produce and have contracts to sell to large foreign companies such as L'Oréal.

How do you decide the price at which you sell your produce?

The way to decide the pricing of produce can vary significantly. Some companies such as L'Oréal inform the farm about what they would like and exactly how much they will spend on it and then the farm complies to the numbers provided to them. However, in other cases, the farm must determine the prices of its produce itself. The farm also possesses a marketing team which will modify the prices of certain items based on the quality of the goods, the season, and the supply at demand in the market.

Do buyers try to bargain with you for the price of your produce?

The marketing team and the owner set the prices of the produce and if any consumer has a complaint about the price or wants to bargain, the owner of the farm can slightly modify it.

How do you prevent yourself from selling your produce at a value lower than it should be sold?

There are several things that prevent the produce from being sold for a lower price than they are worth. The first is that by having a marketing team, there are many people working to calculate an accurate price for each individual product. Another way to keep from selling at a lower value than they should is that they have contracts with foreign companies and they work together with these companies to decide on a price that properly reflects the time and effort put into growing the crops.

Are you a part of any cooperatives for selling the specific crops you are growing?

No, they are not a part of any cooperatives; however, they would love to start more partnerships and collaborate with other farmers.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

Customers will ask about the farms' specific practices, but not about if the farm is organic. Some of their clients' demand to know everything about how the crops are grown and will sometimes even request that they be grown in certain ways. These requests can vary from asking to see receipts for the seeds to ensure that they are organic to requesting that they do not use animals to fertilize the soil.

Do you export your crops?

Yes, the farmer exports the majority of the farms crops.

Do you mark your produce as being organic? How?

Yes, the farmer marks the majority of their crops as organic. Certain countries prefer different certification types than others, so the farm possesses multiple types of certifications. When they sell to American companies, they label their products as USDA approved, but when they ship their products to Europe, they label them using the German organic certification.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

They would like for the government to become more involved in the promotion of organic farming. They believe that the government should train technicians that specialize in organic farming techniques and that those technicians should then educate farmers on new organic practices that they can utilize. They also believe that agricultural extension centers are inefficient and lack any useful information about organic practices. They really wish that the agricultural extension centers had relevant information and training programs specifically about organic practices that they could utilize.

Appendix M: Farmer Interview with BOTE Farm owner Madrani

Interviewee: Madrani
Interviewers: Sarah Boecker, Shahnaz Ghahremani, Shane O'Dell
Interview Date: Wednesday, January 24th, 2018
Interview Location: Greater Rabat Region, Morocco
Audio Recorded by: Shane O'Dell
Photographically recorded by: Sarah Boecker
Notes taken by: Shahnaz Ghahremani
Transcribed by: Shane O'Dell
Transcription Date: Wednesday, January 24th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: No, permission not granted.

Farming Methods:

Farm Name: BOTE

Size of Farm: 14 hectares

Type of Farm: Organic Certified (Italian) – experimenting with permaculture

Type of Irrigation: Drip-Irrigation

What types of crops do you currently grow?

He grows a variety of fruits and vegetables such as figs, pomegranates, olive trees, lemon trees, chickpeas, corn, squash, pumpkin, melons and cereals.

How long have you been growing these crops?

He started his farm in the summer of 2017.

How are the crops that will be grown decided?

The owner is testing growing a wide variety of crops to determine which ones are the best adapted to survive and grow with the environment and soil found on his farm.

How do you deal with pests, insects, weeds, and diseases?

He has not had very much experience dealing with pests and diseases because his farm is new, although he plans to only use natural remedies to combat pests and

diseases. He hopes to use permaculture techniques in which the plants will work together to naturally combat these nuisances.

Do you use fertilizers and/or chemicals? What is each used for? Do you have information on what kind of chemicals are in them? (Ask to see labels if they have them)

He does not use any chemicals in his farming. His neighbors often use chemicals and he is so careful about not using chemicals that he even created a screen around his farm to prevent any contamination from other farms.

Where did you learn your farming techniques?

He is an electromechanical engineer that intends to use this farm as his retirement plan. He does not have much experience with farming, but what he does know comes from networking and from information that he found on the internet.

Where do you get seeds for your crops?

He gets his seeds from other countries, like France, Switzerland and the United States and brings them into the country in small amounts. He also purchases seeds through the company Kokopelli.

Do you know if your seeds are genetically modified organisms (GMOs)?

His seeds are not genetically modified organisms.

Do you employ crop rotation?

Yes, he does.

Why did you choose to become organic?

The owner of this farm recently purchased the farm, so she is unsure on why they chose to become organic in the first place, but she believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques.

How did your farm go about receiving an organic certification?

The owner purchased it in October. When she made the purchase, the farm was already a well-established organic farm.

Farming Challenges:

As a farmer, what challenges are you facing?

The most significant problem on the farm is dealing with the weather. Typically, there is only rain during three months of the year. In the dry months of the year, the soil contains no water and it cracks causing cultivation to become very difficult. During the rainy months of the year, the soil retains so much water that it becomes muddy and difficult to walk on. Figuring out a way to manage the water so that the farm can function all year round is a significant challenge on this farm. He also suffers from a lack of information. He is not originally a farmer, so he is inexperienced and does not know all of the cultivation techniques that would benefit his farm.

What solutions do you employ to combat these challenges?

In order to deal with the lack of water during the dry seasons of the year, he employs drip irrigation on his crops. This allows his crops to grow, however, the amount of water needed to moisturize the soil is quite significant and he wants to grow water-retaining plants in the future to reduce his farms' water consumption. He currently has no solution to combat the muddy seasons of the year, but he stated that he was going to look into plants that could help reduce the waters' impact on the farm's soil. In order to combat his lack of information, he is trying to find an agricultural engineer to come to his farm for 5-6 months to guide him and his workers on how to create the most effective farm that they can.

How have you been adapting to climate change?

Since this is a new farm, the owner is experimenting at growing a variety of different plants to see which ones can handle the environment before he starts mass producing any specific type of produce. In addition to this, the farm has 4 wells which feed into a 3-million-liter capacity water basin that can provide water for drip irrigation across the farm. This allows the farm to continue growing crops during the dry months of the year.

Marketing:

Where do you sell your produce and who are your buyers?

Due to the fact that he recently began his farm, he has not started to sell any of his produce.

How do you decide the price at which you sell your produce?

He has not started to sell his produce.

Do buyers try to bargain with you for the price of your produce?

He has not started to sell his produce.

How do you prevent yourself from selling your produce at a value lower than it should be sold?

He has not started to sell his produce.

Are you a part of any cooperatives for selling the specific crops you are growing?

He is not a part of any cooperative; however, he expressed a desire to increase his networking and amount of connections within the farming community.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

He has not started to sell his produce yet, so he does not receive this kind of question. He expressed that he wants to meet the expectations of his consumers so that they will trust in the quality of his produce.

Do you export your crops?

No, he does not export.

Do you mark your produce as being organic? How?

He possesses the Italian Certification (CCPB) which he will use to mark his produce.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

The owner believes that the resources and services that would be the most beneficial would be information and networking. He also stated that there is a lack of support

for organic farming in Morocco and that there should be specific training courses and services designed to aid organic farmers. He would like there to be an organization that could offer training courses and information to farmers about organic practices.

Appendix N: Farmer Interview with Farm Owner Tourya Atarhouch

Interviewee: Tourya Atarhouch (Farm Owner)
Interviewers: Maggie Kuck, Shahnaz Ghahremani, Shane O'Dell
Interview Date: Thursday, January 25th, 2018
Interview Location: Greater Rabat Region, Morocco
Translated by: Annie Mellouki of RIAM
Audio Recorded by: Maggie Kuck
Photographically recorded by: Shahnaz Ghahremani
Notes taken by: Shane O'Dell
Transcribed by: Maggie Kuck
Transcription Date: Thursday, January 25th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Size of Farm: 40 hectares, with only 20 of these being cultivated

Type of Farm: Organic Certified

Type of Irrigation: Drip-Irrigation

What types of crops do you currently grow?

Aromatics, fruit trees, vegetables, cereals (Barley and 3 types of wheat)

How long have you been growing these crops?

4 years

How are the crops that will be grown decided?

Based on climate and permaculture techniques of having plant varieties mixed in to support each other. She also knows the variety her customers like to see.

How do you deal with pests, insects, weeds, and diseases?

By letting the plants help each other

Where did you learn your farming techniques?

She studied Agrofood Industry Engineering, attends classes to fill gaps in knowledge, communicates with other farmers and uses the internet when necessary

Where do you get seeds for your crops?

Like other organic and natural farmers, she brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.

Do you know if your seeds are genetically modified organisms (GMOs)?

Seeds are non-GMO

Do you employ crop rotation?

Yes.

Why did you choose to become organic?

She has enough surface area of each crop that certification is worth it to commercialize a bit more and have the ability to sell in local stores.

How did your farm go about receiving an organic certification?

She went through the process of getting Italian certification on all of her crops.

Farming Challenges:

As a farmer, what challenges are you facing?

The arid climate, harsh weather and remote locations. It is also hard to find workers for the farm.

What solutions do you employ to combat these challenges?

She creates a self-sustaining farm by bring in solar panels to provide the only electricity. She also hired 6 full time farm workers and invites others to work when she requires more assistance. She also uses students to help her as well.

Marketing:

Where do you sell your produce and who are your buyers?

She makes and sells baskets weekly at a market for organic farmers and at Ribat al-Fath. She sells to people who live in and around Rabat.

How do you decide the price at which you sell your produce?

In order to calculate everything, she would need an engineer just working on that. So, she focuses on supply and demand and her knowledge of other organic and natural farmers.

Are you ever asked if your produce is "organic"? "natural"? "Pesticide-free"?

Her customers know that she possesses an organic certification.

Do you export your crops?

No, and she doesn't have a desire to.

Resources and educational opportunities

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

Workers, specifically those educated in organic and natural agriculture. Organic seeds that are available in Morocco.

Appendix O: Farmer Interview with Farm Owner Hamid Ben Mbarak

Interviewee: Hamid Ben Mbarak (Farm Owner)
Interviewers: Sarah Boecker, Maggie Kuck
Interview Date: Wednesday, February 7th, 2018
Interview Location: Azemmour, Morocco
Audio Recorded by: Maggie Kuck
Photographically recorded by: Maggie Kuck, Sarah Boecker, Shahnaz Ghahremani
Notes taken by: Shane O'Dell, Maggie Kuck, Sarah Boecker
Transcribed by: Maggie Kuck
Transcription Date: Thursday, February 8th, 2018

Permission to include farm's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

Farming Methods:

Farm Name: The Green Farm

Size of farm: 40 hectares

Type of farm: Natural - Monoculture

Type of Irrigation: Minimal Drip-Irrigation

What types of crops do you currently grow?

Vegetables (cucumbers, zucchini, green beans), corn

How long have you been growing these crops?

6 months on this farm land

How are the crops that will be grown decided?

He decides what he wants to grow based on weather and what would give him greater variety

How do you deal with pests, insects, weeds, and diseases?

Through organic and natural farming practices

Where did you learn your farming techniques?

His parents are farmers so he grew up learning the techniques and also studied agriculture in France.

Where do you get seeds for your crops?

Europe, mainly France (Kokopelli)

Do you know if your seeds are genetically modified organisms (GMOs)?

Non-GMO

Do you employ crop rotation?

Yes, he uses crop rotation.

Why are you not certified as an organic farm?

The farm does not possess an organic certification yet because there are remnants of chemicals in the soil, so he cannot get his farm certified for several years. Hamid does want to certify his crops as soon as he can.

Farming Challenges:

As a farmer, what challenges are you facing?

To Hamid, Moroccan farmers, as a whole, face a few key challenges. These include access to clean water, renewable energy and the motivation for Moroccans and immigrants to work to earn money. He also mentioned the problem of organic seeds not being available in Morocco. On top of that, he mentioned the problems of middle men taking money from small farmers and that the government focuses on exportation first rather than the produce that can be sold in Morocco. Specifically, since Hamid lives on the coast, he spoke about the challenge of preserving the land. Since Azemmour is an area that has a lot of potential for tourism and urbanization, private companies and the government want to use the land to build instead of preserving it for farming. Farmland on the coast though is quite ideal because it naturally possesses more surface water and the potential for desalinization to provide more water.

Marketing:

Where do you sell your produce and who are your buyers?

He sells the produce in Casablanca for now through a middle man to be able to bring the produce from where he is in Azemmour to Casablanca. His goal is to have more people come to him to buy produce and start up some other projects for ecotourism but is still in the early stages and waiting for approval to build on his land.

Resources and Educational Opportunities:

What resources and services do you wish you had at your disposal to make your farm more efficient or sustainable?

Because of Hamid's extensive background and experience in both agriculture and engineering, he does not feel as if he personally needs more resources and services from Morocco. He only desires that permits and authorization be easier and also faster for himself and other farms because delays in his projects costs more time and money.

Appendix P: Coding Key

Codes

- Farming Techniques
- Organic *bolded
- Natural *not bolded
- Challenges
- Seeds
- Water scarcity
- Marketing
- Lack of resources
- Solutions
- Trust
- Cooperatives
- Permaculture/Biodiversity
- Adaptability
- Support
- Government
- NGO
- Agricultural Community (Parents, farmers, friends, etc.)

