BARILLA SUSTAINABLE FARMING

Implementing an educational framework to increase farmers' application of sustainable practices.

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MSc Strategic Product Design
Master thesis report

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Barilla TUDelft

There is no favourable wind for the sailor
who doesn't know where to go.

- Seneca

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EXECUTIVE SUMMARY

Dealing with agriculture is challenging for companies like Barilla because of several uncontrollable factors, such as climate change. Purchasing from the spot market constitutes a high economical risk for the company, which decided, in 2010, to launch the Barilla Sustainable Farming Projects.

Barilla Sustainable Farming projects support and promote the adoption of more efficient and sustainable agricultural practices while increasing the economic advantages of farmers. Accordingly, farmers sign agricultural contracts with the company, that in exchange for the security to buy the product ask for sustainable practices' application.

The Barilla Sustainable Farming project spread throughout the Italian farmers successfully; then, the company decided to expand these sustainable projects abroad. One of the two scopes of this graduation project is to export the Barilla Sustainable Farming projects abroad to increase the number of contracted farmers further.

However, despite many contracted farmers, Barilla still faces a significant issue: the tools and the Sustainable Farming practices developed by the company are not understood and thus adopted by farmers holistically. The scenario creates relevancy for this graduation project that aimed to apply the design methodologies to find a creative solution.
Then, the problem is defined in exporting the Sustainable Farming projects abroad while convincing farmers to adopt the Sustainable Guidelines developed by the company.

The project started from in-depth research on the countries' agricultural systems where Barilla could export the Sustainable Farming Projects and passed through semi-structured interviews with farmers to gain insights on possible design directions to convince them to apply the sustainable practices.

Then, with a conjoint definition on the two pieces of research (one for each scope), the final design direction was defined: creating an educational framework that aims to create engagement, understanding, and participation on the Barilla Sustainable Guidelines. Accordingly, the solution is a platform that allows farmers to learn, via different activities, all the company's guidelines, which should be applied while cultivating.

In the end, in compliance with the educational model, the company's interest would be relevant in implementing the Barilla Sustainable Farming in countries with a rearward agricultural level. Therefore, the most relevant countries have a lower educational and technological level among the studied countries. Consequently, after developing the educational framework, namely how farmers should learn the guidelines, a roadmap has been developed for implementing the educational framework in two different countries: Turkey and Russia.

Besides the academic core of the project, the main goal is to create a creative direction to investigate new possibilities further to expand the Barilla Sustainable Projects abroad. Then, the primary aspiration of the project for an actual application would be to create inspiration to explore new possible strategies Barilla may consider in the future.

Sincerely,
Gabriele

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0. INTRODUCTION

This chapter introduces the project, it explains the main scopes and it gives an overview the involved stakeholders.

Studies show that 13,5% of global greenhouse gas emissions arise from agriculture (Barilla Center for Food & Nutrition, 2012). Raw materials for the food industry sector directly depend on the agricultural sector's ability to overcome climate issues. Reducing emissions, therefore, constitutes a challenge for companies (and for humanity) that need to re-think their cultivation strategy towards a low-carbon society.

Food companies constantly face new challenges aiming for a more secure raw materials supply to avoid the threat to their supplies. Among these, durum wheat constitutes a fundamental resource for the pasta-making sector. Barilla, a leading company in the pasta-making sector (Pogutz, 2013), relies on durum wheat supplies and deploys around 1,1 million tonnes annually (Barilla, 2020).

Barilla has developed a win-win-win framework within their durum wheat suppliers, allowing the stakeholders to gain more from the raw materials supply. With the creation of agricultural contracts, Barilla ensures a fixed amount of durum wheat supply while enhancing its quality by adopting more sustainable agricultural practices. Furthermore, farmers can earn more money while decreasing the quantity of resources used to grow the durum wheat.

This graduation project has been executed in collaboration with Barilla, the largest durum wheat purchaser (Agostinelli, 2021) and the largest pasta maker worldwide (Barilla, 2020a). The largest Italian food company and the most important exporter of the Italian food lifestyle worldwide, Barilla aims for higher-quality pasta production with lower exploitation of resources. Like other food companies, Barilla has been facing important challenges in guaranteeing a safe, high-quality supply of raw materials over the past years. Thanks to the company's commitment, in 2010, a project called Barilla Sustainable Farming was launched to generate better quality raw materials for their products.

0.1 Initial project brief

Barilla has implemented the Barilla Sustainable Farming Project for durum wheat in Italy and Greece and has started in Turkey (Barilla, 2020a). Thanks to the BSF project, Barilla is helping farmers transition from the traditional durum wheat cultivation methods to a more sustainable and supported approach.

In 2019 29% of the Italian and 21% of the Greek durum wheat purchase came from agriculture that meets the sustainable standards defined by the BSF project (Barilla, 2020a).

As a result of the success concerning the BSF project, Barilla aims to expand it to additional countries where durum wheat is currently purchased, such as the USA, Turkey, Russia, France and Spain or countries where durum wheat is not purchased, such as Canada.
Thus, the simplest way to define the problem would be:

"How will Barilla assure an economically, environmentally and socially sustainable durum wheat supply from the foreign countries where it is purchased?"

Primary scope

The first issue addressed during the graduation project consists of overcoming the barriers outlined by the different countries (e.g. contractual issues) and minimizing the resistance caused by the system in force. For instance, farmers generally receive recommendations over fertilizers' usage by the producers, whose interest is to increase sales instead of Barilla's intent to reduce their usage.

Secondary scope

The second scope of the graduation project consists of swaying farmers about the worthwhileness of deployed methodologies and the differences from their usual cultivating methods. Hence, the issue is on unearthing the most manageable way to introduce the BSF methods into new paradigms different from the already established Italian one.

Overall, the initial aim was to design a coherent and holistic view of the Barilla Sustainable Farming project: understand the impact on the company's future, which are the opportunities for Barilla, how to combine all these considerations and coherently follow Barilla's vision towards the future.

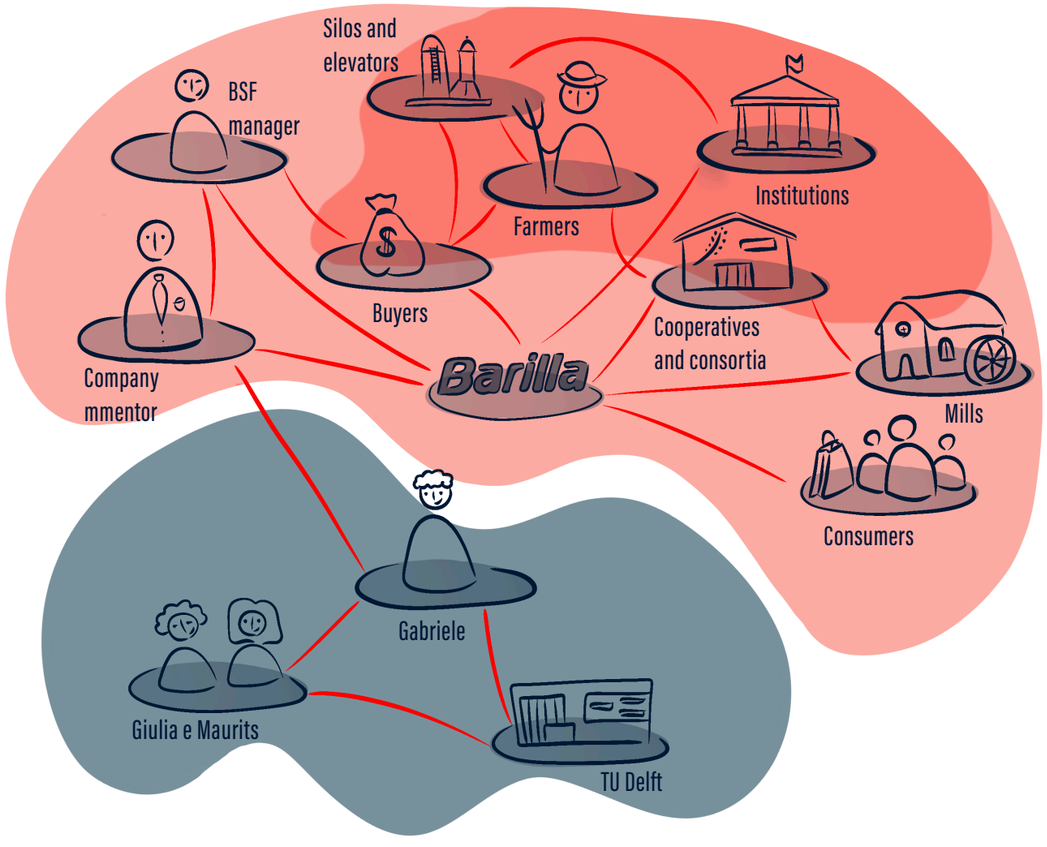
A strategic roadmap is the main design solution for the problem to be more impactful and guide the BSF to reach more farmers with its methodologies.

0.2 Main stakeholders

Many stakeholders take part in this project. The figure shows the involvement and the relations between different stakeholders. Therefore, we can divide stakeholders into three main branches:

TU Delft is the branch I belong to, with my Chair, Giulia Calabretta and my Mentor, Maurits Willemen. Barilla is the second branch, where the problem owner and company mentor, Luca Fernando Ruini, can be found. Secondly, the BSF Coordinator, who has a primary interest in this project, can be found. He is the person in charge of coordinating all the Sustainable Farming projects active in Barilla. The third branch comprises the net of durum wheat suppliers, including farmers, cooperatives, mills, elevators and consortiums.

In the end, consumers will be affected indirectly by the BSF project because they will buy a higher quality product.



▲ ***Figure 1:*** *the main involved stakeholders.*

1. PROJECT APPROACH

This chapter explains the methodology, the research approach and the research assumptions that characterize the project.

1.1 Methodology

As previously stated, the initial project's scope was to define a roadmap for Barilla, with the final aim to extend the Barilla Sustainable Projects for durum wheat in other countries. Therefore, the research method started by targeting some countries that could potentially lead Barilla to establish a BSF project within their borders. All the targeted countries are relevant for the company, where they already purchase raw materials or could potentially be bought. Furthermore, the so-called "raw material" treated in this graduation project is always durum wheat.

A disclaimer needs to be underlined regarding the impossibility, partially due to the Covid-19 pandemic and partially due to distance limitations, of deeply interviewing and getting in contact with representatives of all the countries. Additionally, in some cases, the documents' language led to the impossibility of using them as a reliable source of evidence to support the assumptions of the graduation project.

The main project set-up is based on two different models *(Figure 2)*, one derived from the other. First, the "design classic" Double Diamond methodology (British Design Council, 2019). This model divides the design process into two phases (diamonds): the research and design phase. The approaches of utilizing this model focus on this project's secondary issue: attract more farmers to join the BSF projects network.

The secondary design framework (aligned with the Double Diamond model) follows the Design Roadmap methodology (Simonse, 2018). This model was used to develop the Roadmap, which is the main deliverable of the graduation project. Derived from the Double Diamond, the design roadmap model is a "diamond" based model, composed of several diverging-converging exploration phases. Hence, it is suitable to support the more classic Double Diamond model.