Appendix Q: Farmer Interview Transcriptions with Coding Highlights

Farmer Interview with Farm Technician Mustafa

- Mustafa explained that Zineb, the owner of the farm, grows vegetables, fruits, medicinal herbs, flowers, and tropical trees, as well as a local variety of figs and prunes.
- This farm uses permaculture techniques in order to fix these problems. This means that they use other plants or herbs in order to protect their crops. They use compost made in their farm from other trees, plants, fruits, etc. and put it over the land for natural fertilizers. They also allow the chickens and animals to naturally fertilize the land, decreasing the need for chemical fertilizers.
- Mustafa informed the team that Zineb learned techniques from her family and parents as well as through experimentation with different techniques. She plants certain crops and waits to see what the results are. She also uses online resources to stay informed on new agricultural techniques.
- Mustafa informed the team that Zineb learned techniques from her family and parents as well as through experimentation with different techniques.
- Mustafa answered that they get some of their seeds from Association Kokopelli, a non-profit organization based in France, that sells organic seeds. He mentioned that Zineb also uses seeds from her own crops as well as seeds that she exchanges with other local natural and organic farmers.
- Their seeds are not genetically modified organisms.
- Mustafa answered yes, that they employ crop rotation.
- Mustafa explained that Zineb doesn't need or want to get an organic certification because she cares more about peoples' trust. Zineb's costumers are always welcomed to come to her farm so they can see exactly how the produce is being made and understand the natural and permaculture techniques that she uses.
- Mustafa answered that natural farms tend to have more biodiversity and **organic farms usually have one type of crop in each section of the farm.**
- Mustafa answered that natural farms tend to have more biodiversity.
- Mustafa explained that during the dry months of the year (July through October) the farm faces issues with water scarcity. He said that the crops that they grow need to be able to adapt to more extreme temperature differences and that they are currently in a critical condition due to the recent droughts. Zineb lost all of her fig trees to a flood after the cracked soil eroded once being saturated with water and it was very devastating for the farm.
- Mustafa answered that Zineb believes that a passion and love for farming will help them get through these challenges. He explained that they adapt to the differing conditions due to climate change, however, they do not change their ways of natural farming
- Mustafa explained that Zineb encourages people to come straight to the farm to buy products. The farm sells a lot of jams and olives and they prepare baskets to sell to local people as well.
- Mustafa explained that Zineb and himself as the lead technician make the price choices for their produce. They choose the price based on the amount of labor needed to create the

crop in proportion to their crop yield and also factor in the price of the container. He added that they do not use precise mathematics to choose their prices but they make more of an estimate in order to remain efficient.

- Mustafa answered that Zineb's farm has a reputation for creating high quality produce. Many locals and farmers know of her techniques and often use her as a resource to learn how to improve their own farms. These people are aware of the type of farm that Zineb runs and do not ask about it.
- Mustafa explained that they do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.
- Mustafa explained that they do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.
- Mustafa informed that team that Zineb gives training lessons to other farmers about the permaculture techniques that she uses however, more information should be accessible to farmers since not all farmers have the resources or knowledge to travel to another farm or seek out trainings for themselves.
- Mustafa answered that having more written resources could assist the teaching and the spreading of information on permaculture techniques to other farmers. He added that Zineb chooses not to have a website and would rather have solely in-person interactions with other famers. In addition to growing natural produce, Zineb also transforms her produce into high quality products like jams and honey that she also sells.

Farmer Interview with Farm Owner Taha Touijri

- Taha answered that he grows all different kinds of plants including fruits and vegetables, with each being grown in different varieties. He has 14 different types of fruit trees include apples, pears, apricot, plums, and olives.
- Taha explained that he decides what he wants to grow on his farm. He bases part of his decision on the climate and the rest on which plants help to support one another in order to create a sustainable ecosystem (permaculture technique). Taha also said that he enjoys experimenting and trying new plants as well as exchanging and buying seeds that seem less common.
- Taha informed the team that he lets his "vegetables and fruits fight against [pests and insects]. It is a kind of natural selection of seeds. The seed has a memory and is stronger to fight the pest." Taha also told the team that he uses black soap and chili pepper as a natural way to help keep pests away.
- Taha informed the team that he lets his "vegetables and fruits fight against [pests and insects]. It is a kind of natural selection of seeds. The seed has a memory and is stronger to fight the pest."
- Taha explained that he started farming by learning at Zineb's farm (Zineb is the first farmer we visited who is well known among natural and organic farmers in Morocco). He added that he also learns from friends that come and share their knowledge with him, and that he also uses the Internet as resource.
- Taha explained that because organic seeds are not available in Morocco, he has to purchase organic seeds from other countries. He prefers to get them from California in the USA since the climate there is comparable to where he farms and therefore the seeds are better equipped to grow on his farm. He also gets seeds from Europe but finds that they do not

always grow as well due to climate differences. He explained that France, for example, is colder than Morocco so seeds from France are not as apt for Moroccan weather. Taha also exchanges seeds with other organic and natural farmers in Morocco.

- Taha also exchanges seeds with other organic and natural farmers in Morocco.
- Taha's seeds are not genetically modified organisms.
- Taha answered yes, he employs crop rotation.
- Taha said that **in his opinion, organic certification is too commercial.** He wants people to buy his produce based on the trust that they have in him and his farm. Taha explained that a piece of paper does not always mean much to his consumers and that even those that have a certification could still be secretly farming in a different way. Taha stated, "I feel it is hard to convince and sell but I really want to find a world where I am going to live where people trust each other and this is where I am looking to sell my product."
- **Taha explained that…even those that have a certification could still be secretly farming in a different way**.
  Taha explained that having a natural farm gives him more freedom to try new things and not have to operate under the strict requirements that an organic certification requires. Since the farmer needs to certify each individual crop that they grow, it is not worth it to certify his plants since he grows new varieties of plants each year.
- **The farmer needs to certify each individual crop that they grow.**
- Taha said that the first challenge that he is facing is the lack of available information on natural farming and permaculture specifically applying to Morocco. His second challenge is that when workers initially start working on his farm, they desire instant income, and they do not take the time to try and understand the value of long-term investment in his farm. He explained that this is unfortunate since natural farming allows one to get a higher profit in the end but that it just takes more time to set up the farm and cultivate it. Taha said that his third problem is that middlemen can easily take advantage of farmers in the countryside who do not know how much they should be selling their produce. Like Taha, a lot of these farmers do not actually make it to the market themselves to see how much the produce is selling for there.
- Taha answered that he works to find as many resources as he can in regards to combating these challenges and that he meets and talks to as many new farmers as he can in an effort to exchange information with them. He also challenges his skeptical workers by having them create one plot using his method and one plot using their own method. He lets them observe the difference in yield between the two plots and they decide for themselves which way is better. They usually realize that his way is better than the conventional way.
  Taha explained that he does not have a big problem in regards to his water supply since he covers the ground near his crops with hay. The hay helps to retain water and keep the moisture locked into the soil. He does not have to use a lot of irrigation and can mostly rely on rainwater. He even removed part of his irrigation system after his first year of cultivating his land. He explained to the team that his plants that die during droughts are not as strong as those that survive them so he selects his seeds from the ones that do survive for his next planting season. Taha also added that he is sure to grow varieties of crops near each other in a strategic way since some plants will help retain water for the other plants around them. This is an important part of permaculture farming and also helps to provide varied root lengths in the soil in any one area. This helps to works against soil erosion, which occurs

when the land gets very dry and then suddenly heavy rainfall or a flood saturates the dry soil.

- Taha answered that he sells his fruits and vegetables in organic markets or just in a souk (Moroccan market). His most plentiful crop that he sells is lemon and since he has so many of them he sells them in multiple locations.
- Taha explained that he sets the prices of his produce by checking multiple markets and the going price for any given crop. He then tries to set the price so that it is profitable for him but is still affordable to most Moroccans since he believes everyone should be able to afford organic produce. He told the team that one method that helps to keep his costs down is hosting farmers from around the world. The organization for World Wide Opportunities on Organic Farms (WWOOF) organizes these international organic farm workers (WWOOFers) and puts them into contact with farmers who reach out to the organization in search of workers. Taha explained that you give them room and board in exchange for them working on your farm for a few hours each day. This is another great way to share information regarding farming and culture around the world. Regardless of extra help on the farm, the price of organic produce can fluctuate and based on the supply and demand within the produce market. Sometimes organic produce can be sold at a higher price than conventionally grown produce, and at other times, it the prices of these two types of produce are similar.
- **The price of organic produce can fluctuate and based on the supply and demand within the produce market. Sometimes organic produce can be sold at a higher price than conventionally grown produce, and at other times, it the prices of these two types of produce are similar.**
- Taha told the team that many people ask him whether his food is organic certified or natural. He added that even at organic or natural markets people still ask him questions about his produce and that sometimes they are suspicious that he is using chemicals.
- Taha answered, "Yes Of Course." He explained that the people in Rabat seem to bargain a lot and more so than in other cities, whereas the people in Casablanca are willing to pay the fair price if the food is good for their health. In order to combat this, Taha tells people that they need to pay even more money in an effort to encourage them to bargain to a higher final price. This is his only option to stay on his path with permaculture techniques by allowing him to make a profit. Taha also said that it is difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many customers do not trust the farmer.
- Taha also said that it is difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many customers do not trust the farmer.

  Taha answered that he is not currently a member of any cooperatives but that he is looking to become involved in one with his other farmer friends. He added that in a cooperative there is a higher level of benefits for crop rotation and being able to concentrate on more technical farm matters without worrying about marketing, sales, or price management.
- Taha explained that he does not want to export his produce because he believes that he has a job to create a trusting community in his local area before he can consider trying to find trust in other locations, such as other countries.
- Taha told the team that he does not mark his produce as natural but that he just sells it at natural and organic markets without having to specify that that is what it is.

- Aside from access to local organic seeds and more information on natural farming in Morocco specifically, Taha said that he likes the idea of an agricultural extension or advice center. Before the team's interview with Taha, he did not know what an agricultural extension center or agricultural advice center was.

Farmer Interview with Farm Manager A of Farm A

- The farm possesses a drip irrigation system and has an automatic system that they program each month that applies different quantities of water to different crops. The system pumps water out of a well and into an open basin. The system then distributes the water to the plants through a series of pipes. A problem with this irrigation system is that the sunlight causes green algae to grow inside the water basin and the algae can block the pipes.
- **They use certified bio products or they will figure out a remedy that uses plants as the treatment**.
- **They use certified bio pesticides in combination with aromatic plants for treatments.**
- They learned their farming techniques from ecotourism and other countries they have visited, as well as new experiences such as the trial and error of experimentation. Since there is no bio association in Morocco that controls the certification, they learned from other people.
- They re-use seeds that have already been cultivated and they propagate other plants such as palm trees. It takes more times for pitted fruit with pits to grow but they are very strong.
- No, **the farm does not use genetically modified organisms because it is organic**.
- Yes, **they employ crop rotation based on the season**.
- **They attained an Italian certification and they need to be aware of every step in the production process for accountability and documentation purposes.**
- Climate change adversely affects which crops can be grown. It's a successful harvest if 80% of the crops are harvestable.
- They have a restaurant, a bakery, and other stores that sell their products on-site. They also sell crops by the basket size.
- Prices depends on market prices. It depends on what is comparable in the market to the same quality. They see that prices are too high in Rabat so they lower them. This makes their food prices comparable to fair market prices. The price is also based on supply and demand.
- They will sometimes make the price of the product lower than average market price in order to sell the produce.
- They collaborate with RIAM, organic markets near the residence hall in Agdal, and the foundation of Mohammad VI.
- Yes, they mark their produce as being organic using labels.

Farmer Interview with Farm Owner Said Akkif

- Different types of tomatoes, fruit trees (fig trees), vegetables, artichokes, broccoli, cactus, cereals, Brussel sprouts, aromatic and medicinal crops, and wild flowers. He has fields dedicated for wheat for bread and couscous. He has 10 different types of cabbages.

- He has been growing these crops for 5-6 year without chemicals. His father and him started the farm 8 years ago.
- He uses aromatic crops that prevent insects and pests from disturbing his crops. He also has a wall of cactus that prevents other pests.
- No, he doesn't use chemicals or fertilizers. He uses roaming chickens to graze and fertilize the land.
- He learned his farming techniques from his father, farming training, and collaborating with other farmers or organizations.
- His seeds are organic and come from France. He also uses seeds from his own produce. Recently, he has gotten some seeds from Mexico and Mauritania so that the seeds can be better adapted to the more recent extreme temperatures.
- No, his seeds are not GMO.
- Yes, he employs crop rotation. He would switch the rows he planted in each year back and forth.
- **He wants to possess an organic certification, but he has not begun the process. He thinks it will help him become more commercialized.**
- Solar panels could cut down his electricity costs so he could afford certification.
- He leaves weeds and flowers to work with his vegetables to create an ecosystem and because all of the plants are working together it helps with nutrient balance and increasing humidity of the soil.

  He is facing climate change. This year was more difficult to cultivating because there were two months that were too cold and two months that were too hot and dry. The temperature difference makes it hard for crops to grow and happens too quickly for plants to adjust
- He tries to buy seeds from Mexico and Mauritania to have seeds adapted to high temperatures.
- He sells 12 baskets of produce each week to people Hasna puts in contact with him. He loses money frequently because he is unable to sell enough produce. The market inside of Rabat is too far away for him to travel to for the sale of his produce. He also attempted to sell his produce to a school, but they wanted specific produce such as potatoes which he did not produce enough of, but he had a surplus of vegetables such as cabbages which they did not want, so he was incapable of sustaining the partnership.
- He works together with Hasna who sets prices and organizes the commercialization of his crops. In order to ensure that the produce sells well, he raises the price.
- There is more investment in natural farming so he must sell the produce for a more expensive price; however, at the end of the month, he has a larger profit than he would if he was non-natural farmer.
- He is not a part of any cooperatives. The organizers of baskets sometimes sell other farmers produce with his to increase the variety of the materials in the baskets.
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  in the baskets.
- He informs people that it is chemical free and locally grown.
- He wishes he had another well for ground water. He would like solar panels to decrease the cost of the pumps his well uses to irrigate his crops because the electricity is very costly. He also wishes he had more access to transportation to bring his produce to the markets in

Rabat on Saturdays. He is aware that there are three agricultural extension centers located in cities around his, but they only understand how commercialized agriculture works. He would be willing to utilizing the center if he were able to learn more about organic and natural cultivation techniques.

Farmer Interview with Cooperative Owner Mohammed of the Bashua Village

- They plant aromatic plants, eggplant, peppers, artichokes, green beans, potatoes, radishes, zucchini and other vegetables and cereals.
- Each villager has their own bit of land and they can decide what they want to grow in each and have the help of Mohammed and the Modern Agriculture organization.
- Each villager has their own bit of land and they can decide what they want to grow in each and have the help of Mohammed and the Modern Agriculture organization.
- Like other natural and organic farms, they rely on permaculture. They grow aromatic plants to keep pests away and plant varieties of crops to work together to prevent the spread of disease.
- Like other natural and organic farms, they rely on permaculture. They grow aromatic plants to keep pests away and plant varieties of crops to work together to prevent the spread of disease.
- Everything grown relies on permaculture and so they do not use fertilizers or chemicals. The way they help keep good soil is by composting food and old plants, and also allowing sheep and chickens in their crops.
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- A French permaculture expert and a Canadian permaculture expert (named Alonzo) came to the village to teach the villagers permaculture techniques. Mohammed became interested and learned enough to become an expert in the village and help the others. He also worked with the Modern Agriculture organization, hosts classes to teach the latest techniques, and aids villagers as they need.
- They harvest seeds from their own crops to use in the village.
- Seeds are non-GMO.
- Yes, they employ crop rotation.
- The farm does not have the proper facilities to certify their produce and especially couscous from the woman's cooperative. Because each farmer has his or her own smaller plot of land each would need a certification, which becomes expensive. In the future, they would like to build facilities to be able to certify the cooperative since it is becoming well known and they wish to be able to export crops.
- The farm does not have the proper facilities to certify their produce and especially couscous from the woman's cooperative. Because each farmer has his or her own smaller plot of land each would need a certification, which becomes expensive. In the future, they would like to build facilities to be able to certify the cooperative since it is becoming well known and they wish to be able to export crops.
- The idea of permaculture is to be able to adapt, so they combat challenges by continuing to do what they do.

- People come from nearby villages and Rabat to buy produce. Because this place is popular for ecotourism they get many people from all around Morocco and other tourists who want to see the village and farms and buy from them. With the women's cooperative, the couscous and lentils are being sold in Rabat and in Casablanca (3 tons a month).
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- For the cooperative, they look at how many women are working, how much the crops and material cost and how much time was put in; more like an enterprise. For the villagers who have their own natural crops, they can each set their price based on work and with the help of the Modern Agriculture organization.
- For the cooperative, they look at how many women are working, how much the crops and material cost and how much time was put in; more like an enterprise. For the villagers who have their own natural crops, they can each set their price based on work and with the help of the Modern Agriculture organization.
- They market their cooperative products as locally grown and natural.
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- More training courses would be most beneficially to the people here. It is very hard to leave the village, especially for the women who must stay to watch their children, so it is best to have professionals come to them. They would also like training on transforming their produce into other products as well. With the training, they really need investments into the cooperative and certifications and the means to do the transformations.

Farmer Interview with Farm Owner Rim Sedraoui

- Aromatics, fruit trees (including many plums), vegetables. She also has about 300 organic chickens, which she uses for eggs.
- She grows different types of crops based on climate but mostly careful consideration of design to be able to have organic permaculture and follow bio-geometry.
- She deals with pests and diseases by letting the plants help each other and by using only natural remedies like essential oils.
- She deals with pests and diseases by letting the plants help each other and by using only natural remedies like essential oils.
- She studied Agro-food Industry Engineering in Madrid and takes classes in Madrid and other countries when she wants to learn more. She'll purposefully look for information first and then travel to where she needs.
- Like other organic and natural farmers, she brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.
- Seeds are non-GMO.
- Originally, **she had many plums and so it would be easy to certify the large crops**. She also got certification on all her crops because it helps with the trust between her produce and the consumer. She does not sell her produce commercially and focuses on it being good quality.

- **She went through the process of getting Italian certification because it is the cheapest and easiest to get for Moroccans. Every week she must send in a report on her crops as a part of the certification**.
- When Rim first bought the farm, she stopped the use of chemicals immediately. As a result, many of the old trees there died because they were so reliant on chemicals. Her neighbors did not believe in the way she was doing things so they even came onto her land and threw chemicals on her trees, but once she started to see results, the same neighbors started to come to her for advice. Another challenge she faces is balancing making a profit with taking time to design crops that will be self-sustainable and successful. **She also finds it challenging to be able to grow a variety of crops that are organic**. Since there are no organic seeds sold in Morocco, it becomes harder to get good quality and gets more expensive.
- She prioritizes the quality of her produce and animals and takes the time to try out things before incorporating it into everything. For seeds, Rim seeks out what she can and works with what she has. With organic certification you need to show a receipt that proves the seeds are organic or prove that they are your own which takes a lot of time.
- Rim delivers boxes of produce weekly to her customers, which are relatively local. She gains customers through word-of-mouth and it is a way that works best for her.
- She does some calculation into the time spent and initial cost but it would be hard to fully calculate everything for pricing. She ends up selling at a price that works for her and the customer but will adjust prices based on the amount of each product she has.
- For Rim, she wishes there were organic seeds available in Morocco and a Moroccan organic certification. She also highlighted the fact that there are very few books written in Arabic on permaculture and natural and organic farming. She has not heard of extension centers or advice centers before.

Farmer Interview with Farm Owner Aymar at Dar Slaoui

- He grows a large variety of vegetables and legumes, such as artichokes, brussel sprouts, tomatoes, broccoli, fava beans, and lima beans, aromatic plants such as rosemary, lavender, oregano, and nettle, as well as fruits such as oranges, lemons, olives, figs, and strawberries.
- Aymar choses which crops he will grow. He is trying to have as much variety as possible. He doesn't want monoculture (having one type of each crop).
- He plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations. The use of permaculture also naturally prevents the spread of diseases from one plant to another.
- He plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations. The use of permaculture also naturally prevents the spread of diseases from one plant to another.
- He does not use any chemicals in his farming. He only uses natural remedies for his farming challenges. He uses plants to treat and help his other plants.
- Aymar initially didn't know where to start with his farm but learned through Youtube and online resources. He also was put into contact with other natural farmers in the area and they were able to give him insights. There was a sense of aloneness in his farming training until other farmers collaborated with him and RIAM helped and provided training sessions.

Aymar also hosts WWOOFer (organization that links workers with farmers) on his farm. These are international traveling farmers that share their farming knowledge and will live on the farm for a given amount of time.

- He gets his seeds from other countries, like France and Spain and brings them into the country in small amounts. After ordering seeds, it is easier to collect his own seeds since he can only order small amounts at a time. 2-3 years of cultivating that crop, he would have enough of his own seeds to provide himself with the seeds to create produce. He also exchanges seeds with other small farmers.
- His seeds are not genetically modified organisms.
- **He does not possess a certification because he does not desire to become certified. In order to obtain certification, you need to pass certain tests that the government determines and the tests take a year to produce results. If there are traces of chemicals in the soil, you must wait 3-5 years before you are able to organically certify the farm. In addition to this, organic farms are monoculture because there are more regulations on what and how you grow**, and Aymar believes that biodiversity is very important when it comes to farming because plants can benefit and aid one another.
- He doesn't desire to become an organic farm because he believes that having a diverse and sustainable farm is more important than an organic label.
- Without having an organic certification, it is easy to avoid monoculture and have a wide variety of plants at his farm. These plants can also be grown in close proximity to one instead of being separated and there are many environmental benefits to this kind of growth because the farm becomes more self-sustaining. There are many environmental benefits to using permaculture as well as health benefits to the people that consume the farm's produce.
- **A major problem about organic farming is that some crops are seasonal and without the use of chemicals, they can only be grown for part of the year**. The demand for these crops is constant throughout the entire year so figuring out what to grow and how to market produce that might not be in high demand is a significant issue on his farm. Another significant issue with agriculture in Morocco is transportation and marketing. He needed to pay 200 dollars to have someone transport 3 tons' worth of cucumbers to a market to sell them and upon selling all of them, he had only made 180 dollars. This meant that he lost money from selling several tons' worth of produce after months of cultivating the plants and he didn't even have enough to pay his workers. This is outrageous to him and he believes that getting products to the market, especially as a small farmer is a very significant issue in the agricultural sector. A third issue Aymar has is that since there is no company that sells organic seeds in Morocco, he has difficulty finding seeds that he can trust to be organic.
- In order to better sell his goods, he started participating in the basket exchange market, where sells a basket of produce for a set price. He is able to pick and choose what crops he puts in each basket, so it allows him to sell produce that may not be in as high demand as the ones that he cannot grow during certain seasons. This also allows him to have a regular means of selling produce so he does not need to pay expensive transportation fees as frequently. To deal with the lack of an organic seed distributor, he smuggles seeds in from France and Spain in small quantities and then slowly cultivates them and harvests their seeds until he has enough of them to properly grow a large quantity of the plant on his farm. However, this is a very slow process, which can take several years. In addition to

this, he exchanges organic seeds with other farmers that he has connections to in order to increase the variety of crops on his farm.

- The practices that he uses on his farm such as permaculture promote a natural means of fighting climate change because the farm mimics an ecosystem and therefore the plants can work together to increase their efficiency and survivability in the face of water shortages and drastic temperature fluctuations.
- He believes that climate change has altered the zones of heavy rainfall in Morocco. Northern cities that used to have little rainfall now receive more than ever while locations that used to get large quantities of rain are now undergoing desertification. He believes that this can actually be a good thing because some places are experiencing a higher rainfall. He also stated that the King is now trying to implement a water system that could transport water from the north to the south where it was needed in order to combat this shift in rainfall.
- He sells his produce in baskets to the same people each month, as well as in markets. He also allows people to come to his farm and pick 1 Kilogram of any types of produce from his farm for the set price of 20 Dirham. At one point in time he sold his crops to a restaurant. The restaurant made a dish with a colorful variety of his vegetable and proceeded to name it after him.
- He determines the price of these baskets based off of what he believes is a reasonable price to sell his produce for in terms of the price of produce sold in markets and by other farmers.
- He explained that there is a set price per basket for all crops, so no need to bargain.
- He sells a lot of his produce at a low rate in order to give his consumers the option and opportunity to select vegetables they may not pick if they were more expensive. Aymar explained a story about how in the past he used to have pay more in transportation costs for his cucumbers to get to the market than the amount of profit he would make from selling the actual cucumbers. He had to spend more than he earned.
- He informs his consumers that his crops are natural by explaining how he prefers to use natural remedies to heal his plants from all diseases and pests that may affect them.
- The resources and services he wished he had is more accessibility to a network of experienced farmers where he could learn innovative and unique techniques from in Morocco. He wished he had access to organic seeds in the country of Morocco. He wished there was a school of permaculture where he and other farmers would be able to take courses that the school would offer in terms of agriculture and specifically permaculture.

Farmer Interview with Farm Owner B at Farm B

- They grow a wide variety of plants because they are a test farm and want to show how to grow many different products. Some such things that they grow are aromatics, vegetables, and essential oils such as olive oil and argan oil.
- The farm acts as a show room, for a bigger organization, so they grow a very wide variety of crops in order to demonstrate how to grow them and what they should look like to any other farmers who visit for advice or training programs. In addition, the farm has contract with companies and they provide a list of what they would like the farm to grow and the farm then complies.
- In order to combat pests and insects, they grow aromatic plants throughout their farm and the insects avoid these plants because they do not like the smell. In addition to this, they

also use the plants they grow as natural pesticides by boiling them in water and pouring the seeped liquid over their plants as a treatment for plants with diseases and pests.

- No, the farm does not use any chemicals. Instead they use natural fertilization such as the use of chicken poop on some of their crops.
- The new owner of the farm does not do the farming and she is unsure on where the farmers learned their individual techniques. In some cases, the companies that they sell to give them predetermined cultivation practices that they must adhere to or their contract becomes void.
- They get their seeds from other organic farms in order to ensure that they are truly organic.
- No, they do not use any GMO seeds.
- The owner of this farm recently purchased the farm, so she is unsure on why they chose to become organic in the first place, but **she believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques**.
- A large challenge on the farm is how to deal with pests and diseases. As an organic farm, they are unable to use chemical treatments on their plants, so instead they need to find natural ways to combat pests and diseases. They have difficulty implementing these natural treatments because they find it challenging to gather the relevant information that they would need to understand how to use these treatments. The biggest challenge that they are facing is water scarcity. The owner expressed that Morocco's agriculture relies on the rain, and if there is no rain, it is a very big deal. It reduces the overall GDP and makes farming practices harder.
- They grow a variety of aromatic plants which act as a natural barrier to protect the plants being grown near them because insects do not like the scent that aromatics release and therefore they stay away from them. Additionally, they boil water and soak medicinal plants in the water and then use the mixture as a medicine that they can apply to plants in order to treat diseases and also as another means of repelling insects. In order to combat the lack of water, the farm relies on the usage of drip irrigation as the primary source of water for its crops.
- The most significant way that the farm is adapting to climate change is through the use of drip irrigation to supplement the decrease in annual rainfall. This reliance on drip irrigation allows them to grow crops that would otherwise die in the face of climate change.
- The way to decide the pricing of produce can vary significantly. Some companies such as L'Oréal inform the farm about what they would like and exactly how much they will spend on it and then the farm complies to the numbers provided to them. However, in other cases, the farm must determine the prices of its produce itself. The farm also possesses a marketing team which will modify the prices of certain items based on the quality of the goods, the season, and the supply at demand in the market.
- The marketing team and the owner set the prices of the produce and if any consumer has a complaint about the price or wants to bargain, the owner of the farm can slightly modify it.
- There are several things that prevent the produce from being sold for a lower price than they are worth. The first is that by having a marketing team, there are many people working to calculate an accurate price for each individual product. Another way to keep from selling at a lower value than they should is that they have contracts with foreign companies and

they work together with these companies to decide on a price that properly reflects the time and effort put into growing the crops.

- No, they are not a part of any cooperatives; however, they would love to start more partnerships and collaborate with other farmers.
- They primarily export their produce.
- **The farmer marks the majority of their crops as organic. Certain countries prefer different certification types than others, so the farm possesses multiple types of certifications. When they sell to American companies, they label their products as USDA approved, but when they ship their products to Europe, they label them using the German organic certification.**
- They would like for the government to become more involved in the promotion of organic farming. They believe that the government should train technicians that specialize in organic farming techniques and that those technicians should then educate farmers on new organic practices that they can utilize. They also believe that agricultural extension centers are inefficient and lack any useful information about organic practices. They really wish that the agricultural extension centers had relevant information and training programs specifically about organic practices that they could utilize.