1.2 Research set-up

The research phase is splittable in three main different research areas, given the huge amount of information related:

1

Context exploration aimed to gain a **deep understanding of the company of the Barilla Sustainable Farming projects**. For the latter, particular attention has been deployed on stakeholders, suppliers and actors involved in the process.

2

In-depth literature (including journals, papers, and research) supported by-laws, policies, and legal documents related to contract farming and agriculture. The aim was to **understand all the agricultural systems of the target countries** to successfully apply the BSF methodologies.

3

Both physical and online interviews performed with Italian interviewees directly or indirectly related to BSF projects. More information in the part of the interview can be found in Appendix A.

1.3 Research assumptions

The research followed a coherent framework during the first explorative part, but some assumptions led the research phase:

I. Target countries. These countries are all durum wheat producers, from which Barilla purchases or could potentially purchase durum wheat.

II. In some of these countries, Barilla owns one or more pasta production plants; therefore, the strategic importance of the production plants has been taken into account (Appendix B).

III. The investigation kept track of the possibility of establishing contract farming with local producers, followed by understanding the agricultural system in force and the definition of opportunities, barriers, and risks that could affect the implementation of the BSF projects in the considered countries.

IV. Based on the retrieved information, a comparative framework has been created to summarize and understand the limitations and the strategic value of the BSF project implementation. The comparative table in some cases misses information, either due to impossibility to find relevant evidence or due to lack of knowledge on the topic.

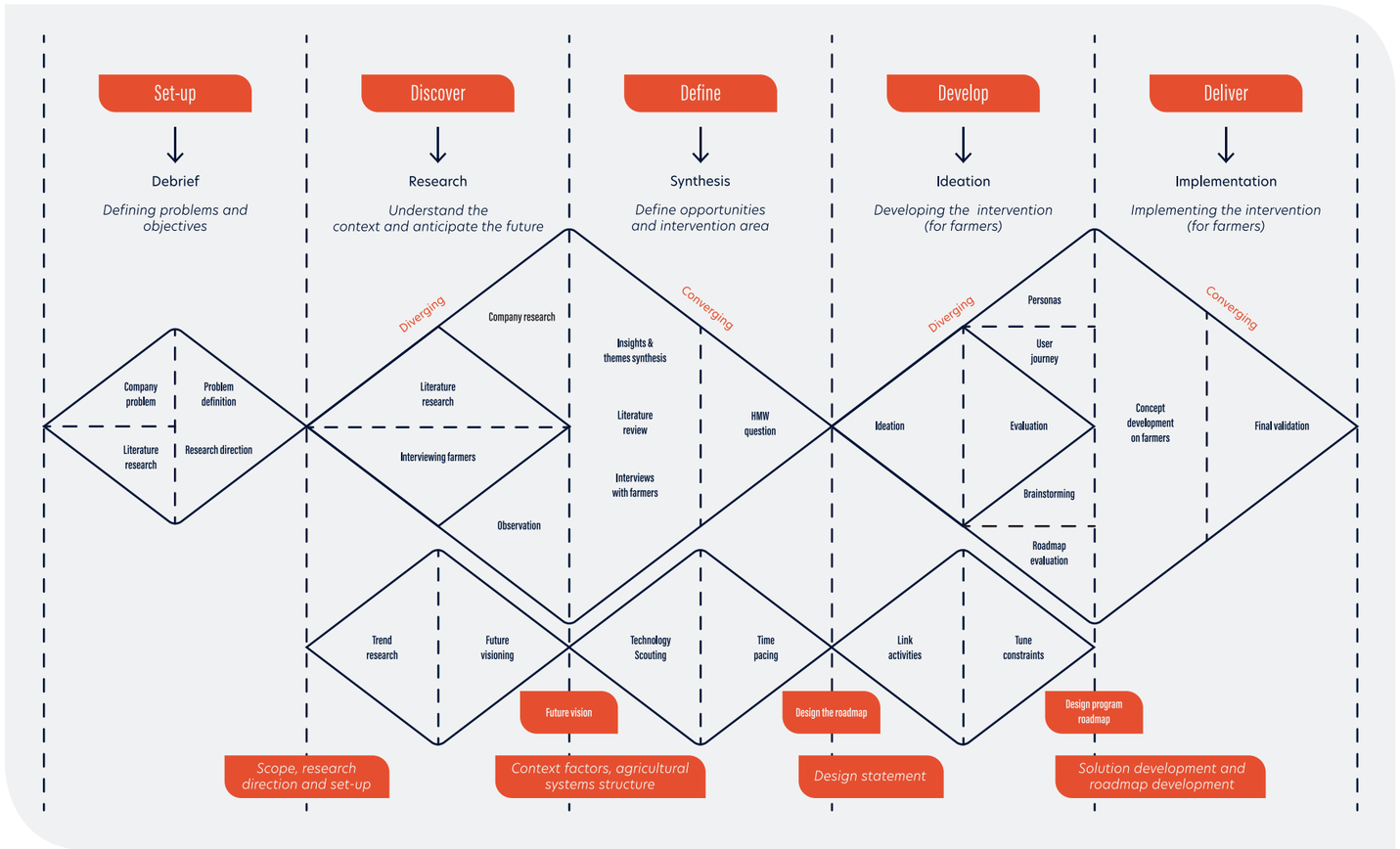


Figure 2: the methodological framework. ▶

DISCOVER

The “discover” phase aims to understand the context of the project in-depth. The process phase went through literature research and research on company materials; additionally, interviews with farmers, agronomists, producers, and experts of the BSF were carried out.

In the double diamond diagram, the discover phase ends with a set of unstructured research findings. The aim is to understand to “design the right thing”.

2. ALL ABOUT BARILLA SUSTAINABLE FARMING

Understanding Barilla and how Barilla Sustainable Farming helps addressing the company's need are explained in this chapter.

2.1 About Barilla

Barilla is the world leader in pasta production (Barilla, 2019) and the second Italian most reputed company worldwide (The RepTrak Company, 2021).

Founded in Parma (Italy) in 1877, Barilla successfully combines traditions with international expansion without neglecting a clear focus on innovation both in processes and products. Part of its popularity especially derives from the attention to the quality of raw materials and products inspired by the Mediterranean nutritional model (Pogutz, 2013).

However, treating different food products implies a various and wide range of different supply chains regarding all the group's strategic raw materials, like durum wheat, soft wheat, rye, eggs, basil, tomato, and vegetable oils (Agostinelli, 2021).

Strategy and mission

Barilla's mission follows the slogan "Good for you, good for the planet", aiming to bring the world good and healthy food sourced from responsible supply chains (Barilla, 2019). Overall, the mission could be divided into two parts, which reflect the company's commitment to improve people's lifestyles and the efficiency of production processes (Barilla, 2020).

The mission

"Good for you..." It is the first part of the mission, focusing on consumers' health and willingness to enjoy good food by continuously improving the nutritional profile of existing products and launching new products that are tasty, safe, and contribute to a nutritionally balanced diet (Barilla, 2021).

... good for the planet" Is instead the part that focuses on improving the efficiency of production processes to reduce greenhouse gas emissions and water consumption. Then, from 2010, the company's commitment, also relevant for the graduation project, is about promoting more sustainable agricultural and farming practices for all of the Group strategic supply chains (Barilla, 2021).

2.2 Barilla Sustainable Farming

Although Barilla relies on many different supply chains, this project's scope covers the durum wheat supplies only. Pasta is a very simple product made of only two ingredients: semolina and water (Barilla, 2017).

However, how do the Barilla Sustainable Farming projects work?

What?

Barilla Sustainable Farming is the managing system of all the supply related sustainable projects. The Barilla Sustainable Projects promote more efficient agricultural practices to obtain safer and higher quality raw materials, to safeguard the environment and farmers' social and economic conditions. (Barilla, 2018).

Barilla aims to guarantee an environmentally, economically, socially sustainable environment for all the people, suppliers, and the food they bring from the field to the final user (Barilla, 2018). To demonstrate the commitment, all the rules (including the definition of the BSF projects) delineate in the Code for Sustainable Agriculture (Barilla, 2018).

The main goals of the Code are:

Why?

Durum wheat is a primarily important resource for pasta, because together with water are the only two ingredients; but, to produce a superior pasta, the most determining factors are gluten quantity and quality of durum wheat. By milling durum wheat, the result is semolina: coarse particles that are needed for pasta production. High-quality semolina generates good cooking and eating quality pasta (Nilusha et al., 2019).

Every year, the company deploys around 1,1 million tonnes of durum wheat (Barilla, 2020). Nevertheless, durum wheat constitutes only 5 to 8% of the global wheat production (Kadkol, 2015), because it is used for a few products (like pasta, bulgur and couscous). Therefore, to satisfy the need for high-quality semolina for pasta production and a safer supply of durum, Barilla launched the Barilla Sustainable Farming project. It supports and promotes the adoption of more efficient and sustainable agricultural practices (Barilla, 2019).

Who?

Being part of a Barilla Sustainable Farming project allows farmers to avail their farms with tools to ease their decision-making process while saving money and reducing the overall consumption of resources. Accordingly, some tools are available for free to those farmers who wish to have support from Barilla.

All the actors along the supply chain are required, whenever is possible, to follow some principles:

- ***Good agronomic practices;*** apply those principles designed to sustainably manage natural resources while guaranteeing social stability and economic sustainability.
- ***Rural and agricultural development;*** by encouraging the adoption of specific tools aiming to efficiency improvement in the agricultural phases. Examples of these tools are the "Barilla Decalogue for Sustainable Durum Wheat Cultivation" or the Decision Support System (granoduro.net).
- ***Production management;*** using practices such as crop rotation fertility and soil biology can reduce the number of chemicals (fertilizers, pesticides, herbicides etc.). As a consequence, costs are being reduced for farmers.

How?

Barilla Sustainable Farming performs as a result of a well-organized net of contracts with suppliers.

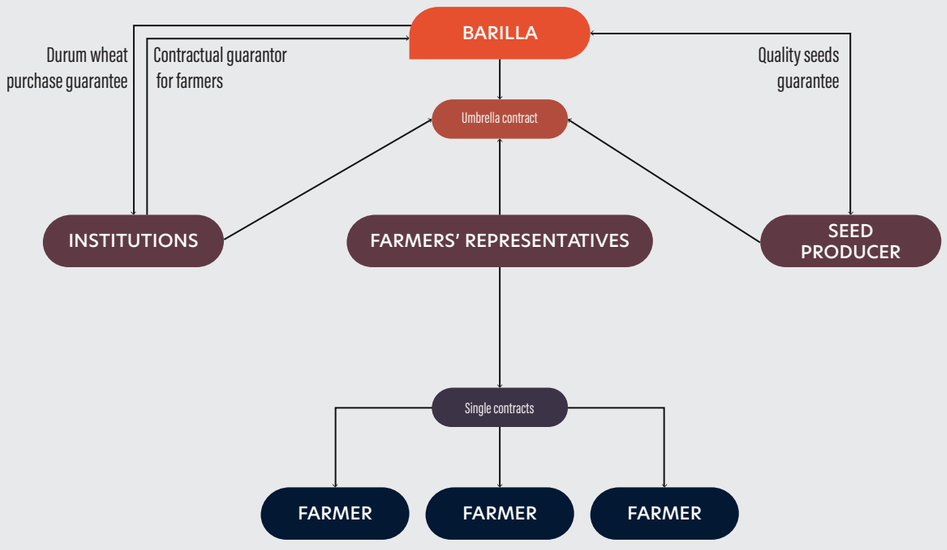
When talking about contracts in agriculture, the term is contract farming.
Contract farming is defined as an agreement between one or more farmers and a contractor to produce and supply agricultural products under mutual agreements, often at predetermined prices (Eaton and Shepherd, 2001).

However, Barilla preferred to sign contracts with farmers' representative entities (e.g. cooperatives or consortiums) to shorten the procedures despite the provided definition. These contracts, called "umbrella contracts" (Regione Emilia Romagna, 2019), are agreed upon between different actors of the agricultural system. Such actors may be regional governmental entities, various cooperatives, representatives of the farmers, seeds producers and Barilla, depending on the agricultural system. In turn, each cooperative will sign specific contracts with its interested farmers.

"[...] The economical situation gets better on a long term. Also because, the rest of the crops [the ones that are not under contract, ed.] are sold autonomously."
Paolo., farmer.

Contract farming enables many advantages for farmers and Barilla; on the one hand, farmers gain more economic certainty over the spot market volatility of prices, long term stability and the surety that, if quality standards are met, the produced durum will be bought by Barilla. On the other hand, Barilla gains the certainty that a set amount of raw material will be delivered under certain conditions. Besides, the company will ensure to buy only the desired quality of the product.

Although Barilla's effort in creating support for farmers, they struggle in actually implementing the principles in farmers' routine. The main offered tools are the "Decalogue for Sustainable Durum Wheat Cultivation", crop rotation and the DSS.



2.3 The Decalogue for Sustainable Durum Wheat Cultivation

Barilla Decalogue for Sustainable Durum Wheat Cultivation is a set of ten rules developed by Barilla after assessing and confronting several agricultural systems, practices and methodologies. The Decalogue provides farmers with enough knowledge to grow crops in a more sustainable way, saving resources, money and increasing the crop yield.

In the decalogue, Barilla sees farmers as a new entrepreneurial figure, asked to take tactical and strategic decisions. Consequently Barilla believes that "entrepreneurial farmers" need a constant update on the decision making process and a specific consulting on agricultural practices.

2.4 About monoculture and crop rotation

The first rule of the Decalogue is to "Alternate the crops" and it shows the importance of differentiating crops over different years, because in many industrial farms the unsustainable practice of monoculture is more common and widely applied. *Monoculture* is a very popular agricultural practice broadly used in industrial farming worldwide. It consists of growing only annual crops and field crops, such as wheat, corn or rice (Salaheen, 2019). This agronomic practice helps the farmer cut some costs (e.g. using different machinery for different crops) and strongly specialize in the production of one crop (Salaheen, 2019).

However, continuous monoculture where the same species is grown for several years in a row, can lead to unsustainable environments such as building up disease pressure, reducing nutrients in the soil, diminishing yield and leading to land desertification (Salaheen, 2019). After several years of monocropping, a chain reaction occurs for the farmer, who needs to increase the number of synthetic substances to avoid harvest loss.

In order to increase the yield of the harvest, farmers spray high synthetic fertilizers that aid the propagation of weeds, as they also benefit from the fertilizers. However, the more fertilizers are used, the more weeds propagate amidst the crops: then pesticides are sprayed. Pesticides are willing to contain chetales, organic compounds that

◀ ***Figure 3:*** *the umbrella contracts framework.*

bind metals (micronutrients for plants) such as magnesium, manganese, iron, zinc and copper. When these micronutrients are not available anymore, plants are more willing to get diseases. Thus fungicides are the next ring of the chain; fungicides are detrimental to the soil's health, harming the soil biology. Furthermore, plants are unable to arrest pests, and more pesticides are needed, also killing very important insects such as pollinators (Brown, 2016).

Following this path, the soil is more willing to become arid and sterile, enhancing the risk of desertification. The reaction chain shows that the more chemicals humans spray, the more is needed to obtain a better harvest.

2.5 Crop rotation

An alternative practice that can be used to reduce the number of chemicals used, thus decreasing the gross expense for the farmers, is crop rotation. Crop rotation is already part of the BSF projects, and it is one of the mandatory practices laid down in the Barilla disciplinary for farmers. Specifically, farmers must conduct at least three rotations to be part of the BSF projects.

Crop rotation is an agronomic practice that rotates crops in sequence to regenerate soil's health and micronutrients naturally. It was a common practice that led agriculture for millennia, but it has been overshadowed by the era of industrial farming (Bowles et al., 2020).

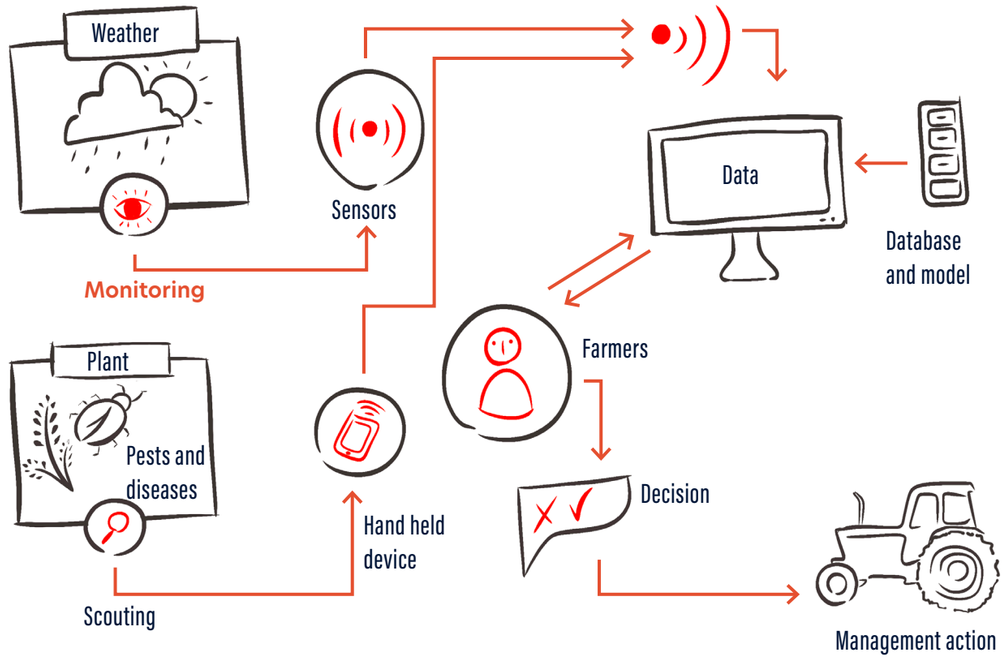
According to Bowles et al., crop diversity is progressively perceived for potential risk reduction from climate-change-related threats. Additionally, although few studies have demonstrated how crop diversity affects yield resilience and resistance to yield declines of individual crops across time (Bowles et al., 2020), Barilla believes crop rotation is beneficial to crop yield (Ruini et al., 2013).

Indeed, during the initial studies on the application of Barilla Sustainable Farming methodologies, Barilla has proven that, by using crop rotation along with a decision support system, it is possible to increase yield and to have better control on agronomic practices. Thus reducing machinery usage (and therefore being less costly) (Ruini et al., 2013).

2.6 DSS is a powerful tool to support farmers

Barilla and Horta s.r.l have developed a Decision Support System for each strategic raw material of the group to assist and support every part of the production processes. Granoduro.net (*grano duro* means durum wheat in Italian) is the platform specifically created for durum wheat supplies (Ruini et al., 2013).

Granoduro.net is a web service that combines information on weather, soil status and varietal characteristics to provide farmers decision support related to seeding, weeds control, nitrogen fertilization and information about risk for fungal diseases (Ruini et al., 2013). Farmers often do not adopt web tools; hence, a simplified version of the web app has been created for farmers. (Horta S.r.l., 2021).



▲ ***Figure 4:*** *explaination scheme of the Decision Support System (Barilla, 2021).*

The platform generates useful data on diverse decisions (figure 4); there are two distinct inputs that the DSS uses to generate decisions. In the first place farmers have to insert some data in the system, such as soil composition or land size. In the second place, weather stations generate live data depending on the changing climate. Together, based on the inputs uploaded by farmers and on data generated by weather stations, the DSS can create a decision-pathway that farmers can follow on being more sustainable both environmentally and economically (Ruini et al., 2013).

Accordingly, the conjoint application of crop rotation and DSS allow for a reduction of carbon footprint and an overall reduction of costs of about 10%. In the course of time, with a supported decision, farmers can better manage the usage of resources, reducing the utilization of petrol and fertilizers, for example. On a longer term, the yield will also increase as well as the nitrogen that lays in the ground (Ruini et al., 2013).

2.7 Limitations to the DSS utilisation

In compliance with interviews' insights, DSS provides accurate information depending on farmers' thoroughness in inserting data in the system.

"[the DSS, ed.] is quite easy to use, but in the starting phase it is a bit hard-working. They [Barilla, ed.] should ease the initial required number of data."
Paolo, farmer.

Thus, it is possible that the efficiency of the system would be affected by human accuracy in collecting and transferring data, making the whole DSS functioning only if the farmer fully agrees on the functionality of the system. The DSS is one of the causes of the problem this graduation project is trying to solve: farmers do not understand the tool, its usefulness and its consequences on the outcome of the cultivation season.

However, if farmers meticulously apply the instructions provided by the DSS, as also mentioned before, there would be numerous advantages. Additionally, Barilla provides the platform and the weather stations for free to all the contracted farmers who wish to apply the DSS utilization further.

Nonetheless, there are obstacles to implementing these systems throughout BSF farms network: some entities, such as consortiums, which are in charge of signing contracts with single farmers, are also fertilizers sellers. Hence, their interest is against the DSS' purpose of better managing and reducing the amount and impact of fertilizers, so often farmers are not even aware of such tools and funds to obtain them.

In the end, it is important to bear in mind that not all farmers are receptive to these new tools, and they generally trust their experience the most. Then, making the DSS easy for an holistical implementation, creates a challenging goal for Barilla.

Chapter 2 - **Key Take-aways**

- Barilla defines the goal of BSF as bringing environmental, economic and social sustainability to all the Barilla people.
- Expanding BSF is an essential goal for the company because it ensures safety in the durum wheat supplies.
- Expanding BSF is not a standing alone goal because farmers need to understand and deploy the tools Barilla provides.
- To bring a real value to the future of the company, Barilla should communicate BSF values more directly to farmers.
- Supporting farmers in data collection and insertion will increase the effectiveness of the DSS.

3. RESEARCH SCOPE 1

In this chapter the first research scope is addressed, through a PESTEL analysis overview of the selected countries.

The first research phase of the graduation project consists of overcoming the barriers outlined by the different countries (e.g. contractual issues) and minimizing the resistance caused by the system in force.

To better understand the drivers of research scope 1, the simplest way to define the problems would be:

What countries to target to export BSF?
How can Barilla better adapt their strategy to bring BSF abroad to the local reality of specific countries?

3.1 Target countries

In total, six countries were targeted to understand where exporting Barilla Sustainable Farming projects abroad is worthwhile. The analyzed countries are Canada, the United States, France, Spain, Turkey and Russia.