Farmer Interview with BOTE Farm Owner Madrani

- He grows a variety of fruits and vegetables such as figs, pomegranates, olive trees, lemon trees, chickpeas, corn, squash, pumpkin, melons and cereals.
- The owner is testing growing a wide variety of crops to determine which ones are the best adapted to survive and grow with the environment and soil found on his farm.
- He has not had very much experience dealing with pests and diseases because his farm is new, although he plans to only use natural remedies to combat pests and diseases. He hopes to use permaculture techniques in which the plants will work together to naturally combat these nuisances.
- He is an electromechanical engineer that intends to use this farm as his retirement plan. He does not have much experience with farming, but what he does know comes from networking and from information that he found on the internet.
- He gets his seeds from other countries, like France, Switzerland and the United States and brings them into the country in small amounts. He also purchases seeds through the company Kokopelli.
- His seeds are not genetically modified organisms.
- The owner of this farm recently purchased the farm, so she is unsure on why they chose to become organic in the first place, but **she believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques**.
- The most significant problem on the farm is dealing with the weather. Typically, there is only rain during three months of the year. In the dry months of the year, the soil contains no water and it cracks causing cultivation to become very difficult. During the rainy months of the year, the soil retains so much water that it becomes muddy and difficult to walk on. wit the water so that the farm can function all year round is a significant challenge on this

farm. He also suffers from a lack of information. He is not originally a farmer, so he is inexperienced and does not know all of the cultivation techniques that would benefit his farm.

- In order to deal with the lack of water during the dry seasons of the year, he employs drip irrigation on his crops. This allows his crops to grow, however, the amount of water needed to moisturize the soil is quite significant and he wants to grow water-retaining plants in the future to reduce his farms' water consumption. He currently has no solution to combat the muddy seasons of the year, but he stated that he was going to look into plants that could help reduce the waters' impact on the farm's soil. In order to combat his lack of information, he is trying to find an agricultural engineer to come to his farm for 5-6 months to guide him and his workers on how to create the most effective farm that they can.
- Since this is a new farm, the owner is experimenting at growing a variety of different plants to see which ones can handle the environment before he starts mass producing any specific type of produce. In addition to this, the farm has 4 wells, which feed into a 3-million-liter capacity water basin that can provide water for drip irrigation across the farm. This allows the farm to continue growing crops during the dry months of the year.
- He is not a part of any cooperative; however, he expressed a desire to increase his networking and amount of connections within the farming community.
- He has not started to sell his produce yet, so he does not receive this kind of question. He expressed that he wants to meet the expectations of his consumers so that they will trust in the quality of his produce.
- **He possesses the Italian Certification (CCPB), which he will use to mark his produce**.
- The owner believes that the resources and services that would be the most beneficial would be information and networking. He also stated that there is a lack of support for organic farming in Morocco and that there should be specific training courses and services designed to aid organic farmers. He would like there to be an organization that could offer training courses and information to farmers about organic practices
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Farmer Interview with Farm Owner Tourya Atarhouch

- She grows aromatics, fruit trees, vegetables, cereals (Barley and 3 types of wheat).
- Based on climate and permaculture techniques of having plant varieties mixed in to support each other. She also knows the variety her customers like to see.
- She studied Agro-food Industry Engineering, attends classes to fill gaps in knowledge, communicates with other farmers and uses the internet when necessary.
- Like other organic and natural farmers, she brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.
- **She has enough surface area of each crop that certification is worth it to commercialize a bit more and have the ability to sell in local stores**.
- **She went through the process of getting Italian certification on all of her crops**.
- The arid climate, harsh weather and remote locations.
- It is also hard to find workers for the farm.
- She creates a self-sustaining farm by bring in solar panels to provide the only electricity. She also hired 6 full time farm workers and invites others to work when she requires more assistance. She also uses students to help her as well.

- She makes and sells baskets weekly at a market for organic farmers and at Ribat al-Fath. She sells to people who live in and around Rabat.
- In order to calculate everything, she would need an engineer just working on that. So, she focuses on supply and demand and her knowledge of other organic and natural farmers.
- She doesn't have a desire to export crops.
- They wish they had more workers, specifically those educated in organic and natural agriculture and organic seeds that are available in Morocco.

Farmer Interview with Farm Owner Hamid Ben Mbarak

- He decides what he wants to grow based on weather and what would give him greater variety.
- His parents are farmers so he grew up learning the techniques and also studied agriculture in France.
- He gets his seeds from Europe, mainly France (Kokopelli).
- His seeds are not GMO.
- He uses crop rotation.
- **The farm does not possess an organic certification yet because there are remnants of chemicals in the soil, so he cannot get his farm certified for several years. Hamid does want to certify his crops as soon as he can.**
- To Hamid, Moroccan farmers, as a whole, face a few key challenges. These include access to clean water, renewable energy and the motivation for Moroccans and immigrants to work to earn money. He also mentioned the problem of organic seeds not being available in Morocco. On top of that, he mentioned the problems of middlemen taking money from small farmers and that the government focuses on exportation first rather than the produce that can be sold in Morocco.
- Specifically, since Hamid lives on the coast, he spoke about the challenge of preserving the land. Since Azemmour is an area that has a lot of potential for tourism and urbanization, private companies and the government want to use the land to build instead of preserving it for farming. Farmland on the coast though is quite ideal because it naturally possesses more surface water and the potential for desalinization to provide more water.
- He sells the produce in Casablanca for now through a middleman to be able to bring the produce from where he is in Azemmour to Casablanca. His goal is to have more people come to him to buy produce and start up some other projects for ecotourism but is still in the early stages and waiting for approval to build on his land.
- Because of Hamid's extensive background and experience in both agriculture and engineering, he does not feel as if he personally needs more resources and services from Morocco. He desires that permits and authorization be easier and also faster for himself and other farms because delays in his projects costs more time and money.

Appendix R: Coded Comments Organized by Theme with Main Idea Charts

Coding Theme: Organic

- She had many plums and so it would be easy to certify the large crops.
- She went through the process of getting Italian certification because it is the cheapest and easiest to get for Moroccans. Every week she must send in a report on her crops as a part of the certification.
- She also finds it challenging to be able to grow a variety of crops that are organic.
- He does not possess a certification because he does not desire to become certified. In order to obtain certification, you need to pass certain tests that the government determines and the tests take a year to produce results. If there are traces of chemicals in the soil, you must wait 3-5 years before you are able to organically certify the farm. In addition to this, organic farms are monoculture because there are more regulations on what and how you grow, A major problem about organic farming is that some crops are seasonal and without the use of chemicals, they can only be grown for part of the year.
- She believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques.
- The farmer marks the majority of their crops as organic. Certain countries prefer different certification types than others, so the farm possesses multiple types of certifications. When they sell to American companies, they label their products as USDA approved, but when they ship their products to Europe, they label them using the German organic certification.
- She believes that organic farming practices are important because farmers have a responsibility to try to maintain the environment to the best of their abilities and organic practices are far less impactful on the environment than modern farming techniques.
- He possesses the Italian Certification (CCPB), which he will use to mark his produce.
- She has enough surface area of each crop that certification is worth it to commercialize a bit more and have the ability to sell in local stores.
- She went through the process of getting Italian certification on all of her crops.
- The farm does not possess an organic certification yet because there are remnants of chemicals in the soil, so he cannot get his farm certified for several years. Hamid does want to certify his crops as soon as he can.
- Organic farms usually have one type of crop in each section of the farm.
- The farm does not use genetically modified organisms because it is organic.
- They employ crop rotation based on the season.
- They attained an Italian certification and they need to be aware of every step in the production process for accountability and documentation purposes.
- The price of organic produce can fluctuate and based on the supply and demand within the produce market. Sometimes organic produce can be sold at a higher price than conventionally grown produce, and at other times, it the prices of these two types of produce are similar.
- The seeds are not genetically modified.
- They employ crop rotation based on the season.

- They attained an Italian certification and they need to be aware of every step in the production process for accountability and documentation purposes.
- In his opinion, organic certification is too commercial.
- Taha explained that…even those that have a certification could still be secretly farming in a different way.
- The farmer needs to certify each individual crop that they grow.
- He wants to possess an organic certification, but he has not begun the process. He thinks it will help him become more commercialized.

Organic Farming Main Ideas	**Example 1**	**Example 2**
Monoculture makes certification easy, biodiversity makes certification difficult.	When there is a large demand for one product, monoculture is economically successful, such as in Farm B.	Rim only certified her plums at the beginning stage of her farm because of the large portion of land they took up.
An organic certification is valuable for certain commercial purposes.	Farm B is a large international exporter for mainly essential oils and cosmetic products.	Touya's Farm is organically certified in order to export internationally as well as sell locally.
There is no Moroccan certification, so many farmers use international certifications.	Farm A uses the Italian certification for all of its crops.	Farm B uses multiple certifications depending on the location of their target market.

Coding Theme: Natural

- Like other natural and organic farms, they rely on permaculture. They grow aromatic plants to keep pests away and plant varieties of crops to work together to prevent the spread of disease.
- They do not use fertilizers or chemicals. The way they help keep good soil is by composting food and old plants, and also allowing sheep and chickens in their crops.
- Yes, they employ crop rotation
- They market their cooperative products as locally grown and natural.
- She deals with pests and diseases by letting the plants help each other and by using only natural remedies like essential oils.
- He plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations.
- Permaculture naturally prevents the spread of diseases from one plant to another.
- Only uses natural remedies for his farming challenges. He uses plants to treat and help his other plants.
- Without having an organic certification, it is easy to avoid monoculture and have a wide variety of plants at his farm. These plants can also be grown in close proximity to one another instead of being separated**;** there are many environmental benefits to this kind of growth because the farm becomes more self-sustaining.
- He informs his consumers that his crops are natural by explaining how he prefers to use natural remedies to heal his plants from all diseases and pests that may affect them.
- In order to combat pests and insects, they grow aromatic plants throughout their farm and the insects avoid these plants because they do not like the smell. In addition to this, they also use the plants they grow as natural pesticides by boiling them in water and pouring the seeped liquid over their plants as a treatment for plants with diseases and pests.
- They use natural fertilization such as the use of chicken poop on some of their crops.
- They grow a variety of aromatic plants which act as a natural barrier to protect the plants being grown near them because insects do not like the scent that aromatics release and therefore they stay away from them. Additionally, they boil water and soak medicinal plants in the water and then use the mixture as a medicine that they can apply to plants in order to treat diseases and also as another means of repelling insects.
- He lets his “vegetables and fruits fight against [pests and insects]. It is a kind of natural selection of seeds. The seed has a memory and is stronger to fight the pest.” Taha also told the team that he uses black soap and chili pepper as a natural way to help keep pests away.
- Taha’s seeds are not genetically modified organisms.
- He employs crop rotation.
- He uses crop rotation.
- Having a natural farm gives him more freedom to try new things and not have to operate under the strict requirements that an organic certification requires.
- Natural farming allows one to get a higher profit in the end but that it just takes more time to set up the farm and cultivate it.
- It it is not worth it to certify his plants since he grows new varieties of plants each year.
- He has been growing these crops for 5-6 year without chemicals.

- He uses aromatic crops that prevent insects and pests from disturbing his crops. He also has a wall of cactus that prevents other pests.
- He uses roaming chickens to graze and fertilize the land.
- No, his seeds are not GMO.
- Yes, he employs crop rotation.
- They also allow the to naturally fertilize the land, decreasing the need for chemical fertilizers.
- They employ crop rotation.
- Natural farms tend to have more biodiversity.

Natural Farming Main Ideas	**Example 1**	**Example 2**
A successful mechanism for dealing with agricultural challenges is plant-to-plant therapy.	Rim uses essential oils, aromatic/medicinal plants to deal with plant and animal diseases.	Aymar uses an app that informs him of which crops can be symbiotically living with each other. He also uses black soap and chili pepper as natural pesticide.
Natural farming supports crop variation and biodiversity on farms.	Aymar finds it easy to avoid monoculture and have a variety of plants without having an organic certification.	Taha likes to grow new varieties of plants each year, and let the stronger varieties survive. This mimics natural selection.
Allowing your animals to graze where your crops are growing enriches the soil.	Zineb allows her chickens and other animals to naturally fertilize her land. This lowers her dependency on chemicals.	Cooperative Owner Mohammad keeps his soil rich by allowing his sheep and chickens loose in his crops.

Coding Theme: Seeds

- They harvest seeds from their own crops to use in the village.
- Seeds are non-GMO.
- She brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.
- Seeds are non-GMO.
- Since there are no organic seeds sold in Morocco, it becomes harder to get good quality and gets more expensive.
- With organic certification, you need to show a receipt that proves the seeds are organic or prove that they are your own which takes a lot of time.
- For Rim, she wishes there were organic seeds available in Morocco
- He gets his seeds from other countries, like France and Spain and brings them into the country in small amounts. After ordering seeds, it is easier to collect his own seeds since he can only order small amounts at a time. 2-3 years of cultivating that crop, he would have enough of his own seeds to provide himself with the seeds to create produce. He also exchanges seeds with other small farmers.
- His seeds are not genetically modified organisms.
- A third issue Aymar has is that since there is no company that sells organic seeds in Morocco, he has difficulty finding seeds that he can trust to be organic.
- To deal with the lack of an organic seed distributor, he smuggles seeds in from France and Spain in small quantities and then slowly cultivates them and harvests their seeds until he has enough of them to properly grow a large quantity of the plant on his farm. However, this is a very slow process, which can take several years. In addition to this, he exchanges organic seeds with other farmers that he has connections to in order to increase the variety of crops on his farm.
- He wished he had access to organic seeds in the country of Morocco.
- They get their seeds from other organic farms in order to ensure that they are truly organic.
- No, they do not use any GMO seeds.
- He gets his seeds from other countries, like France, Switzerland and the United States and brings them into the country in small amounts. He also purchases seeds through the company Kokopelli.
- His seeds are not genetically modified organisms.
- Like other organic and natural farmers, she brings in seeds from Europe, uses her own seeds and will exchange with other Moroccan organic and natural farmers.
- Wish they had organic seeds that are available in Morocco.
- Their seeds are not genetically modified organisms.
- They get some of their seeds from Association Kokopelli
- Zineb also uses seeds from her own crops as well as seeds.
- He enjoy exchanging and buying seeds that seem less common.
- He lets his “vegetables and fruits fight against [pests and insects]. It is a kind of natural selection of seeds. The seed has a memory and is stronger to fight the pest.”
- Because organic seeds are not available in Morocco, he has to purchase organic seeds from other countries. He prefers to get them from California in the USA since the climate there is comparable to where he farms and therefore the seeds are better equipped to grow on his

farm. He also gets seeds from Europe but finds that they do not always grow as well due to climate differences. He explained that France, for example, is colder than Morocco so seeds from France are not as apt for Moroccan weather. Taha also exchanges seeds with other organic and natural farmers in Morocco.