To select countries, the assumptions to consider in order to respect the company's needs are:

I. All the considered countries are relevant durum wheat producers.
II. All the considered countries are part of the current strategic purchase portfolio of countries.
III. All the considered countries have been or might be new markets for durum wheat exports.
IV. All the considered countries already have one or more BSF projects active or are in the company's investigation phase.

For each country, the analysis focuses on the changing factors that might happen in the agricultural environment. Then understand the macro factors that the company is not able to control.

Many forces strongly influence agriculture - both controllable, such as policies and non-controllable, such as climate change. Therefore, understanding strategic risks and opportunities constitute a primarily important step to building up reliable deliverables for the graduation project.

3.2 The PESTEL framework

The analysis builds up following the PESTEL model (adding the "I" of infrastructures because it is a relevant variable to move agricultural goods).

PEST(EL) is a mighty and diffuse tool for understanding strategic risk. PEST(EL) refers to the acronym for the significant forces of change: political, economic, social, technological (environmental and legal for a more inclusive version that has been used for BSF macro environment analysis). The scope of the PESTEL is to determine the evolution and the effect of the external macro environment of the company's competitive position. The external environment is composed of variables beyond the corporate's control, but a proper analysis can be realigned to the strategy (Sammut & Galea, 2015).

Since the PESTEL analysis aims to understand the macro-environment that may impact the Barilla Sustainable Farming projects in different countries, the PESTEL analysis looked into Canada, the United States, France, Spain, Turkey, and Russia.

The outcome of the PESTEL is a comparative table to contrast all the possible implications for the BSF expansion. Then, all the retrieved information has been divided into three main branches: opportunities, risks, and barriers for each category.

3.3 The PESTEL tables

To further support the next chapter, the PESTEL analysis has been divided in six tables that can be consulted while reading the chapter. Tables were useful to compare and draw conclusions, per each country, the main opportunities, risks and barriers of the country's agricultural system.

3.4 Political and Legal

Governments and their political decisions on physical, social and economic matters shape the agricultural environment. Accordingly, agriculture interlinks with climate change, energy markets and policies (Candel, 2014). As a source of food, agriculture widely depends on policies, and in turn, is based on countries' political stability.

Opportunities

In Canada, the United States, France and Spain, the agricultural system is legally organized, with easy access to policies and legislation. However, all those countries have a prominent political influence by the governments. In addition, France and Spain have to deal with the European policies for the adaptation of Agriculture to zero emissions by 2050 (e.g. limited use of fertilizers) (European Commission, 2021).

Turkey has several specific legislations about contract farming. However, the current government does not guarantee governmental stability and is also included in the "elevated warning" list of the most fragile countries worldwide (Fund for Peace, 2021). Nevertheless, the current policy promotes the private agricultural sector and industrial development instead of agricultural development (Kılıç, 2009), creating a good opportunity for Barilla to establish a set of Sustainable projects.

Risks

In the United States, the US Farm Bill constitutes a significant risk, which is the most critical tool for policies and legislations of agri-food of the federal government (Congressional Research Service, 2019). Every five years, the government renews the Farm Bill, and it could potentially create instability, whereas it changes policies that may influence farmers' long term planning.

Notable is the European prohibition of glyphosate (unless used as a herbicide) for growing crops: the high levels of glyphosate in Canadian and American durum wheat could lead to a failure in the exports in Europe (European Union, 2017). However, this is not valid for the local production of pasta, thus affecting only future exports.

	Opportunities	Risks	Barriers
Canada	• Governmental stability • Laws are clear and accessible • Local laws simplify governmental intervention • Strong grant funding are available to farmers • CUSMA[9] • Geographical access to contract farming laws[10 11]	• Farmers have easy access to contract farming guidelines • Decision-making is guided • Guidelines for farmers on contract farming available [10 11] • Food safety regulations may affect the future exports of durum • European list of non allowed substances [12] • European ban for glyphosate by December 2022 [13]	• High political influence from the ministry of Agriculture and Agrifood
USA	• 10,3% of farmers are under contract in wheat production[1] • New Generation Cooperatives can be targeted • Contract farming is managed locally • CUSMA[9] • Regional legislation for contracts	• US Farm Bill • High risk with new Farm Bills • Barely impossible wheat production without glyphosate[2] • Increased customer concerns regarding residue levels, food safety, labeling, etc. • Contractual framework has multiple levels • Every state of the federation needs different contracts • European ban for glyphosate by December 2022 [13]	• High political impact on agriculture • In some countries contract farming is limited
France	• Open dialogue with regional institutions • Cooperatives are well organised and very common • Supportive tax system to reduce tax burden[3] • Organic farming's biggest increase worldwide[4]	• Trade unions of farmers	• EU funds are taxated[3]
Spain	• EU funds are less taxated[3] • Spain has the second lowest tax burden in the EU-15 [14]	• Trade unions of farmers • Dry land is expected to become even drier	• Taxation is not supportive[3]
Turkey	• Government is retiring from the agricultural development[6] • Private sector is freer to act[6] • Government push to privatization of the agricultural sector [5]	• Agricultural basins govern the allowed varieties • Cooperatives are statal • New urban areas threatens rural development[6] • the Turkish seed market is mainly controlled by 400 companies where the most powerful 30 are multinational [6]	• Alignment laws to european standards are destroying rural land and small farmers[6] • Central government requires registration of contracts[7] • new regulations enforced threatening to destroy the rights of peasants by interfering with their access to seeds, land and political rights [6] • Turkish law on seeds (2006) is largely against farmers, who must buy defined seeds from privates [5]
Russia	• State policies have facilitated an increase in grain and wheat[8]	• Policy outcomes are influenced by the efficacy of state policy and state capacity[8] • Present-day state is interventionist in agriculture • Agriculture is influenced by the efficacy of state policy levers even in a privatised agrarian sector[8]	• High federal influence and intervention on agriculture[8] • Russian government has officially banned the cultivation and breeding of genetically modified crops[15] • 'high' policy impact to grain storage and grain transportation[8]

▲ ***Table 1:*** *Political and legal factors for each country.*

** references for this table can be found in Appendix C*

In Turkey, the creation of Agricultural basins from the government could lead to obstacles in Barilla's decision on seeds varieties, since all the allowed varieties are decided and managed by the Turkish Ministry of Agriculture (Republic of Turkey – Ministry of Agriculture and Forestry, 2009).

In the end, the political presence of the Federal Government in Russia is the highest risk for the BSF project implementation. Remarkably, the government is interventionist in agricultural matters (Wegren et al., 2019), significantly pushing the production towards being the most prominent agricultural producer worldwide (Sheremet, 2019). Hence, the political presence could potentially create instability in the agricultural world, forasmuch as new policies efficacy could fail. Furthermore, most policies also apply to the private sector (Wegren et al., 2019).

Barriers

The main barriers focus on Turkey and Russia. Due to the Turkish attempt to enter the European Union, the government is adapting many legislations to the European Union's standards. In addition, because the rural population in Turkey is much higher than the European average, new laws to unify villages into larger urban centres were created, threatening the local population's employment and rights. Thus, the inevitable consequence is a reduction in agricultural land (Meriç, 2018).
Furthermore, if, on the one hand, the agricultural sector's privatization could benefit BSF, on the other, the Turkish law of seeds (2006) forces farmers to buy seeds by privates with an increase of prices for farmers (Meriç, 2018).

Finally, in Russia, genetically modified crops are illegal, also for privates. So then, the application of certain seed varieties is forbidden, thus shortening the possible choice and creating more willingness to get pests and diseases (USDA Foreign Agricultural Services, 2016).

3.5 Economical

Opportunities

Incentives are a significant part of agricultural maintenance because, without external funds, agriculture would not be sufficient to sustain the population. Rising interest in investments to support Agriculture 4.0 also derive from private multinationals for developing startups (De Clercq et al., 2018).

Canada offers a wide range of funding opportunities to its farmers (Government of Alberta, 2021a). However, these highly depend on policies, and if money will be eligible for sustainable farming practices is up to politics. On the contrary, there are provisions for contract duration in the EU to increase long-term benefits for farmers (Endres & Endres, 2017). Similarly, in Russia, farmers have many incentives to adopt driverless machinery or precision farming tools to increase efficiency (Wegren et al., 2019). Incentives constitute an opportunity, whereas they concern adopting sustainable practices or modern tools that help to increase efficiency through the production phases.

Contract farming is already an ordinary reality in many countries. Indeed, in Canada, the USA and Europe, it is a more accepted practise (Agostinelli, 2021). For example, in the USA, considering only the wheat market, more than 10% of farmers adopt contract farming (USDA, 2021). To get a grip over this market, Barilla also provides many premiums over the quality. As a consequence, they increase the adoption of such contracts.

A different situation exists in Russia, where farmers have a low income and grain markets face low prices due to overproduction, increasing chances for a BSF settlement.

Risks

A potential risk in Russia is Putin's intent to push agriculture shortly. Specifically, he aims to increase exports by 12% every year until 2024 (Sheremet, 2019). The risk of enlarged export threatens Barilla's

intentions to internally purchase locally produced durum wheat for internal production (a production plant is based in Moscow) because policies might favour exports instead of internal sellings. Furthermore, consistent investments are needed in rural Russian areas, especially in infrastructures like roads, railroads and storage facilities.

In the end, recent news about glyphosate bans by 2022 (European Union, 2017) will threaten American and Canadian durum wheat imports, which, due to short summers, spray it on the crops before the harvest (P. P., 2021, Interview on Barilla Sustainable Farming). Glyphosate allows for a shorter drying period. Therefore, Barilla means that the import of durum would not be allowed from these regions anymore, and the local production will be increasingly important.

Barriers

The loss of workers in rural areas constitutes the most significant barrier for Turkey and Russia due to privatization and low income. In addition, Turkey is experiencing a massive loss of land due to adaptive policies to EU standards (Meriç, 2018).

In the end, Russia is ranked as one of the lowest land's yields worldwide (Sheremet, 2019), that together with poor infrastructures, could potentially create a negative economic impact shortly.

	Opportunities	Risks	Barriers
Canada	▪ Incentives for agribusiness and corporate farming ▪ Acceptance of contract farming as beneficial for long term planning ▪ Great economical stability[1] ▪ Lower price of durum, if compared to Italy[2]	▪ Higher farmers' income[3] ▪ Low crop differenciation per area ▪ Usage of glyphosate during pre-harvest phase might cause economical loss[4]	▪ Employement is low in rural areas of Canada ▪ Glyphosate is accepted in Europe until December 2022[5]
USA	▪ Agricultural crisis in Montana and North Dakota ▪ Acceptance of contract farming as beneficial for long term planning	▪ Higher farmers' income ▪ Low crop differenciation per area[6] ▪ Significant quality discounts ▪ EU potential tariff on US goods due to aircraft production subsisides[8]	▪ Glyphosate is accepted in Europe until December 2022[5] ▪ Farm Bill's decoupling of production and price supports ▪ Petrol dependent agriculture ▪ Strong world demand for high quality wheat
France	▪ Acceptance of contract farming as beneficial for long term planning ▪ Biodiversity, organic farming, young farmers and other areas received a welcome financial boost from the EU institutions		
Spain	▪ Acceptance of contract farming as beneficial for long term planning ▪ Biodiversity, organic farming, young farmers and other areas received a welcome financial boost from the EU institutions	▪ Latifundos exist (large cultivated areas)	
Turkey	▪ low agricultural employment ▪ the government aims to strengthen contract farming in agriculture, towards a more capitalist mindset[9] ▪ Investment in new agri technologies for contractors	▪ Consistent investments need to be done for infrastructures	▪ Loss of workers, that, due to a heavier industrialization moved from the countryside to the cities to find new job opportunities ▪ Agricultural land is disappearing, the last 10 years, Turkish agricultural land has decreased by 2.7 million hectares[10]
Russia	▪ Land is cheap ▪ face low domestic grain prices due to recent large harvests and full elevators[11] ▪ Low income farmers	▪ Consistent investments need to be done for infrastructures[11] ▪ Putin wants to push exports of 12% (per year) by 2024[12] ▪ Inefficient use of land[11]	▪ Low infrastructures availability ▪ inadequate level of investment R&D, and innovation [11] ▪ Poor crop yield ▪ No evidence of contract farming found

▲ ***Table 2:*** *Economical factors for each country.*

** references for this table can be found in Appendix C*

3.6 Social

Opportunities

In Canada and the USA, there is, on average, a high level of specialized farmers; some of them even have a second job (Hoppe et al., 2004). These farms are defined as “lifestyle farms” (Hoppe et al., 2004) and, together with “family farms”, constitute the majority of farms in the USA and Canada. Contract farming is generally accepted, but strong ideas on practices and climate change often might influence their decision-making towards more sustainable agriculture (Tickell, 2020). Similarly, in France and Spain, contract farming is already quite diffused and accepted among the community (Agostinelli, 2021).

In Turkey and Russia average poverty of the farmers gives room to implement contract farming to increment local people’s wealth.

Risks

Social risks might be found in the adoption of crop rotation in contracts. For example, in American prairies, crop rotation is less diffused and, due to land extension and cost of the necessary machinery, it might be a possible encountered risk. Also, strong opinions on traditional methods can affect adopting new and more innovative practices unless policies will help in this direction (Tickell, 2021).

In Turkey, two-third of the farms are the poorest segment of the population (Meriç, 2018). Socially, it might mean low specialization, low knowledge of modern farming practices, and old machinery. Hence, the risk is about the benefit that both farmers and Barilla will obtain from the contracts.

In Russia, there is a high demand for skilled workers such as managers, technicians and machinery experts (Wegren et al., 2019) that, jointly with the Russian agriculture expansion, will mean a higher investment in specialization needed.

Barriers

In the USA, there is a solid personal conviction over matters such as sustainability and climate change (Olson, 2019). Furthermore, unsustainable practices are still very diffused in local communities: land management is done on the total land and not on the yield.

In Turkey, there is a lack of transparency over the final product (Agostinelli, 2021): farmers hide the actual quality of the product aiming to earn more. Furthermore, the socio-economic situation in the country is very diverse, passing from wealthy areas to extremely poor.

	Opportunities	Risks	Barriers
Canada	• Good sense of community between Canadians • Acceptance of contract farming as beneficial for long term planning • Higher expertise, more specialized farmers • Acceptance of contract farming as beneficial for long term planning	• Farmers are more aware of what contract farming is an what are the consequences • Large farms tend to save money[1] • Low crop differentiation per area • Size of the land affects the planning and way farmers work[1]	• Limited changes in decision making • Unsustainable practices still widely applied. Monoculture.[2]
USA	• Lifestyle farms allow for a wider education of farmers • Consumers want fewer chemicals and additives on food labels. • Higher expertise, more specialized farmers • Family farms are predominant, contracts are a strong point Acceptance of contract farming as beneficial for long term planning	• Strong opinions on traditional methods[4] • Lifestyle farms are common farming in US • Profit-oriented farms tend to save money • Size of the land affects the planning and way they work • Low crop differentiation per area	• Every farmer has his own opinions on planning and climate change (USDA commetee) • Difficult to deal with everyone has a different idea or definition. • Unsustainable practices still widely applied. Monoculture.[3]
France	• Acceptance of contract farming as beneficial for long term planning[5] • Higher expertise, more specialized farmers • Cooperatives only work with subscribed farmers		
Spain	• Acceptance of contract farming as beneficial for long term planning[5]		
Turkey	• Farmers are on average poor[6]	• Peasantry holds 2/3 of the total Turkish farms and are the poorest segment of the population[6]	• Lack of transparency of products' quality by farmers[5] • Need of informatics knowledge. • Lower expertise, poor specialisation • Poor farmers political, economical and cultural rights are violated by the ruling Government[6]
Russia	• Unemployment in rural areas • Farmers are on average poor but in growth[7]	• State surveys say largest number of agricultural job vacancies are for skilled labour[8] • Conservatism leads to an attachment to Soviet mindset[8]	• Lack of qualified workers[8] • Insurance is ineffective and unpopular among farmers[8] • Lack of informatics knowledge. • Lower expertise, poor specialisation[8]

▲ ***Table 3:*** *Social factors for each country.*

** references for this table can be found in Appendix C*

3.7 Technological

Innovation will play a central role in smart and precision farming to increase efficiency and decrease emissions soon.
However, skilled labour is needed to proceed with increasing technology usage in farmland.

Smart farming, IoT, and big data are quickly spreading in Europe, Canada, the USA, and Russia, where state policies support and facilitate the introduction of hi-tech machinery (Wegren et al., 2019).

To comply with Barilla Sustainable Farming contracts, it is unnecessary to have a particularly advanced set of equipment (P. P., 2021). However, the risk in developing countries such as Turkey and Russia is that the technology level's investments are too consistent for farmers. However, Russia is formalizing a plan of subsidies to allow producers the purchase of appropriate technical equipment (Yakupova, 2018).

The barriers in technology development and implementation are mainly caused by producers' inability to use them, therefore decreasing the overall performance of the well studied Barilla Sustainable Farming model. In this case, it might be possible that the quality requirements are not met. Consequently, farmers would not benefit from the contract if Barilla will not buy the durum wheat produced. Alternatively, the contracts and quality requirements need to be adapted to a lower level until farmers can guarantee it.

	Opportunities	Risks	Barriers
Canada	• Canada boasts a strong grant funding ecosystem that should serve as a foundation for stronger early-stage investing, including seed-stage investments[1]	• Adaptation to crop rotation	
USA	• Agriculture 4.0 spreading		
Spain			• Investments for replacing the equipment.
Turkey		• Age of the current equipment. • Available machinery not up to date.	• Investments for replacing the equipment.
Russia	• 15% subsidies were offered to agricultural producers to purchase appropriate technical equipment[4] • State policy supports and facilitates the introduction of high-tech machinery and practices[2] • Subsidies exist to implement Agriculture 4.0 equipment in Russia	• Age of the current equipment.	• Investments for replacing the equipment. • World's 2nd inefficient with its arable land, and 5th with its farmland plots[3] • Machinery fleet requires significant upgrades

** references for this table can be found in Appendix C*

▲ ***Table 4:*** *Technological factors for each country.*

3.8 Environmental

Besides crop rotation that is a mandatory practice to be included in BSF projects, other practices are applied in areas to recover soil's biology, such as covering soil or green manure. Cover soil is the most used practise in some very extended rural areas to avoid soil erosion and desertification (Zlomislic, 2019), thus keeping the soil characteristics intact. Green manure is a way to regenerate nitrogen in soil between two different crops, thus shortening the rotation and increasing the overall expenditures.

Positive trends show that organic agriculture is spreading very quickly in France (Lorenzen, 2021) and the USA, Canada and Spain (FiBL & IFOAM, 2020). Organic agriculture is different from the BSF project methods, but it uses standard practices to preserve soil health and biology.

In Turkey, the land is very fertile, so the yield is relatively high, while in Russia, climate change allows planting more summer crops such as durum wheat, even though the yield is low. Notable is the spreading of many startups that treat green agriculture in Russia, helping farmers throughout the transition (Tracxn, 2020).

Risks

Environmental risks are primarily located in the Northern plains (USA), where monocropping (still very diffused) creates a brutal biodiversity loss. In addition, with desertification and more intense drought during growing periods, the risk is that durum wheat is not suitable for the market. (Olson, 2019).

	Opportunities	Risks	Barriers
Canada	• Cover soil[1] • Livestock integration[1] • Warmer summers with drought[1] • Incentives on research and experimentation[2]	• Higher risk of glyphosate due to conservation[3] • The harvest is late, no time to dry the durum correctly[3] • Climate change is already affecting canada[1] • Drought during growing period[1]	• Pests and diseases (fusarium) • Short summer forces the use of glyphosate in the late stage of crops growing phase[3] • Soil protection harmed by desertification • Loss of biodiversity
USA	• Cover soil • Green manure usage	• Drought during growing period[4] • Since drought is growing there is uncertainty over spring and durum acres. Farmers didn't harvest in 2020 many fields	• Adverse weather cause significant harvest delays and quality issues • Loss of biodiversity
France	• Organic agriculture is spreading[5] • natural conditions are very favourable for agriculture[5]		• France has one of the lowest shares of environmental taxes in the EU[6]
Spain	• Most of Spanish crop land is not irrigated		
Turkey	• High average yield in Turkey • Good soil health as well		
Russia	• Warmer temperatures in summer are positive factors for durum cultivation • Increase of agro holdings that buy farms for vertical integration • Start-up farms are common in Russia	• Decrease of long term agro-sustainability	• substantial agro-biodiversity loss and increased susceptibility to disease and weather conditions

** references for this table can be found in Appendix C*

▲ ***Table 5:*** *Environmental factors for each country.*

In Russia, the policies push the export to the detriment of long term agro sustainability because the focus is on extending the arable land with intensive industrial farming (thus preferring mono-cropping) (Sheremet, 2019).

Barriers
Due to loss of biodiversity and extensive land exploitation in the USA, soil degradation and pests will increase, creating the need for more sustainable production and more responsible soil management. Furthermore, the Farm Bill currently promotes overproduction, pushing farmers to produce more in return for government reimbursements (Anderson, 2017). Threatens are also provided by more and more adverse climate conditions that often cause delays in the harvest or even the inability to harvest.
In Europe, the recent policy proposals for going CO2 zero by 2050 should provide an authentic and intense commitment to sustainable practices, being agriculture one of the most polluting sectors nowadays.

3.9 Infrastructures

Opportunities
Canada and the USA are well established commercial partners. CUSMA (Canada - United States - Mexico agreement) creates a flourishing environment for the export/import of grains (Government of Canada, 2020). Furthermore, there is also a joint organization for storage and transport management: the railroad is connected between the two countries, and many elevators provide rail yards. Barilla's production plant in Ames (IA) has one rail yard as well, and it is fully capable of exploiting the well-organized net of transport (Canadian Railroad Network, 2021).

Although Russia has experienced evident problems with grain storage and transport (Wegren et al., 2019), Barilla is building a new mill that partly addresses the shortage of storage available in the Russian elevators (Ruini, 2021). However, the government controls most of the elevators and wagons for railroad transportation, which cannot manage the enormous amount of wheat produced in the rural areas (Wegren et al., 2019). Rural roads are underdeveloped too.

However, more than 10 million hectares of Russian land is still idle (Yakupova, 2018), creating an excellent opportunity for Barilla to establish sustainable production there.