- They re-use seeds that have already been cultivated and they propagate other plants such as palm trees. It takes more times for pitted fruit with pits to grow but they are very strong.
- His seeds are organic and come from France. He also uses seeds from his own produce. Recently, he has gotten some seeds from Mexico and Mauritania so that the seeds can be better adapted to the more recent extreme temperatures.
- He gets his seeds from Europe, mainly France (Kokopelli).
- He also mentioned the problem of organic seeds not being available in Morocco.

Seeds Main Ideas	Example 1	Example 2	Example 3
A common outside source for organic seeds are through international organic companies.	Taha gets some of his seeds from California because the seeds are adapted to a climate much like Morocco's.	Said gets his seeds from Mexico and Mauritania so that the seeds are resilient to more extreme conditions.	Having limited options for seeds makes it hard for Rim to find an affordable way to import them.
It's illegal to buy and sell organic seeds in Morocco forcing farmers to build communities around individual seed stock.	Taha will trade seeds with other farmers, in particular Rim and Aymar in order to have a wide variety of organic seeds.	Aymar says, it is a slow process for farmers to wait long periods of time just to produce a reasonable amount of seeds for themselves and to trade with others.	Aymar relies on his fellow farmers in order to get a high level of variety in the crops that he grows.

Coding Theme: Water scarcity

- He believes that climate change has altered the zones of heavy rainfall in Morocco. Northern cities that used to have little rainfall now receive more than ever while locations that used to get large quantities of rain are now undergoing desertification. He believes that this can actually be a good thing because some places are experiencing a higher rainfall. He also stated that the King is now trying to implement a water system that could transport water from the north to the south where it was needed in order to combat this shift in rainfall.

- The biggest challenge that they are facing is water scarcity. The owner expressed that Morocco's agriculture relies on the rain, and if there is no rain, it is a very big deal. It reduces the overall GDP and makes farming practices harder.
- In order to combat the lack of water, the farm relies on the usage of drip irrigation as the primary source of water for its crops.
- This reliance on drip irrigation allows them to grow crops that would otherwise die in the face of climate change.
- The most significant problem on the farm is dealing with the weather. Typically, there is only rain during three months of the year. In the dry months of the year, the soil contains no water and it cracks causing cultivation to become very difficult. During the rainy months of the year, the soil retains so much water that it becomes muddy and difficult to walk on. Figuring out a way to manage the water so that the farm can function all year round is a significant challenge on this farm.
- In order to deal with the lack of water during the dry seasons of the year, he employs drip irrigation on his crops. This allows his crops to grow, however, the amount of water needed to moisturize the soil is quite significant and he wants to grow water-retaining plants in the future to reduce his farms' water consumption. He currently has no solution to combat the muddy seasons of the year, but he stated that he was going to look into plants that could help reduce the waters' impact on the farm's soil
- The farm has 4 wells, which feed into a 3-million-liter capacity water basin that can provide water for drip irrigation across the farm. This allows the farm to continue growing crops during the dry months of the year
- During the dry months of the year (July through October) the farm faces issues with water scarcity.
- They are currently in a the recent droughts
- A problem with this irrigation system is that the sunlight causes green algae to grow inside the water basin and the algae can block the pipes.
- Climate change adversely affects which crops can be grown.
- These challenges include access to clean water
- Farmland on the coast though is quite ideal because it naturally possesses more surface water and the potential for desalinization to provide more water.
- Zineb lost all of her fig trees to a flood after the cracked soil eroded once being saturated with water.

Water Scarcity Main Ideas	Example 1	Example 2
Water scarcity is a two-sided issue, with some months having too little rain and some months having too much.	Madrani's biggest challenge is figuring out a way to manage water so that the farm can function all year round. In the dry months of the year the soil cracks, and during the rainy months it becomes muddy and hard to walk on.	Zineb lost all of her fig trees to a flood after the cracked soil eroded once being saturated with water.
Drip Irrigation is a common method of water conservation.	Farm Owner B's drip irrigation allows them to grow crops that would otherwise die in the face of climate change.	Madrani has 4 wells, which feeds into a large water basin. This water supplies his drip irrigation and allows his farm to survive in dry months.
Water-retaining plants are an alternative water conservation method.	Madrani wants to grow water-retaining pants to reduce his farms' water consumption.	

Coding Theme: Marketing

- In the future, they would like to build facilities to be able to certify the cooperative since it is becoming well known and they wish to be able to export crops.
- People come from nearby villages and Rabat to buy produce
- Ecotourism
- Many people from all around Morocco and other tourists who want to see the village and farms and buy from them. With the women's cooperative, the couscous and lentils are being sold in Rabat and in Casablanca (3 tons a month).
- How many women are working, how much the crops and material cost and how much time was put in
- set their price based on work and with the help of the Modern Agriculture organization.
- They market their cooperative products as locally grown and natural.
- She does not sell her produce commercially and focuses on it being good quality.
- Another challenge she faces is balancing making a profit with taking time to design crops that will be self-sustainable and successful
- Rim delivers boxes of produce weekly to her customers, which are relatively local. She gains customers through word-of-mouth and it is a way that works best for her.
- She does some calculation into the time spent and initial cost but it would be hard to fully calculate everything for pricing. She ends up selling at a price that works for her and the customer but will adjust prices based on the amount of each product she has.

- Figuring out what to grow and how to market produce that might not be in high demand is a significant issue on his farm. Another significant issue with agriculture in Morocco is transportation and marketing.
- This is outrageous to him and he believes that getting products to the market, especially as a small farmer is a very significant issue in the agricultural sector.
- Participating in the basket exchange market, where sells a basket of produce for a set price. He is able to pick and choose what crops he puts in each basket, so it allows him to sell produce that may not be in as high demand as the ones that he cannot grow during certain seasons. This also allows him to have a regular means of selling produce so he does not need to pay expensive transportation fees as frequently.
- Sells his produce in baskets to the same people each month, as well as in markets. He also allows people to come to his farm and pick 1 Kilogram of any types of produce from his farm for the set price of 20 Dirham. At one point in time he sold his crops to a restaurant.
- He determines the price of these baskets based off of what he believes is a reasonable price to sell his produce for in terms of the price of produce sold in markets and by other farmers.
- Set price per basket for all crops, so no need to bargain.
- Sells a lot of his produce at a low rate in order to give his consumers the option and opportunity to select vegetables they may not pick if they were more expensive.
- The way to decide the pricing of produce can vary significantly. Some companies such as L'Oréal inform the farm about what they would like and exactly how much they will spend on it and then the farm complies to the numbers provided to them. However, in other cases, the farm must determine the prices of its produce itself. The farm also possesses a marketing team which will modify the prices of certain items based on the quality of the goods, the season, and the supply at demand in the market.
- The marketing team and the owner set the prices of the produce and if any consumer has a complaint about the price or wants to bargain, the owner of the farm can slightly modify it.
- Having a marketing team, there are many people working to calculate an accurate price for each individual product. Another way to keep from selling at a lower value than they should is that they have contracts with foreign companies and they work together with these companies to decide on a price that properly reflects the time and effort put into growing the crops
- They primarily export their produce.
- She makes and sells baskets weekly at a market for organic farmers and at Ribat al-Fath. She sells to people who live in and around Rabat
- She focuses on supply and demand and her knowledge of other organic and natural farmers.
- She doesn't have a desire to export crops
- Zineb encourages people to come straight to the farm to buy products.
- They prepare baskets to sell to local people as well.
- They choose the price based on the amount of labor needed to create the crop in proportion to their crop yield and the also factor in the price of the container. He added that they do not use precise mathematics to choose their prices but they make more of an estimate in order to remain efficient.
- They do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.

- his third problem is that middlemen can easily take advantage of farmers in the countryside who do not know how much they should be selling their produce. Like Taha, a lot of these farmers do not actually make it to the market themselves to see how much the produce is selling for there.
- he sells his fruits and vegetables in organic markets or just in a souk (Moroccan market). His most plentiful crop that he sells is lemon and since he has so many of them he sells them in multiple locations.
- He sets the prices of his produce by checking multiple markets and the going price for any given crop. He then tries to set the price so that it is profitable for him but is still affordable to most Moroccans since he believes everyone should be able to afford organic produce
- The price of organic produce can fluctuate and based on the supply and demand within the produce market. Sometimes organic produce can be sold at a higher price than conventionally grown produce, and at other times, it the prices of these two types of produce are similar.
- many people ask him whether his food is organic certified or natural.
- even at organic or natural markets people still ask him questions about his produce and that sometimes they are suspicious that he is using chemicals.
- The people in Rabat seem to bargain a lot and more so than in other cities, whereas the people in Casablanca are willing to pay the fair price if the food is good for their health. In order to combat this, Taha tells people that they need to pay even more money in an effort to encourage them to bargain to a higher final price. This is his only option to stay on his path with permaculture techniques by allowing him to make a profit. Taha also said that it is difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many customers do not trust the farmer.
- he does not mark his produce as natural but that he just sells it at natural and organic markets without having to specify that that is what it is.
- They do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.
- He sells 12 baskets of produce each week to people Hasna puts in contact with him. He loses money frequently because he is unable to sell enough produce. The market inside of Rabat is too far away for him to travel to for the sale of his produce. He also attempted to sell his produce to a school, but they wanted specific produce such as potatoes which he did not produce enough of, but he had a surplus of vegetables such as cabbages which they did not want, so he was incapable of sustaining the partnership.
- In order to ensure that the produce sells well, he raises the price.
- There is more investment in natural farming so he must sell the produce for a more expensive price; however, at the end of the month, he has a larger profit than he would if he was non-natural farmer.
- The organizers of baskets sometimes sell other farmers produce with his to increase the variety of the materials in the baskets.
- He also wishes he had more access to transportation to bring his produce to the markets in Rabat on Saturdays.
- He informs people that it is chemical free and locally grown.
- They have a restaurant, a bakery, and other stores that sell their products on-site. They also sell crops by the basket size.

- Prices depends on market prices.
- They will sometimes make the price of the product lower than average market price in order to sell the produce.
- They collaborate with RIAM, organic markets near the residence hall in Agdal, and the foundation of Mohammad VI.
- They mark their produce as being organic using labels.
- On top of that, he mentioned the problems of middlemen taking money from small farmers and that the government focuses on exportation first rather than the produce that can be sold in Morocco.
- He sells the produce in Casablanca for now through a middleman to be able to bring the produce from where he is
- His goal is to have more people come to him to buy produce and start up some other projects for ecotourism.

Marketing Main Ideas	Example 1	Example 2
There are various target markets that farmers can sell their produce to.	Said works with Hasna to sell his produce and baskets in Rabat so he can stay on his rural farm. He tried to sell his produce to a school, however, they wanted a surplus of potatoes and his farm was not capable of producing a large-scale quantity.	Mohammed's women cooperatives for lentils and couscous brings many people from all around Morocco and other tourists to their village and town. This ecotourism helps them sell their produce.
Many natural farmers sell baskets of their produce regularly to the same people. This is a stable option for them.	On Aymar's farm, his customers come to pick produce from his farm for a set price. He sells more of his produce through word-of-mouth with his existing customers.	Said gives his produce to a basket organizer that sometimes sells other farmers' produce with his in order to increase the variety of the materials in the baskets.
Some farmers do not have the resources to travel to markets to sell their produce, and middlemen take advantage of their situation.	Farm Owner Hamid mentioned the problems of middlemen taking money from small farmers and the government focusing on exporting farms rather than produce that can be sold in Morocco.	Taha mentioned that middlemen take advantage of farmers in the countryside who do not know how much they should be selling their produce for. A lot of these farmers do not actually make it to the market themselves to see how much the produce is selling for there.

Coding Theme: Lack of Resources

- The farm does not have the proper facilities to certify their produce and especially couscous from the woman's cooperative.
- More training courses would be most beneficial to the people here
- They would also like training on transforming their produce into other products as well. With the training, they really need investments into the cooperative and certifications and the means to do the transformations.
- Moroccan organic certification. She also highlighted the fact that there are very few books written in Arabic on permaculture and natural and organic farming. She has not heard of extension centers or advice centers before.
- More accessibility to a network of experienced farmers where he could learn innovative and unique techniques from in Morocco
- He wished there was a school of permaculture where he and other farmers would be able to take courses that the school would offer in terms of agriculture and specifically permaculture.
- They have difficulty implementing these natural treatments because they find it challenging to gather the relevant information that they would need to understand how to use these treatments
- Suffers from a lack of information. He is not originally a farmer, so he is inexperienced and does not know all of the cultivation techniques that would benefit his farm.
- In order to combat his lack of information, he is trying to find an agricultural engineer to come to his farm for 5-6 months to guide him and his workers on how to create the most effective farm that they can.
- The resources and services that would be the most beneficial would be information and networking. He also stated that there is a lack of support for organic farming in Morocco and that there should be specific training courses and services designed to aid organic farmers. He would like there to be an organization that could offer training courses and information to farmers about organic practices
- It is also hard to find workers for the farm
- They wish they had more workers, specifically those educated in organic and natural agriculture
- More information should be accessible to farmers since not all farmers have the resources or knowledge to travel to another farm or seek out trainings for themselves.
- More written resources could assist the teaching and the spreading of information on permaculture techniques to other farmers.
- The first challenge that he is facing is the lack of available information on natural farming and permaculture specifically applying to Morocco
- When workers initially start working on his farm, they desire instant income, and they do not take the time to try and understand the value of long-term investment in his farm.

Lack of Resources Main Ideas	Example 1	Example 2
Lack of accessible information pertaining to farming in Morocco specifically.	Taha's biggest challenge is having lack of available information on natural farming and permaculture specifically applying to Morocco.	Rim highlighted the fact that there are very few books on permaculture and organic farming in Arabic.
Lack of trainings offered by organizations.	Madrani stated that there is a lack of support for organic farming in Morocco and he would like there to be an organization that could offer training courses to him.	Mohammed would like training on transforming their produce into other products as well in order to improve their cooperative and its business.
Lack of workers that respect organic practices.	When Taha's workers initially start working, they desire instant income, and they do not take the time to understand the value of long-term investment in his farm.	Farm Owner Tourya wishes that she had more workers that were educated specifically in organic and natural agricultural practices.

Coding Theme: Trust

- She also got certification on all her crops because it helps with the trust between her produce and the consumer.
- He expressed that he wants to meet the expectations of his consumers so that they will trust in the quality of his produce
- Zineb doesn't need or want to get an organic certification because she cares more about peoples' trust
- Costumers are always welcomed to come to her farm so they can see Exactly how the produce is being made and understand the natural and permaculture techniques that she uses.
- A passion and love for farming will help them get through these challenges.
- Her farm has a reputation for creating high quality produce. Many locals and farmers know of her techniques
- These people are aware of the type of farm that Zineb runs and do not ask about it.
- They do not label their food as being natural since people know that they are buying their produce from Zineb and they trust her.
- Zineb chooses not to have a website and would rather have solely in-person interactions with other famers.
- He wants people to buy his produce based on the trust that they have in him and his farm. Taha explained that a piece of paper does not always mean much to his consumers and that even those that have a certification could still be secretly farming in a different way. Taha stated, "I feel it is hard to convince and sell but I really want to find a world where I am going to live where people trust each other and this is where I am looking to sell my product."
- Taha also said that it is difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many customers do not trust the farmer.
- He does not want to export his produce because he believes that he has a job to create a trusting community in his local area before he can consider trying to find trust in other locations, such as other countries

Trust Main Ideas	Example 1	Example 2
Trust with customers is more valuable than a certification or label.	Taha wants people to buy his produce based on the trust that they have in him and his farm. He thinks that a piece of paper does not mean much to his consumers.	Zineb's reputation of having high quality food precedes her farm. She does not mark her food as being natural since people trust her.
Building trust with customers takes time and openness.	Taha dedicates himself to develop trust with his costumers saying, "I feel it is hard to convince and sell but I really want to find a world where I am going to live where people trust each other and this is where I am looking to sell my product."	Zineb welcomes her costumers to come to her farm and take the time the understand how permaculture works and the exact techniques that she uses.
There is a lack of trust towards organic practices by non-informed individuals.	Taha finds it difficult to get a good price where both parties can win and that setting a price for organic produce is very challenging, since many costumers do not trust the farmer.	Taha had workers that were skeptical in his natural method of farming. He solved this by letting them farm two plots of land, one with his method and one with theirs. They compared the results and learned to trust his method.

Coding Theme: Cooperatives

- Each villager has their own bit of land and they can decide what they want to grow in each and have the help of Mohammed and the Modern Agriculture organization.
- They would love to start more partnerships and collaborate with other farmers.
- He is not currently a member of any cooperatives but that he is looking to become involved in one with his other farmer friends. He added that in a cooperative there is a higher level of benefits for crop rotation and being able to concentrate on more technical farm matters without worrying about marketing, sales, or price management.
- He is not a part of any cooperatives. The organizers of baskets sometimes sell other farmers produce with his to increase the variety of the materials in the baskets.
- The farm does not have the proper facilities to certify their produce and especially couscous from the woman's cooperative. Because each farmer has his or her own smaller plot of land each would need a certification, which becomes expensive. In the future, they would like to build facilities to be able to certify the cooperative since it is becoming well known and they wish to be able to export crops.

- This place is popular for ecotourism they get many people from all around Morocco and other tourists who want to see the village and farms and buy from them. With the women's cooperative, the couscous and lentils are being sold in Rabat and in Casablanca (3 tons a month).
- For the cooperative, they look at how many women are working, how much the crops and material cost and how much time was put in; more like an enterprise. For the villagers who have their own natural crops, they can each set their price based on work and with the help of the Modern Agriculture organization.
  They market their cooperative products as locally grown and natural.

Cooperatives Main Ideas	Example 1	Example 2
Involvement in cooperatives has a positive perception.	Said and one of his friends want to be a part of a cooperative and they are actively looking for an opportunity to do so.	Mohammed and his cooperative members would love to start more partnerships and collaborate with other farmers.
There are many economic and environmental benefits to being a part of a cooperative.	Mohammed explained that in a cooperative there is a benefit of sharing land for better crop rotation. This also allows his farmers to concentrate on more technical matters without worrying about marketing, sales, or price management.	Said is not a part of a cooperative however his produce is sold with other farmers' food, and he values the increase of variety that this brings.

Coding Theme: Permaculture/Biodiversity

- They plant aromatic plants, eggplant, peppers, artichokes, green beans, potatoes, radishes, zucchini and other vegetables and cereals.
- They grow aromatic plants to keep pests away and plant varieties of crops to work together to prevent the spread of disease.
- They do not use fertilizers or chemicals. The way they help keep good soil is by composting food and old plants, and also allowing sheep and chickens in their crops
- Aromatics, fruit trees (including many plums), vegetables. She also has about 300 organic chickens, which she uses for eggs.
- She deals with pests and diseases by letting the plants help each other and by using only natural remedies like essential oils.

- He grows a large variety of vegetables and legumes, such as artichokes, brussel sprouts, tomatoes, broccoli, fava beans, and lima beans, aromatic plants such as rosemary, lavender, oregano, and nettle, as well as fruits such as oranges, lemons, olives, figs, and strawberries.
- He is trying to have as much variety as possible. He doesn't want monoculture
- He plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations. The use of permaculture also naturally prevents the spread of diseases from one plant to another.
- Aymar believes that biodiversity is very important when it comes to farming because plants can benefit and aid one another
- Because he believes that having a diverse and sustainable farm is more important than an organic label
- There are many environmental benefits to using permaculture as well as health benefits to the people that consume the farm's produce
- Permaculture promote a natural means of fighting climate change because the farm mimics an ecosystem and therefore the plants can work together to increase their efficiency and survivability in the face of water shortages and drastic temperature fluctuations
- They grow a wide variety of plants because they are a test farm and want to show how to grow many different products. Some such things that they grow are aromatics, vegetables, and essential oils such as olive oil and argan oil
- He grows a variety of fruits and vegetables such as figs, pomegranates, olive trees, lemon trees, chickpeas, corn, squash, pumpkin, melons and cereals.
- He hopes to use permaculture techniques in which the plants will work together to naturally combat these nuisances.
- He grows aromatics, fruit trees, vegetables, cereals (Barley and 3 types of wheat).
- She creates a self-sustaining farm by bring in solar panels to provide the only electricity.
- He grows all different kinds of plants including fruits and vegetables, with each being grown in different varieties. He has 14 different types of fruit trees include apples, pears, apricot, plums, and olives.
- He bases part of his decision on the climate and the rest on which plants help to support one another in order to create a sustainable ecosystem (permaculture technique).
- He is sure to grow varieties of crops near each other in a strategic way since some plants will help retain water for the other plants around them. This is an important part of permaculture farming and also helps to provide varied root lengths in the soil in any one area. This helps to works against soil erosion, which occurs when the land gets very dry and then suddenly heavy rainfall or a flood saturates the dry soil.
- She grows vegetables, fruits, medicinal herbs, flowers, and tropical trees, as well as a local variety of figs and prunes.
- She uses permaculture techniques in order to fix these problems
- They use other plants or herbs in order to protect their crops.
- They use compost made in their farm from other trees, plants, fruits, etc. and put it over the land.
- Natural farms tend to have more biodiversity.
- Different types of tomatoes, fruit trees (fig trees), vegetables, artichokes, broccoli, cactus, cereals, Brussel sprouts, aromatic and medicinal crops, and wild flowers. He has fields dedicated for wheat for bread and couscous. He has 10 different types of cabbages.

- He leaves weeds and flowers to work with his vegetables to create an ecosystem and because all of the plants are working together it helps with nutrient balance and increasing humidity of the soil.

Permaculture/Biodiversity Main Ideas	Example 1	Example 2
Permaculture's incorporation of a high level of biodiversity is a solution to extreme temperature and rainfall fluctuations.	Aymar explained that permaculture promotes a natural way of combating climate change. The farm mimics an ecosystem and therefore the plants can work together to increase their efficiency and survivability in the face of water shortages and drastic temperature fluctuations.	Taha said permaculture helps to provide varied root lengths in the soil in any given area. This helps to works against soil erosion from when the land gets very dry and suddenly saturated from heavy rainfall or a flood.
Aromatic plants, amongst other plants and animals, are a vital component of the biodiversity in permaculture.	Aymar's farm has a lot of biodiversity such as chickens, vegetables, fruit trees, cereal crops, and aromatic plants such as rosemary, lavender, oregano, and nettle. These aromatic plants contribute to a healthier life for the rest of the biodiversity on the farm.	Aymar plants aromatic plants near his crops to naturally keep pests away and uses mixtures of plants to treat diseases or pest infestations. This use of permaculture naturally prevents the spread of diseases from one plant to another.
The benefits to permaculture and having biodiversity are multidimensional.	Rim deals with pests and diseases by letting the plants help each other and by using only natural remedies like essential oils on her plants as well on herself.	Aymar believes that there are many environmental benefits to using permaculture as well as health benefits to the people that consume the farm's produce.

Coding Theme: Adaptability

- He does not have a big problem in regard to his water supply since he covers the ground near his crops with hay. The hay helps to retain water and keep the moisture locked into the soil. He does not have to use a lot of irrigation and can mostly rely on rainwater. He even removed part of his irrigation system after his first year of cultivating his land. He explained to the team that his plants that die during droughts are not as strong as those that survive them so he selects his seeds from the ones that do survive for his next planting season.

- The temperature difference makes it hard for crops to grow and happens too quickly for plants to adjust.
- He tries to buy seeds from Mexico and Mauritania to have seeds adapted to high temperatures.
- He decides what he wants to grow based on weather and what would give him greater variety.
- The crops that they grow need to be able to adapt to more extreme temperature differences
- They adapt to the differing conditions due to climate change; however, they do not change their ways of natural farming
- The idea of permaculture is to be able to adapt, so they combat challenges by continuing to do what they do.
- She grows different types of crops based on climate but mostly careful consideration of design to be able to have organic permaculture and follow bio-geometry.
- The owner is testing growing a wide variety of crops to determine which ones are the best adapted to survive and grow with the environment and soil found on his farm.
- Based on climate and permaculture techniques of having plant varieties mixed in to support each other
- The arid climate, harsh weather and remote locations
- Learned through techniques from her family

Adaptability Main Ideas	Example 1	Example 2
Utilizing Natural and Permaculture practices do not prevent adaptation to climate change.	Zineb works to adapt to conditions caused by climate change however she would never change their ways of natural farmer.	Rim grows different types of crops based on the climate and takes careful consideration into the design of her farm to ensure she can use organic and permaculture practices.
Farmers can mimic natural selection with their crops in an effort to adapt to climate change.	Taha explained that his plants that die during droughts are not as strong as those that survive them. For his next season, he selects his seeds only from the plants that thrived.	Madrani grows a wide variety of crops in order to find the ones that are the best adapted to survive within the specific environment at his farm.

Coding Theme: Government Support

- They would like for the government to become more involved in the promotion of organic farming. They believe that the government should train technicians that specialize in organic farming techniques and that those technicians should then educate farmers on new organic practices that they can utilize. They also believe that agricultural extension centers are inefficient and lack any useful information about organic practices. They really wish

that the agricultural extension centers had relevant information and training programs specifically about organic practices that they could utilize

- Before the team's interview with Taha, he did not know what an agricultural extension center or agricultural advice center was.
- He is aware that there are three agricultural extension centers located in cities around his, but they only understand how commercialized agriculture works. He would be willing to utilizing the center if he were able to learn more about organic and natural cultivation techniques.
- He desires that permits and authorization be easier and also faster for himself and other farms because delays in his projects costs more time and money.

Government Support Main Ideas	Example 1	Example 2	Example 3
Agricultural Extension Centers are not a good resource for organic/natural farmers since they lack experts and resources in organic/natural agriculture.	Farm Owner B thinks that the government should train specialized technicians in organic farming techniques and that those technicians should then educate farmers on these techniques. Farm Owner B wishes that the agricultural extension centers had relevant information and training programs specifically about organic practices.	Said is aware that there are three agricultural extension centers located near his city but these centers only understand how commercialized agriculture works. Said would utilize these centers if they could teach him more about organic and natural cultivation techniques.	Before being interviewed by the team, Taha did not know what an agricultural extension center or agricultural advice center was.

Coding Theme: Non-Governmental Support

- They have help from the Modern Agriculture organization.
- RIAM helped and provided training sessions.
- In addition, the farm has contract with companies and they provide a list of what they would like the farm to grow and the farm then complies.
- The organization for World Wide Opportunities on Organic Farms (WWOOF) organizes these international organic farm workers (WWOOFers) and puts them into contact with farmers who reach out to the organization in search of workers. Taha explained that you give them room and board in exchange for them working on your farm for a few hours each day. This is another great way to share information regarding farming and culture around the world.

- Hosts WWOOF (organization that links workers with farmers) on his farm. These are international traveling farmers that share their farming knowledge and will live on the farm for a given amount of time.

Non-Governmental Support Main Ideas	Example 1	Example 2
There are some non-governmental organizations that do outreach to small farmers.	Mohammed and his cooperative workers receive help from the Modern Agriculture organization.	Aymar received help from RIAM as they provided him with training sessions.
The World-Wide Opportunities on Organic Farms (WWOOF) workers are a valuable resource for small farmers in Morocco.	Taha has international organic farm workers, called WWOOFers. He gives them room and board in exchange for them working on his farm for a few hours each day. This is another great way to share information regarding farming and culture around the world.	Aymar hosts WWOOFers on his farm. These are international traveling farmers that share their farming knowledge and will live on his farm for a given amount of time.

Coding Theme: Agricultural Community (Parents, farmers, friends, etc.)

- Zineb learned techniques from her family and parents as well as through experimentation with different techniques.
- She uses online resources to stay informed on new agricultural techniques.
- She exchanges with other local natural and organic farmers.
- His parents are farmers so he grew up learning the techniques and also studied agriculture in France.
- Many locals and farmers use her as a resource to learn how to improve their own farms.
- Zineb gives training lessons to other farmers about the permaculture techniques that she uses
- He started farming by learning at Zineb's farm (Zineb is the first farmer we visited who is well known among natural and organic farmers in Morocco).
- He also learns from friends that come and share their knowledge with him
- He also uses the Internet as resource.
- Taha also exchanges seeds with other organic and natural farmers in Morocco.
- one method that helps to keep his costs down is hosting farmers from around the world.
- He meets and talks to as many new farmers as he can in an effort to exchange information with them.