Risks
In Canada and the USA, farmers immediately sell the grains to elevators. Therefore, finding an agreement with some elevators for a private and separate durum wheat storage could be a need to decrease risks regarding infrastructures.

	Opportunities	Risks	Barriers
Canada	• Canadian grains railroad connects directly to Iowa[1] • Road net is good and advanced	• On-farm storage possibilities. • Own storage usually unavailable • Production-storage capabilites are insufficient • Mills/elevator distance from the farm	• Elevators are the main storage used by Canadians • Storage arrangements need to be agreed
USA	• Canadian grains railroad connects directly to Iowa[1] • Elevators are connected both with railroads and Canadian elevators network[1]	• On-farm storage possibilities. • Mills/elevator distance from the farm	• Elevators are the main storage used by Americans • Storage arrangements need to be agreed
Russia	• New mill to be built by 2023[2] • 10 million ha of arable Russian land is still idle[3]	• On-farm storage possibilities. • Mills/elevator distance from the farm • the state owns and operates the railroads that transport grain[4] • state-owned and privately-owned grain elevators for storage[4] • deficiencies in grain transportation that create problems for Russia's grain producers and trading companies[4]	• Underdeveloped infrastructures, especially rural roads[4] • Grain railroad under governmental control and management[4] • Elevators lack of available space[4]

▲ ***Table 6:*** *Relevant infrastructures literature.*

Country	*Agricultural system description*	*Key take-aways*
USA	The major durum wheat producers are located in Montana, North Dakota, Arizona and California. In the United States, contract farming is widely diffused, but every state's legislation is managed locally with the USDA (United States Department of Agriculture).	American farmers already use advanced and efficient cultivation systems, including precision farming and similar tools to the DSS (Barilla, 2019).
		Barilla is already working with institutions to spread sustainable guidelines and even a digital platform through their durum wheat supply chain (Barilla, 2019).
		Assumption: bringing crop rotation seems more complex due to the size of the land and the current predominant mono-cropping system.
Canada	Barilla has cut durum wheat purchases from Canada by 35% (Beres et al., 2020) due to producers inability to guarantee low levels of glyphosate. *Glyphosate* is a chemical used as herbicide, but it can also be used to dry durum wheat faster if summers are short (P. P., 2021). The issue in the latter case is that residual remain on the kernels and for this reason the durum wheat does not meet the quality standards anymore. Nevertheless, Canada remains one of the biggest durum producers worldwide (Tedone et al., 2018).	Barilla would gain bargaining power towards all the other durum wheat markets, if farmers tope using glyphosate for drying.
		Barilla would move durum to the production plants using the joint railroad system covering Canada and the USA.
		Split the purchasing between the Canadian and the American markets, would allow obtaining different choices over the quality available on both markets.
		Canadian farmers can afford the most cutting-edge technologies, such as DSS, that indeed are already widely applied.
Russia	Russian agriculture is still in a development phase, and many hectares of farmland are idle, partly due to climate change. Russia is strategically the most interesting market for the BSF expansion. Putin intends to make Russia the biggest durum wheat exporter worldwide to create more opportunities for Barilla to establish a contract network.	The expansion of exports may be supported by various policies to incentivize exports more than the internal utilization of goods. This could also lead to more intensive farming soil's exploitation.
		The efficiency of agriculture is highly interlinked and dependent on legislations' effectiveness, because of government interventionism.
		No evidence about the existence, possibility, or legislation that allows contract farming has been found during the research phase.
		Available investments and subsidies for farmers will push agriculture to be more advanced and up to date.
Turkey	Turkey is a significant producer of durum wheat, and Barilla owns a production plant and a mill in Bolu. Therefore, Turkey can be considered a fruitul market to expand the BSF projects for durum wheat. The presence of a production plant contributes to Barilla's needs to grow durum wheat there. Currently, the company has 20 active trials for the BSF projects in this country.	Government's decision to increase agriculture privatization allows Barilla to expand contracts with local farmers.
		Unemployment in farmland is causing a decrease in cultivated land, and people are moving towards more industrialized centres.
		Agricultural basins provide regions like Ankara, Bilecik or Kirikkale to be attractive targets for Barilla, very close to Bolu's production plant.
France and Spain	As both part of the European Union and given the envisaged policies that will change the agricultural emissions, there will be an overall shift in agricultural practices. In France, a shift towards more sustainable practices is already happening, but the country has a very complex system of laws that govern the agricultural panorama. In Spain instead, the cooperatives create a fragmented environment, do to lack of organization.	Contract farming is already a realm in both countries, and farmers consider contracts as safe sources of money for the long term.
		Using cooperatives as third parties to find interested farmers would replicate what has been done in Italy.

▲ ***Table 7:*** *Key take-aways per analyzed country.*

4. RESEARCH SCOPE 2

In this chapter the second research scope is addressed, focussing on how to convince farmers to adopt the BSF methodologies.

The second research phase addresses Barilla's need to convince farmers to adopt the BSF tools and methodologies.

As explained in chapter 2, the DSS utilization depends on farmers thoroughness in inserting data into the system; if farmers were discouraged by the amount of data required, the DSS would be less effective.

"The analysis needs to be executed autonomously [of the required data to put in the DSS, ed.] otherwise the DSS estimates the suggestions if the farmer knows roughly the composition of his fields."

With esteemed data, the DSS' usefulness is jeopardized. Therefore, Barilla needs to convince farmers first to understand the DSS and then learn how to use it. If, on the one hand, the successful application of the DSS would bring many advantages to farmers, on the other also Barilla would gain many advantages in a correct application of the DSS. Assuming that farmers would correctly use the DSS, an overall increased yield would produce more durum wheat from the same number of farmers. Then, it appears clear why the second scope of this project focuses on convincing farmers to apply the BSF tools correctly.

Then, academic evidence of the DSS effectiveness is far from the actual application of the software from farmers. It is also imperative to bear in mind that the integration of this system is complex, given the difficulties for farmers to use technological inputs:

"[...] farmers are not particularly technical, but they instead insist on simplicity." Luca, farm manager.

Furthermore, sometimes farmers are unaware of these tools because some consortia, especially those that also sell fertilizers, do not have an interest in proposing tools that reduce the amount of chemicals used by farmers, such as the DSS. However, more aware farmers would benefit the company independently from cooperatives' willingness to share these tools with farmers.

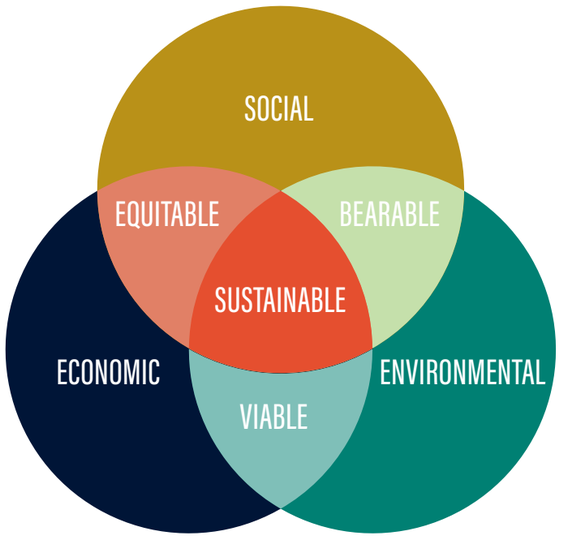
4.1 Addressing the second scope

According to Barilla, their goal is to guarantee an environmentally, economically, socially sustainable environment for all the people, suppliers, and the food they bring from the field to the final user (Barilla, 2018). Besides, the Barilla Sustainable Projects promote more efficient agricultural practices to obtain safer and higher quality raw materials, to safeguard the environment and farmers' social and economic conditions. (Barilla, 2018).

The first step of this research phase was questioning if Barilla met all the three aspects of sustainability in the BSF projects (figure 6):

Do these aspects effectively match the aforementioned sustainable goals? Why, given the company's efforts to create support to farmers, are these tools still not fully understood from farmers?

▼ ***Figure 6:*** *the three pillars sustainability model.*



Three main pillars that support the company idea of sustainable projects are economical, environmental, and social.
During the company materials' analysis, there was the consciousness that Barilla, in the BSF rise, has mainly developed the economic and environmental pillars, leaving more room to develop social sustainability-related matters. This happened somewhat because Barilla intended to establish only indirect relationships with the farmers to ease the contract procedures. The indirect relationship with farmers works to ease the amount of work and contracts issued with farmers. However, it created a gap in communication between the company and farmers. Because farmers are difficult to reach, communication with them is essential in establishing a stronger relationship to increase their use of the tools.

4.2 Economical pillar

The economic pillar is necessary because it allows the monetary feasibility of the project. Economically, Barilla has created a perfect balance to make every actor benefit from the BSF projects. Indeed, thanks to the contracts, Barilla can lower the economic risks. For example, contracts allow the company to know the expected amount of durum wheat that they will purchase. In this case, uncertainty is lower because Barilla lowers the need to buy raw materials from the spot market. In fact, for this reason, contracts also provide Barilla with more robust economic stability because, with the arrangements, prices are predefined.

From farmers' perspective, contracts ensure that part of their production outcome goes to Barilla at a predefined price. Consequently, farmers know in advance which quantity they expect to deliver, allowing them to make a more accurate long-term plan. Moreover, Barilla proved a long-term increase in economic stability for farmers, who can plan their future activities more accurately across the decade of BSF projects.

"From what I know, my farmer clients are delighted with the supply contracts signed with Barilla". Roberto, fertilizers producer

4.3 Environmental pillar

To increase environmental safeguard, Barilla has created various tools to support farmers' activities. These tools help farmers adopt more sustainable ways to cultivate their durum wheat, but not always they are able or willing to use them.
The essential tools are:

- ***Decision Support System.*** It is free software (Barilla finances it for farmers who sign a contract) that can give targeted suggestions on decision making based on data about the farmland. This tool is beneficial when it comes to managing resources such as water or fertilizers cleverly (Granoduro.net, 2021).

- ***Barilla Decalogue for Sustainable Durum Wheat Cultivation.*** It is a valuable set of rules that the farmers can use as guidelines to support their cultivation practices. (Barilla, 2017)

- ***Guidelines for sustainable farming.*** Several sustainable farming guidelines are published in many countries to support sustainable farming practices. All these guidelines are adapted to the local agricultural system and practices to be more effective for farmers that use them in the cultivation process.

At the current moment, all these environmental tools are a free choice of the farmers, who are often unaware of their existence (P.P, 2021). Increasing social sustainability can help farmers get acquainted with the provided tools, hence helping to increase environmental sustainability.

"I did not know about the existence of the DSS, but maybe because we have signed a contract with Barilla only for a small part of my land". - Flavia, farmer.

4.4 Social pillar

The social pillar has mainly been neglected within the three-pillar model (environment, economy and society) as a broader debate has prioritized environmental and economic issues (Davidson, 2009). This also partly reflects Barilla' choice to develop the economical and environmental pillars mainly.

The social pillar is the widest in sustainability because it considers many human-related aspects such as education, participation, housing, employment (Davidson, 2009).

Naturally, for a company like Barilla, keeping track of all the social-related problems is challenging. However, it is possible to act on some of them to increase the overall understanding of BSF and the related tools.