- They learned their farming techniques from ecotourism and other countries they have visited
- He learned his farming techniques from his father, farming training, and collaborating with other farmers or organizations.
- They learned from other people.
- They have the help of Mohammed.
- A French permaculture expert and a Canadian permaculture expert (named Alonzo) came to the village to teach the villagers permaculture techniques
- Hosts classes to teach the latest techniques, and aids villagers as they need
- She studied Agro-food Industry Engineering in Madrid and takes classes in Madrid and other countries when she wants to learn more. She'll purposefully look for information first and then travel to where she needs
- Learned through YouTube and online resources. He also was put into contact with other natural farmers in the area and they were able to give him insights.
- In some cases, the companies that they sell to give them predetermined cultivation practices that they must adhere to or their contract becomes void.
- He does not have much experience with farming, but what he does know comes from networking and from information that he found on the internet
- He expressed a desire to increase his networking and amount of connections within the farming community
- She studied Agro-food Industry Engineering, attends classes to fill gaps in knowledge, communicates with other farmers and uses the internet when necessary.
- She also hired 6 full time farm workers and invites others to work when she requires more assistance. She also uses students to help her.

Other Support Main Ideas	Example 1	Example 2
Knowledge passed down through families.	Hamid's parents are farmers so he grew up learning many farming techniques from them.	Said learned his farming techniques from his father amongst other resources.
Other farmers and community members.	Madrani does not have much experience with farming, but what he does know comes from networking with other farmers and people in his community.	Taha started farming by learning at Zineb's farm (Zineb is a farmer that the team visited who is well known among natural and organic farmers in Morocco).
The Internet	Aymar learned a lot through watching various YouTube videos and utilizing other online resources.	Taha uses the internet as a resource when he cannot find the information he needs elsewhere.
Formal Education	Rim studied Agro-food Industry Engineering in Madrid. She also takes classes in Madrid and other countries when she wants to learn more. She will purposefully look for information first and then travel to whatever location she needs to.	Hamid studied agriculture in France and learned a lot about farming during that part of his education.

Appendix S: Table of Theme Counts

Farming Theme	Sub-Themes	Number of Mentions
Farming Techniques		
	Natural	28
	Organic	23
Farming Challenges		
	Marketing	51
	Seeds Water Scarcity	28
	Lack of Resources	16
	Marketing	14
Farming Solutions		
	Permaculture/Biodiversity	27
	Trust	12
	Adaptability	12
	Cooperatives	8
Agricultural Support		
	Agricultural Community	25
	Non-governmental	5
	Governmental	4

Appendix T: Expert Interview with Morocco's Ministry of Water

Interviewers: Maggie Kuck, Sarah Boecker, Shahnaz Ghahremani, Shane O'Dell
Interviewee: Mahmoud Zemzami
Interview Date: Thursday, January 18th, 2018
Transcribed by: Shahnaz Ghahremani
Transcription Date: Thursday, January 18th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

How much water goes towards agriculture in Morocco?
The Interviewee explained that ninety percent of surface water is used for irrigation however most of this water is used for large exporters. While this is bad for the already arid environment of Morocco, it is good for the economy since large farms invest more in the country and create more jobs for Moroccans. This is a problem for water scarcity since these large exporters argue that they bring jobs and wealth to Morocco and therefore deserve investment from the government, monetary and in water supply. He stated that the Green Morocco Plan and the New Water Plan (NPE) aim to combat this issue since Morocco only has so many water resources and needs to more carefully prioritize where the water goes.

How much is the government of Morocco willing to aid in the adoption of drip irrigation by farmers?
The Interviewee responded that the government subsidizes 40-60% of the irrigation for farmers but that the ministry of agriculture should know the exact process by which farms are subsidized. He explained that the money could potentially be given out based on how it will help the area and the population since it must always be considered how this allotting of money/water will positively aid the surrounding area of the farm.

Our team heard that in the 1960s, each person had about 3,000 cubic meters of water available for their use each year; what is the current amount of water available to Moroccans?
He stated that the amount of water available for each person in Morocco is 650 cubic meters per year.

How have increased droughts affected the country's ability to irrigate?
The Interviewee commented on how the droughts have not necessarily affected the country's ability to irrigate, but that droughts and lower levels of rainfall per year have led the government to invest in the creation of more dams and projects to desalinate seawater.

What are the social implications of a drought?
The Interviewee described that the social implications of a drought are very severe but that they vary by location. He said that in the cities, people are guaranteed to be affected by a

drought but that farmers in rural areas that rely on rain-fed water for their produce are arguably affected more. During droughts in the past, the government set a certain amount of water that each person could use per day and if they went over this amount they would be charged heavily. In the 1980s and 1990s there were also times when the city would shut off the water for long periods of time. The Interviewee remembered that in the 1990s, when he was a young child, his family at one point only had access to water for about 4 hours of the day. At this time, there was a water truck that would bring water to the town and sometimes his family would have to buy tanks of water off of the truck to bring home. He recalled that they had to use salt water for washing their dishes and bathing and that a couple years later, when desalination became readily usable, salt water was no longer used in households.

What classifies something as a drought?
The Interviewee explained that there is an organization that determines what constitutes as a drought and what doesn't. This organization considers different factors involving rainfall when creating its classifications. If there is a lot of rainfall in 1 month of the year, but then 11 months of very little rain, it is still a drought. He told the team that Moroccans would rather have evenly distributed rainfall throughout the year than the situation previously discussed.

How accessible is it for small farmers to obtain subsidies?
The Interviewee explained that a lot of small farmers don't want subsidies from the government because the farmers do not know the reasoning behind a lot of these subsidies. Since some small farmers are illiterate, they do not want to agree to a subsidy if they cannot even read the agreement.
The Interviewee stressed that there is a lot of tradition in the way that older farmers farm. They have their methods and techniques and they have their own relationship with the land. Many older farmers prefer using surface water, or even though aquifers are classified as strategic resources and they try not to use them unless there is a serious crisis. Overusing aquifers destroys groundwater reservoirs. There are issues with the aquifers they use normally. The way that aquifers work is that there is a clearly distinguished barrier of where the fresh water lies and where the salt water lies. These small farmers use fresh water from the aquifer when water is needed. However, as this fresh water decreases, the saltwater barrier rises in these aquifers. This causes salt water to get sucked out of the aquifer over time of usage which is not what farmers want.

"The government subsidizes 80-100% of smaller farms" Is this correct?
The Interviewee stated 40-60%, but facts should be checked with the agricultural department.
He explained that numbers provided online and by different organizations are not always accurate because they are being continuously updated. Most statistics that are given in the form of rates are more accurate since they still generally apply with each coming year. He warned that numbers could change greatly from one year to another.
What is the transfer system project and why has it not been implemented yet?
The Interviewee explained the transfer system project as being a long-term project to build a type of pipeline that brings water from the North of Morocco to the South of Morocco in

an effort to redistribute water evenly across the nation, since on average the North of Morocco gets more rain than the south. He told the team that the reasons for it not being implemented yet are financial and technical problems. The project is very expensive, costing 3 billion dollars, and possession of water is rather competitive within the country. For example, if water is taken away from small farmers in the northern regions of Morocco it could cause tension since this water is being sent to the south. People in the North still want the water that is native to their land and he predicted that it could cause turmoil and hostility if this plan was set through.

How efficient is your water system?
The Interviewee explained that the Ministries existing water system is approximately 40% efficient as a large amount of water is lost in the system to leaks in pipes. The ministry is trying to reduce this number to 20%.

How many hectares of farmland are being equipped with localized drip-irrigation systems each year?
The Interviewee stated that approximately 50,000 hectares are changed to being locally irrigated using drip irrigation techniques each year through the Green Morocco Plan.

How has a lack of rain impacted the amount of water reserved in dams?
The Interviewee informed the team that two years ago the dams were at 70% of their capacity and they are now currently at about 35% of their capacity due to the lack of rainfall.

Appendix U: Expert Interview with FIMABIO's Executive Director

Interviewers: Sarah Boecker, Maggie Kuck, Shahnaz Ghahremani, Shane O'Dell
Interviewee: El Mekki Hammoutou
Interview Date: Tuesday, January 30th, 2018
Transcribed by: Sarah Boecker
Transcription Date: Tuesday, January 30th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.
Permission to use an audio and/or video recording of this interview: Yes, permission granted.

What is your role at this organization?
The Interviewee stated that he is the Executive Director of FIMABIO. He described this position as being the second in command after the President of FIMABIO.

Do you offer resources to small farmers?
The Interviewee answered yes and began to explain how FIMABIO's resources are inclusive of many types of farmers- large, small, organic, and natural. He answered the following questions during his explanation:

How many small farmers utilize these services?
He answered that approximately 600 farmers each year utilize FIMABIO's services.

What types of crops do the farmers that you work with grow?
He described all different types of crops that the farmers grow including vegetables, olive oil, argon oil, fruits, and medicinal and aromatic plants.

Are these farmers organic or natural?
He replied that the farmers are both organic and natural. FIMABIO encourages both organic certified and non-organic-certified natural farmers to utilize their resources.

What resources or services do you offer?
The Interviewee explained that FIMABIO offers various services to organic and natural farmers. These include training sessions on the topics of drip-irrigation, crop rotation, composting, harvesting and other topics that farmers typically need to know about. They offer these training sessions 1-2 times each month in different locations throughout Morocco. FIMABIO also has multiple model farms for farmers to visit that focus on growing/raising vegetables, olive oil, chicken and sheep, aromatic/medicinal herbs and bees. They arrange transportation and lodging for farmers when necessary in order to enable them to come to training sessions and to visit their pilot farms.

Do you charge people to use these services?

The Interviewee answered that FIMABIO does not charge people to use these services. FIMABIO programs are free however attendees end up paying some amount of money to get to the training sessions and the center. However, he mentioned that there is a shift happening in agricultural extension services with a movement towards private and professional services as opposed to free government services and this shift may lead to farmers having to spend money in order to get agricultural support.

What form(s) are these services offered in?
He answered that their services are mostly in-person training sessions but that they also provide printed training guides that they give out as part of their training sessions.

In what languages are these services offered?
The Interviewee explained that the trainers at their training sessions speak many languages and at a minimum they typically know French, Arabic, and Berber. If there are illiterate farmers attending training sessions, it does not pose many issues in what they are able to gain from the experience since the training is verbal and physical, and does not include written material. He then added that written material handed out during the training is written in only one language but that many farmers have family members that can read the literature to them.

Do farmers have to come to your center to receive these services or does your organization send people out to the farms themselves?
The Interviewee replied that FIMABIO hosts trainings at their own locations but that they also visit farmers to see their progress on certain elements of their farm. He then added that FIMABIO would pay and arrange for the transportation and lodging of a farmer if the farmer's ability to obtain housing and transportation on their own prevents the farmer from attending trainings or visiting other farms.

Out of all of the resources that you offer, which are utilized the most?
He commented that the most commonly used resource of FIMABIO is their training session.

Do you track how your resources and training sessions affect farming outcomes for the farmers that turn to your organization for support?
The Interviewee explained that FIMABIO checks up on farmers that attend their training sessions when these same farmers return for more training. They typically see farmers multiple times since their trainings cover a variety of topics, all of which are vital for farmers to learn about. He mentioned that at some training sessions there are sheets that trainers pass out at the end of the program in an effort to gain feedback from farmers on how helpful their sessions are.

If so, would you mind sharing this data with us?
This question was not applicable. There was no specific data for FIMABIO to share with us.

Does your organization promote organic practices?
The Interviewee answered yes. He stated that the organic sector in Morocco is small but that FIMABIO was created because the government thinks that this sector is very important to Morocco. In fact, the Green Morocco Plan allows for more pro-organic government projects to be created.

How do you market your advice and resources to farmers?
[Question Not Asked]

How does climate change affect your organization?
He explained that climate change affects FIMABIO because they are strong supporters for drip-irrigation systems. Climate change and increasing droughts further encourage their organization to push for this method of water conservation and other techniques of conserving water.

Where do you think you could improve the assistance that you offer to farmers?
The Interviewee answered that FIMABIO is always thinking about whether they are successfully helping the farmers that they work with to solve the problems that they are facing. They are currently helping farmers in many ways and they have had good progress in the development of their program over the past year.

What do you think you do really well with the assistance that you offer to farmers?
The Interviewee explained that as with any organization progress takes time so FIMABIO is still working on developing and improving their services and programs.

<u>Additional FIMABIO-Specific Questions</u>

General overview of organization and what they do.
The Interviewee descried FIMABIO as a federation created by the government to help organic farmers in Morocco organize with one another and succeed in their sector. In 2013, the organization was an association and was called AMABIO. In 2017 the organization was changed to being a federation and was given the new name of FIMABIO. In the current organizations name, the F stands for Federation, the I stands for Interprofessional, MA stands for Maroc, and Bio represents Biologique, the French word for organic. There are three organizations that come together to form FIMABIO. The first organization is ANAPRO BIO and it focuses on the production side of organic farming. The second is VAL BIO and it focuses on validation of value of organic produce. The third is ANADEX BIO and it focuses on the marketing, distribution and exportation of organic produce.

What is most important for us to understand?
The Interviewee explained to the team that it is important for us to understand the importance of the organic agricultural sector in Morocco, and how FIMABIO is supporting organic farming and is adjusting and developing. FIMABIO is a new organization and is only one-year-old.

How do your program offerings differ for large farmers and small farmers?
The interviewee answered that they offer the same resources to both of them.

Do you offer incentives in the agricultural sector?
He answered yes. The government offers incentives and subsidies to all famers for certain things, such as irrigation and farming equipment, however FIMABIO is now able to offer even more subsidies to farms that are certified organic. This is in an effort to inspire investment in the organic farming industry in Morocco and to encourage sustainable farming practices such as using drip-irrigation.

What subsidies are offered? And how many?
The interviewee explained that there are subsidies offered for many different types of things, such as drip-irrigation and farming machinery and equipment. Drip irrigation is often covered in full by the government and equipment subsidies are determine on a case-by-case basis. FIMABIO offers $400-$600 USD of financing per hectare of organic farmland per year. He added that these subsidies are not in effect yet but that they hope to have these subsidies available to organic farmers by the end of the year.