Suppose to relate social sustainability to the Barilla Sustainable Projects. Farmers sign a contract because they foresee an opportunity for their economic stability, but often they are not aware of the existence of supportive tools. In this case, one can observe that farmers do not feel involved in the process, and they do not understand the importance of implementing the environmental side of BSF.

"Among the farmers, some of them do not use it [the DSS ed.]; so I follow for some farms the various alarms and suggestions that it creates [the DSS ed.]." - Luca, farm manager.

Increased social sustainability could lead to a better understanding of the importance of tools such as the DSS or the Decalogue for sustainable farming.

Chapter 4 - **Key Take-aways**

- Barilla should not assume that farmers will insert all correct data in the system, because there is not an intermediate step between the contract signature and the moment in which farmers use the DSS; understand why they are putting data should come first.
- Ease the amount of data or support farmers in collecting data would lead to a better result in the DSS utilization.
- If farmers are unaware of the existence of the DSS, the current communication is not working correctly. Then, communication needs to be increased.
- Relations with farmers can remain indirect, but it should reach farmers better
- Farmers need to perceive Barilla's interest in their problems to enhance their positive response towards the tools.

DEFINE

After the discover phase ends, with many unstructured findings, there is a synthesis phase, where the research needs to narrow down to define the final brief. In this case, the definition of the drivers for the concept development was essential. Indeed, the design direction changed after the research had been analyzed.

In the double diamond diagram, the define phase converges the unstructured findings into a more precise and structured decision that drives the design brief for the final concept development.

5. RESEARCH CONCLUSIONS AND DESIGN DIRECTION

This chapter draws the conclusions for the two research phases previously argumented. Then, the design direction is defined towards the final concept development.

This section concludes the two scopes of the research phase. Both the scopes are interlinked and determine the final solution. Therefore, the conclusions elaborate on both the research phases in one single chapter.

Regarding the first scope of bringing the BSF project abroad, one can see that, it is clear that Barilla already created a strategy to bring the BSF projects abroad. Even if the strategy is an oral version and no explanatory manuals were written, Barilla shaped it into a standard process for the expansion of BSF projects. The data from the company clearly show the success of the strategy: Barilla brought BSF projects in Greece and Turkey (Barilla, 2020a); plus, they partnered with research institutes and universities to assess the feasibility of such projects implementation. Accordingly, the available data disprove the need of developing a new strategy to bring Barilla Sustainable Farming abroad.

In conclusion, the final decision regarding how Barilla will export BSF projects abroad is that no further modifications will be proposed on the current strategy. Instead, the strategy can be adapted to the local requirements that Barilla might encounter in some countries with particular legislation that might harm the operation's success.

To that end, the graduation project will follow a new design direction explained in chapter 5.

5.1 Social sustainability

In order to understand the reasons that brought a substantial deviation from the first intent of this graduation project, one has to bear in mind how Barilla identifies the goals of their Sustainable Projects: guarantee an environmentally, economically, socially sustainable environment for all the people, suppliers, and the food they bring from the field to the final user (Barilla, 2018).

In the definition, considerable attention goes to the *"[...] socially sustainable environment for all the people, suppliers [...]"*.

Social sustainability in this complex context refers to farmers' social conditions, health, access to the market, education, participation and specialization. In particular, the need to convince and involve more farmers to adopt the BSF methodologies creates an opportunity for the company regarding education and participation.

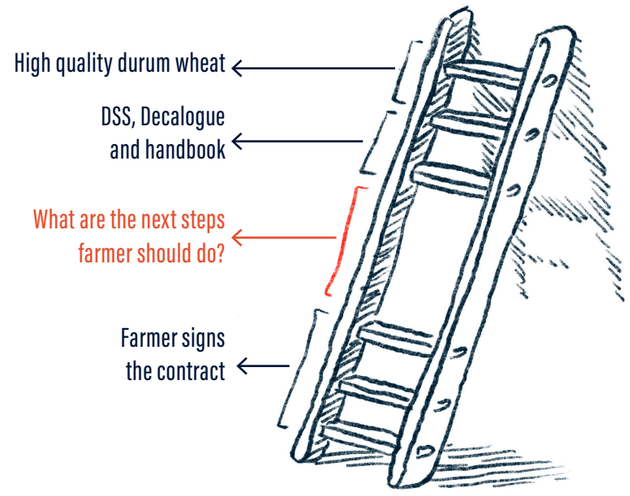
Social sustainability in Barilla is not considered less important than economic and environmental sustainability, but based on their several reports, it is mainly addressed to their employees. Farmers are not considered direct employees from the company, and indeed the success of the BSF comes from the decision to create this framework, always acting through third parties. Specifically, the company rarely signs a contract with a single farmer but instead goes to an intermediary company. However, as introduced in the previous chapter, the indirect relation between farmers and the company generates a communication gap in convincing and adopting the BSF tools.

Consequently, the overall accomplishment of BSF created a big gap between what the company expects from farmers (e.g. the unconditional adoption of the DSS) and what the farmers understand from Barilla; explicitly, farmers do not receive guidance from the company after signing a contract. However, there is much more between the contract and the final product delivery that Barilla and farmers can improve.

On one side, the company provides many supporting tools, but on the other side, farmers are not aware, receptive or interested in their adoption. Furthermore, from the field interviews, these tools, on some occasions, seem too complex for farmers, for example, when it comes to collect the required data to give the DSS enough input to work.

"I understand it is not easy to ease the amount of data because they are important to understand many things. [...] For example, they ask information such as measurements, precessions, manuring and soil analysis (nitrogen, phosphorus, potassium richness)." Paolo, farmer.

Visualizing the problem with a bit of imagination is like having a ladder but without the intermediate steps. There is only the start (farmers) and the end (the DSS, the guidelines for sustainable agriculture). There is a consistent gap between farmers and the tools (see figure 7).



▲ ***Figure 7:*** *the ladder visualization, without the concept..*

In conclusion, Barilla needs to act on involving farmers in actively participating, questioning and learning the tools that they have developed over the years with much effort. In addition, as explained in section 2.2, improving social sustainability complies with two points discussed in the Code of Sustainable agriculture:

I. Improve efficiency and competitiveness of the agricultural system.
II. Work for better cooperation and continuous improvement.

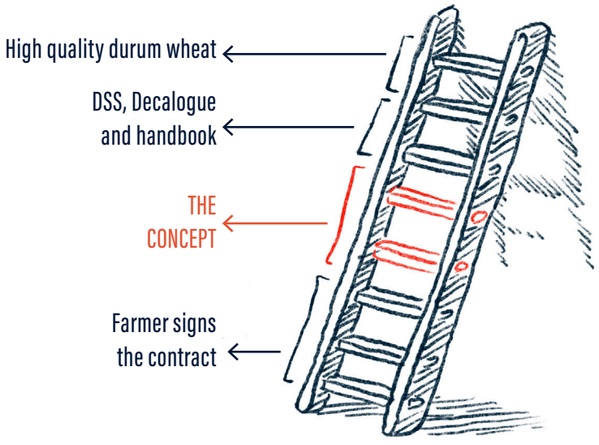
The two scopes of this graduation project are joined in one chapter because social sustainability can be improved more entirely in countries with lower agricultural development, education, and application of sustainable practices. In parallel, great interest in the outcome of the graduation project comes from the outstanding future development expected in developing agricultural systems.

5.2 The new design direction

After finding a more substantial basis to proceed with the project, a new design direction and thus a new project brief was defined.

Notably, there is a shift from the initial intention to "expand BSF abroad", because as previously elaborated, Barilla is already performing a successful strategy to bring their sustainable projects abroad.

The new design direction involves creating an educational system for farmers, a service that acts as a bridge to fill the gap between farmers and BSF tools. The idea develops the need to fill the gap in the visualization concept of the ladder (figure 8).
The new main deliverables are an educational framework and a strategic roadmap to implement the educational framework. The framework intends to increase farmers' participation and understanding of the provided tools (such as Decalogue and DSS); the roadmap focuses on implementing this educational journey in Russia and Turkey, where agriculture is more rearward than the other analyzed countries (the motivation for choosing Russia and Turkey are explained in section 6.4).



▲ ***Figure 8:*** *the ladder visualization, as it would look like with the concept.*

5.3 A company shift

BSF will continue to have indirect relations with farmers, but farmers will need to be involved by the company more proactively. Barilla needs to empower farmers to feel part of a community, a network. The main feature that the company currently lacks is the way they communicate with farmers. Farmers are an arduous target group to reach, mainly due to cultural-related matters and an overall stubbornness when it comes to changing their agricultural practices and habits.

"We do not force farmers to take decisions. Farmers are difficult to convince".
Luca - farm manager

Above all, the company should convey the importance of what farmers do for their value and supply chain. The communication with farmers should be improved between the contract signature and the adoption of the tools moment to create a better understanding from the farmers' perspective. Farmers should have the perception to be full "Barilla people" and that Barilla gives them an economic opportunity and social and skill-related opportunities. Farmers have to comprehend that the more they improve in their activities, the more they will be rewarded and the more prosperity they will gain for their future generations.

5.4 Country selection

As previously mentioned, among the analyzed countries, two are the most suitable to implement the educational framework: Turkey and Russia.

As for now, in Turkey, there are 20 farms involved in BSF projects for durum wheat, covering 100 hectares (Barilla, 2021); therefore, **the roadmap will focus on the BSF farms expansion and integration of the educational model**. In Russia, instead, there

is the need to establish a BSF project trial still. **Therefore the roadmap also involves the introduction of a trial, and then the integration of the educational model.**

The following sections further explain the motivation that drove the selection of Russia and Turkey and the rejection of the other countries.

5.5 The selected countries

Turkey

Aside from the negative aspects underlined in Chapter 3, Turkey has much room to grow as an agricultural country, and there is a favourable climate for durum wheat growth. Thus, Turkey constitutes a fertile environment to bring Barilla Sustainable Farming projects, and indeed Barilla has started 20 trials in the past years.

Suppose Barilla wishes to respect and follow their intention to safeguard the environment and farmers' social and economic conditions. In that case, Turkey could be an excellent opportunity to increase farmers' preparation and social conditions.

From Barilla's perspective, Turkish farmers require more attention to increasing sustainability in their growing practices and social activities. Therefore, it naturally becomes clear why Turkey is an excellent opportunity to establish an educational program.

Organizationally, the Turkish agricultural system is similar to Italy. For example, it is based on the cooperatives model, where farmers attend their retail. Cooperatives provide Barilla with the opportunity to build a network of contacts with farmers, similarly to what was done in Italy. Given the government's clear intention to increase the agricultural privatization process, Barilla could act more freely to establish solid relationships with companies active in the private sector. Since private companies mostly manage the seeds market (Meriç, 2018), prices for farmers may increase but not if Barilla finds a deal with such companies.

From farmers perspective instead, one can see that the overall educational level, according to Eurostat, is lower than most of the European countries (Eurostat, 2017).
Then, farmers would benefit from an educational model to learn, understand and apply all the knowledge Barilla has developed and is currently developing in Turkey through the academic institutes.

In the end, Barilla already operates in Turkey, where a production plant and a mill are active in Bolu.