How do you aid organic farmers since they cannot buy organic seeds in Morocco and what is their opinion on seed smuggling?
The interviewee chuckled, acknowledging the issue of obtaining seeds. He stated that FIMABIO and the government is working on a big program to provide organic farmers with seeds but it will take time and research. This may be more of a ten-year project for them. There is a private group that will allow organic farmers with nonorganic seeds to certify their seeds and produce as organic after three years of planting the seeds from their plants.

Our team heard through word of mouth that there are few legal organic markets in Morocco. What is your opinion on organic markets and how there are so few of them?
The interviewee asked where the team had heard this information. To his knowledge there are many opportunities to sell organic food in Morocco. He informed the team there is a store with FIMABIO Farmers' produce called La Vie Claire. There is also a store called Les Domaines that sells a lot of organic and natural produce. FIMABIO plans on organizing large markets in the big cities of Morocco, such as Casablanca, Fes and Tangier.

What is your opinion on middle-men in the produce market and how you help farmers survive and ensure their produce is being sold for a fair market value?
The interviewee answered that FIMABIO encourages farmers to organize into cooperatives in order to ensure that their produce is being sold at a fair price. He referenced an existing couscous cooperative [that the team visited] and how they thrive off of the ecotourism that their cooperative brings to their village.

What is your opinion on cooperatives?
He repeated that FIMABIO works with many farmers to organize cooperatives for certain products. They think that cooperatives combat many marketing challenges that organic and natural farmers face.

How does your federation work with agricultural advice centers? Do you have a relationship with them?

The interviewee explained that FIMABIO has a partnership with these centers. FIMABIO will sometimes ask the advice centers questions so that they can learn more about the topics for which FIMABIO offers training sessions.

Appendix V: Expert Interview with CIPA

Interviewers: Maggie Kuck, Sarah Boecker
Interviewee: Boujemaâ Gueghlan
Interview Date: Friday, February 9th, 2018
Translated by: Yannis (Student at CIPA)
Transcribed by: Sarah Boecker
Transcription Date: Thursday, February 15th, 2018

Can you tell us a little bit about CIPA as an organization and what you do?
Boujemaâ Gueghlan is the manager of CIPA, the Crossroads International Agro-Ecological Practices. This center was created in 2005 by the Association of Earth and Humanism in Morocco. The association was founded in 2001 with the goal to propagate agro-ecology as well as to experiment with agro-ecological techniques, specifically within an arid climate. The association also aims to create a network of farmers that practice permaculture and agro-ecology on multiple scales: locally, regionally, nationally and internationally. At the CIPA center, they offer trainings in agro-ecology to all different kinds of people. Their center is open to everybody in Moroccan society. It frequently hosts farmers, students, organizations, and people that are just interested in gardening for themselves.

Do you offer services only at the center, or do you travel to other locations to offer services?
CIPA offers both services, trainings and workshops at their center but they also visit farmers and organizations if the program requires it.

In what ways do you connect with farmers, how do people find out about you and the center?
Boujemaâ had trouble making connections with farmers of agro-ecology but since the center started, his network significantly increased. They now have people nearby in the mountains and from all over Morocco asking for information on CIPA's farming techniques. He makes most of his connections through word of mouth. People visit the center and then tell their friends and fellow farmers about it. When the center first started, he was mostly focused on cultivating the land and didn't put much effort into marketing or networking. Once the farm was doing well he was able to focus a bit more on developing this marketing side of the center.

Currently how many small-scale farmers connect with CIPA?
Boujemaâ could not actually provide an exact number of small-scale farmers that CIPA is connected to but they have multiple groups of people that they are regularly connected with. They have people or organizations that seek out the center with a specific project or idea that they want to pursue. These people visit the center and may visit multiple times, for trainings, advice and checking up on the projects that they started. The center does not have a huge human resources department so it is difficult to reach out to small-scale

farmers but they do have some relationships that they maintain with small-scale farmers and other participants by phone and email.

In what ways do you take initiative to check up on different farmers
He keeps in touch with and works with a lot of farmers by phone and email. Sometimes when people visit the center multiple times they are able to catch up with them and monitor their progress. Again, they do not have a huge human resources department but they are getting better at networking with time. They are currently building relationships with various organizations. For example, they are working on designing a workshop at the center for children through a school field trip.

Does it cost money to utilize CIPA's services? Do you charge farmers when you go and visit them?
The center charges money for services depending on the circumstance. Most of their trainings and workshops that are designed specifically for someone or for a specific project require a financial contribution. Sometimes these trainings or workshops are financed by an outside association, however CIPA still gets compensation for their programs. If a farmer comes to the center and is looking to be trained in a certain skill, they will be asked to pay for it but on occasion, if the farmer cannot afford to pay for it, the cost will fall on the center. This happens from time to time but is strictly limited due to the fact that it is not sustainable for the center.

When people come here and stay for a longer period of time, how do they compensate the center for its services, and for lodging?
The center hosts both students and WWOOFers. These people are expected to pay small contributions in order to keep the kitchen stocked and provide them with lodging. These people contribute to by farming each day, and then they benefit from getting to participate in any of the formal trainings that are hosted at the center during their stay for free.

What are some things that CIPA does really well?
The training part is a main thing that they do really well. They don't get any negative feedback. People are always very satisfied with the training.

What are some things that CIPA can improve overall?
CIPA could improve on connecting to more individuals. They currently do a lot of work with organizations or groups of farmers or people, but not a lot of work with individual people from the community. Boujemaa said that the center has a lot to improve upon, but that they can only make these improvements one step at a time. The human resources, outreach and ongoing communication parts of their center are something that they really want to improve. They also would like to be able to accommodate people more comfortably. The would also like to have more space and pastures for their animals to graze.

Are there any resources or information that you wish that you had, as a farmer or as an organization?
When the organization first began, they had very minimal resources and support. But more recently they have been receiving more support from different organizations. They have received funding from the Ministry of Agriculture for an irrigation system and the Ministry of Water gave them tree plants in order to run an event called tree week which helped them connect to people in their community.

How did you get the funding from the government?
The funding has actually not come through yet.

Out of curiosity, have you heard of FIMABIO? Do you work with them?
The president and the vice president of CIPA's founding association are members of FIMABIO so they have a good relationship with them. Typically, FIMABIO does not work with small-scale farmers. They currently work mainly with large production farms because of their large contribution to the economy but CIPA thinks that it would be a good idea for them to expand to working with small-scale farmers as well.

Is it difficult to get a bio certification?
It can be a bit difficult especially if you like to have a lot of biodiversity in each section of your farm. If you use monoculture or section off plants it is easier to get the certification. There is a lot of paperwork in order to apply for a certification regardless of how simple your farm is. At the center they have the time and resources to put into getting the certification.

Why did you want to be organic certified?
Boujemaâ explained that if you don't have any commercial purpose as a farmer, then the organic certification is virtually useless to you. The center got their certification for strategical marketing purposes. He thinks that you need to be organic if you want to reach different organization because you have to be able to prove that your farm is clean and natural. For example, in order to receive services from the FIMABIO federation, your farm needs to be certified.

Do you sell the produce that is grown here?
Yes. First we make sure the center has enough food to provide for its residents since self-sufficiency is very important to Boujemaâ, and then the rest of the production is sold for a profit. They sell the food in a market in Marrakech where they sell their produce in baskets with a fixed price.

What kind of relationship does CIPA have with small-farmers?
It depends on the specific farmer, but they have both professional and personal relationships with small-scale farmers.

Appendix W: Expert Interview with Coordinator of GIREPSE Project

Interviewers: Sarah Boecker, Shahnaz Ghahremani, Maggie Kuck, Shane O'Dell
Interviewee: Abdellatif Khattabi
Interview Date: The team emailed questionnaire on Wednesday, February 14th, 2018
The team received answers on Monday, February 19th, 2018
Transcribed by: Shane O'Dell
Transcription Date: Monday, February 19th, 2018

Permission to include organization's name in report: Yes, permission granted.
Permission to include interviewee's name in report: Yes, permission granted.

What is your background and how did you become involved in project GIREPSE?
He has a background in agronomic engineering from IAV, Rabat, and from ESB, Paris. He has an MS and a Ph.D. in economics from the University of Idaho and an MS in information and communications technology from the university of Louis Pasteur, Strasbourg, France. He is a researcher on natural resource management and developed the GIREPSE project to promote a resource management plan in the Tensift Watershed.

Within project GIREPSE, what was your role and which organization did you represent?
He was the coordinator and one of the principal investigators in the GIREPSE project. He represented the Moroccan Association for Regional Sciences and also represented the Ecole Nationale Forestière d'Ingénieurs (National Forestry School of Engineers) where he is a professor.

How have increased droughts affected the country's ability to irrigate?
He explained that droughts are extreme climate events that they have become increasingly frequent in Morocco during the last three decades. The droughts deplete Morocco's water supply and adversely affect farmers. The majority of farmers use rain-fed irrigation, so as the quantity of rainfall decreases, the farmers have more difficulty growing their crops. Additionally, droughts reduce the amount of water in wells and unground reservoirs, which reduces farmers' abilities to irrigate.

What are the social implications of a drought?
The interviewee stated that droughts reduce farmers' ability to grow crops. The farmers' income decreases because they sell less of their produce. These farmers then become unable to provide for themselves and migrate to cities to search for jobs. In addition to migration, farmers are less capable of growing medicinal plants, which reduces the availability of medicine in the country.

How has the lack of rain impacted the amount of water reserved in dams?
The interviewee explained that dams' water reserves fluctuate depending on the duration and severity of droughts.

Has this project involved small-scale farmers as a stakeholder? If so, how?
The research for the GIREPSE project involved collecting data about farmers, assessing their vulnerability to climate extreme events, and providing farmers with suggestions on how they can better adapt to climate change.

What resources and services did you offer to stakeholders, specifically small-scale farmers, to increase their participation in GIREPSE?
He explained that the GIREPSE project team hosted workshops and provided training sessions in order to improve peoples' involvement with the project.

In what format were workshops offered to stakeholders? How were the decisions made as to who received workshops?
The GIREPSE project team customized the workshops they offered to match people's jobs and their exploitation of their natural resources. This means that the workshops in different locations of the Tensift Basin had different focuses. Primarily these workshops focused on assessing the regions' vulnerability to climate change and suggested ways for the people to adapt to climate change. In addition to vulnerability workshops, the project also provided informational training workshops that explained the benefits of joining an association or cooperative to people to encourage group participation.

In what ways is payment for environmental services included in project GIREPSE and how might this affect small-scale farmers?
The interviewee explained that the project provided subsidies to build terraces for cultivation purposes. The project team then plants fruit trees in the terraces and provides the farmers with the technical assistance they need to understand how to cultivate these trees.

How does GIREPSE promote organic and natural farming practices?
The GIREPSE project team assisted a group of women to create an organic farming cooperative and provided them with training courses specific to organic farming. The women in this cooperative have started production on a small scale using the knowledge that they learned from the training courses.

Can you elaborate on GIREPSE's actions to raise public awareness and sensitization towards environmental issues?
The interviewee explained that the GIREPSE project team offered training courses on three levels: national, provincial, and local. These various stages promoted public participation and awareness both on the local scale, and across the entire country. The project team also gave press releases, published national newspapers, and posted articles online to raise public awareness of the GIREPSE project.

How was socio-economic data analyzed and applied to this project?
He explained that the GIREPSE project team focused on the physical, biological and socio-economic aspects of the environment, however, he did not specify how the team analyzed the data.

How can Moroccans ensure that they apply the suggestions from this project throughout Morocco and ensure that the project has a lasting impact?

The interviewee voiced his opinion that development actors in Morocco should consider the GIREPSE project's findings and adopt similar approaches when they create programs of their own in order to ensure that the project has a lasting impact. He believes that if other organizations incorporate the projects' suggestions into their own design plans, they will be able to create a noticeable change in the severity of climate changes' impact on Morocco.

Can you describe the governments involvement in this project?
The government participated in the GIREPSE project through the projects collaboration with public institutions. These governmentally funded institutions provided data, organized activities, and supplied the project team with researchers to aid them in the data collection.

Was there a partnership of GIREPSE with the Ministry of Agriculture or Ministry of Water? If so, how so? If not, why not?
The interviewee stated that the GIREPSE project team aimed to involve all institutions, including the Ministry of Agriculture and the Ministry of Water in their project, although some institutions were more directly involved than others.

Appendix X Prototype Pages for Farmers' Stories Booklet

Le Jardin de Zineb

Chapter 1

Owner:

Zineb Benrahmoune Idrissi

Age of Farm: 15 years
Location: Rabat Region

Key Features of the Farm:

- Permaculture
- Sloped Farming
- Water Purifying Plant System
- Natural Jams & Honey
- Training Sessions

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Zineb's Story

Zineb's natural farm is a wonderful example of permaculture at its finest. This farm utilizes biodiversity to create a natural ecosystem for her plants and animals. Zineb learned agricultural experimentation techniques from her family. She grows natural produce and transforms it into high quality products such as jams and honey. Many farmers know of Zineb's farm and come to her for advice, training sessions, and support in their agricultural endeavors.

She experiences difficulties during the dry months of the year when the farm faces issues with water scarcity. Zineb lost all of her fig trees to a flood caused when the dry cracked soil became saturated from rain and eroded. Her passion and love for farming helps her and her team to overcome these challenges. They adapt to the differing climate conditions due to climate change; however, they do not change their ways of natural farming and permaculture.

Le Petit Fellah

Owner:
Taha Touijri

Age of Farm: 2 years
Location: Rabat Region

Taha's Story

Started from the bottom now he's here

When Taha finished his schooling in Canada, he returned to Morocco. Upon seeing how run down his family farm had become, he decided to become a farmer and revitalize his childhood home. He faced great opposition for his methods and permaculture techniques, but he convinced his workers and community that permaculture could work. Through natural selection, Taha is able to harvest seeds from the plants that have become the most resilient to diseases and pests. He makes connections with other natural farmers to allow him to acquire unique seeds that are not commonly found in Morocco.

Taha started a plant-a-tree initiative that he hopes can grow popular online through social media. The idea is that people can share videos of themselves planting a tree and challenge others to do the same. The proceeds he earns from selling trees will go towards helping Moroccan children living in isolated areas, such as the Atlas Mountains, attend school. His driving passion is to improve the lives of Moroccans through his natural farming practices.

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• **Natural Farm** • **Permaculture** • **Plant-A-Tree Initiative** • **Natural Horse Rehabilitation** •