Russia

As for now, in Russia, no evidence was detected about legally enacting contract farming. Consequently, assuming Barilla's intentions to implement BSF projects in this country and assuming that contract farming is not legal in the Russian Federation, a diverse solution is proposed to reach out to Russia. Unusually, the concept for Russia would implement the durum wheat's products directly in the supply chain, creating a process of **vertical integration**.

There is a substantial difference between contract farming and vertical integration:

Contract farming is defined as a contractual relationship. Generally, each farm retains its separate identity but leaves one or more decisions of production and marketing and farm assets under the control of another firm (Rehber, 2007). *Vertical integration* is instead defined as an ownership integration where two or more stages in production are effectively controlled by single management (Rehber, 2007).
Under the provided definition, the secondary reason why Barilla

should rehearse to set up a trial on an owned piece of land in Russia is that, due to climate change, millions of hectares of land are now available for cultivation. Thus, idle land can be an opportunity to establish a different kind of business model in durum wheat production. If Barilla integrated the durum wheat production in house, farmers would be hired as employees. If farmers are directly employed, the company could implement the educational model more efficiently, allowing a "full BSF standards production" by applying all the developed tools and methodologies.

Lastly, the expected agricultural development Putin's government is operating will consistently affect the amount of available land and the overall production of durum wheat. New legislations are expected to push the production further, creating an ever-changing legislation environment for the company. Since Barilla also owns a production plant in Russia and is building a new mill, the possibility of buying and managing land will ease the effect of legislation that might push unsustainable practices and monoculture, given the government's intentions.

▲ ***Figure 9:*** *a Russian idle piece of land.*

5.6 The non-selected countries

In general, the reasons that drove the decision of what country is most suitable for the educational framework's implementation are:

- Barilla's interest in the candidate country;
- The country's agricultural model and its interest in implementing an educational model to support farmers in the adoption of BSF;
- The country's strategical interest regarding the durum wheat production;
- The extent to which establish a BSF project can benefit the future of the company (e.g. Russia is expanding the durum wheat market);
- The necessity to ease the number of countries, given the limited amount of time to develop the graduation project.

In general, aside the specific motivation for each country, more importance was given to the agricultural systems where an educational system would be more useful for farmers.

The United States of America

In the USA, farmers already deploy similar tools to the DSS; therefore, there is not much interest in bringing an educational process where farmers can already rely on quite advanced tools and methodologies. The issue of the United States is principally related to environmental sustainability, for instance, due to the extensive adoption of monoculture in their regions. This relates to farmers' capital-driven choices, focusing more on soil's continuous exploitation and minimization of machinery and resource utilization.

Furthermore, evidence shows the stubbornness and involuntariness to adopt more sustainable methodologies such as crop rotation (Tickell, 2020). Therefore, there is not much interest for Barilla to bring an educational method more suitable for less developed countries in the USA.

European countries

Although Spanish and French agricultural systems are similar to the Italian ones, the interest for this graduation project in bringing an educational program is also low in these countries.

Indeed, France and Spain do not require an educational model to help farmers transition from traditional methodologies towards more sustainable ones. Thus no added value would be provided to the project.

Canada

Canada was not selected either.
First, Canada has been a source of inspiration because farmers adopt the most advanced technologies and implement crop rotation (or similar techniques) into their cultivation methodologies (Ruini, 2021).

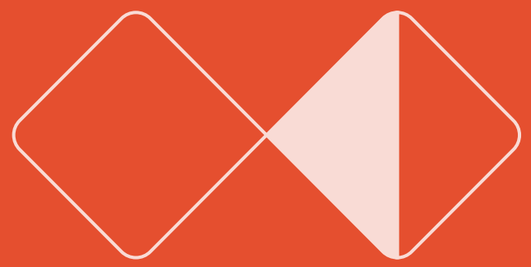
Furthermore, Canadian farmers have much more educational possibilities, such as companies that provide educational coaching sessions on-field or expert agronomists as support. Thus, Barilla again does not have an interest in developing an educational model in this country.

On the contrary, the company's problem with the Canadian durum wheat does not relate to farmers' ability to grow it but the glyphosate contents. Indeed, Canada's problem regarding how the durum wheat is treated before the harvest. As previously stated, using glyphosate to dry durum wheat leaves some chemical remnants that do not meet Barilla's quality standards.

DEVELOP

Develop refers to concept development. In this phase, it is explained how the final concept was developed from the brief.

In the double diamond diagram, the development phase diverges into a broader development phase, where more concept ideas are developed. The diverging phase ends when ideas are generated. The aim is to understand to “design the things right”.



6. CONCEPT DEVELOPMENT

The main outcomes of the research are translated into the final concept, which is explained in this chapter.

Introduction

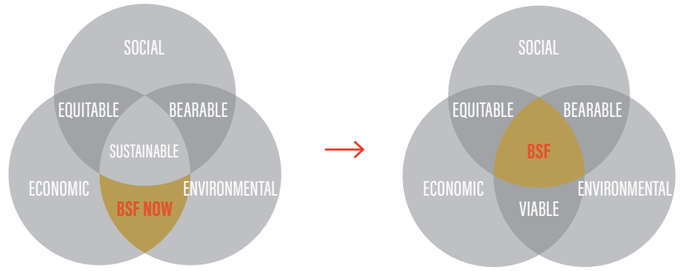
The main outcomes of this graduation project are two distinct deliverables that together try to accomplish the initial scopes. Thus, bringing BSF project abroad while convincing farmers to adopt the BSF methodologies.

The first deliverable is an educational framework to support and help farmers adopt the BSF methodologies and DSS. The aim is to increase farmers' awareness, understanding, and utilization of the guidelines and DSS. The educational framework is designed from a farmers' perspective, using a user journey map. The user journey map highlights all the phases that farmers will go through during their educational process.

The second is a roadmap. A *roadmap* is a strategic plan that defines a goal or desired outcome and includes the major steps or milestones needed to reach it (Simonse, 2018). The roadmap aims to define the significant steps to implement the educational framework in Turkey and Russia, with two distinct roadmaps that share a core structure.

6.1 The educational journey

Before understanding why the final concept is an educational model, it is necessary to understand how BSF is placed within the conceptual framework of sustainability. As argued in chapter 5, the sustainability model comprises three pillars: economic, environmental, and social.



▲ ***Figure 10:*** *BSF shift from "viable" to the centre of the three pillars model.*

In figure 10, it is possible to notice where Barilla is placed within the three pillars model: in the cross-section between the economic and environmental areas. The combination of economic and environmental areas creates the “viable” area. When a project is viable, it is economically worthwhile and, at the same time, it is environmentally sustainable, thus reducing emissions.

The educational model aims to shift the BSF project from the “viable” area to a more centered sustainability vision. Therefore, the goal is to increase overall social sustainability.

As argued in section 5.4, social sustainability encompasses diverse human-related aspects such as education, participation, housing, employment (Davidson, 2009).

The educational model mainly focuses on the education and participation of farmers towards the usage of the BSF tools and methodologies. Thus, the intention is to increase the overall understanding of the BSF methodologies. The most relevant examples are the Decalogue and the Decision Support System.

Therefore, the main pathway focuses on increasing awareness, understanding, and knowledge. Through them, farmers can grow participation in adopting the tools and methodologies.

6.2 The creative process: Cultura

During the idea development phase, to pull out all the possible insights retrieved during the interviews, the “Cultura” toolkit has been adopted.

Cultura provides designers a clear overview of what aspects can be considered when encountering an unknown cultural context (Hao et al., 2017). Since the project revolves around many different contexts and tries to keep track of all the possible cultural-related issues

Cultura - Key Take-aways

- Farmers seek to earn an honest wage.
- Farmers have strong familial bonds that influence their entrepreneurial behavior.
- Farmers might be open to contracts, but the decision-making process is vital for their pride. Then, the DSS needs to be perceived as a cooperation tool.
- Farmers feel experts, even if based on old and out-of-date farming attitudes and practices.
- Farmers aim to preserve their experience and knowledge, so they mistrust DSS.
- DSS should not create friction between farmers and their own decisions.
- Farmers do not appreciate technology and data or information based on data.

Barilla should face when dealing with farmers, Cultura helped the creative process get a grip over the latent needs collected during the interviews, mainly focussing on cultural aspects of farmers.

Limitations

Regrettably, given the limited target group of only Italian farmers, the Cultura tool only considered values from the Italian farmers. Consequently, the outcome of this design process is based on the assumption that farmers as a target group have some commonalities that need to be further investigated by the company in other countries. The Cultura wheel tool can be found in Appendix D.

Based on the main takeaways gained from Cultura, the educational model should be intended as an inspirational pathway to undertake after signing the contract voluntarily. Indeed, forcing farmers to adopt the tools via contractual clauses would be counterproductive because they would like to act with the maximum freedom possible.

“The work is on the field for durum wheat, meaning that the contract does not have many obligations; meeting the quality standards is enough. For soft wheat, instead, there is too much bureaucracy; it is different. For our future, weighing down too much bureaucracy is a limit.” - Luca, farm manager.

6.3 The principles of teaching vs. facilitation

To spark farmers willingness and inspiration in the learning practice, facilitation is more sutiable than conventional teaching experiences. Unlike conventional teaching experiences, facilitation focuses on the users' abilities and willingness to participate in the learning process. In this process, participants are as experienced as the facilitator, but the facilitator guides the learners regarding the learning goals (Wise, 2017).

Facilitation learning (instead of simply delivering information) is distinguished from traditional teaching. Most degreed professionals are comfortable and familiar with the teaching methodologies often used in high school and university assignments. Facilitation, instead, is a student-oriented practice that directly addresses students who learn by doing (Wise, 2017).

Based on the creative phase outcomes and the research phases, an educational model is the first outcome of the development phase. Therefore, the correct definition of the model would be the *facilitation model.*

However, how a facilitation model could be introduced in farmers' lives?

In the ideation phase, during which some creative sessions were carried out, some ideas were determined trying to bring the facilitation model to farmers.

In the first instance, the central idea was to deliver a physical kit that helped farmers understand the importance of applying the methodologies. The concept was to deliver these kits directly to farmers who signed contracts with Barilla to spark their interaction and motivation in undertaking the BSF methodologies. However, the concept was not further developed due to the low probability of receiving feedback on the system's effectiveness.
The second idea related to creating special events, where farmers would be invited to join conversations and create a shared understanding of what BSF is, how it works, and how they could improve their farming practices. During these events, farmers would also experience the DSS. In this case, small workshops were involved in the concept, where farmers would be pushed to understand the Decalogue, the Guidelines for Sustainable agriculture, and the DSS. Again, this idea was discarded because of the high engagement required to participate. Indeed, as shown by the Cultura results, farmers should not feel obliged to undertake demanding tasks, as the path should be voluntary.

In the end, the third idea involves the creation of a platform from where farmers can autonomously engage, depending on their willingness, to a set of online services. The platform fits the facilitation model because farmers can access all the knowledge to implement the Decalogue, the DSS, and the Guidelines for Sustainable Agriculture.

One can argue that an online-based tool can fail to support farmers: indeed, some interview insights validate this supposition. However, there are also supportive motivations behind the choice:

- First, the DSS provided by Barilla is a web-based tool. Thus, it is a website that requires an internet connection. Consequently, the concept of a web-based platform aligns with the company's proposal.
- Secondly, the facilitation framework can be easily managed by the company. Also, it is possible to check whether the farmers adopt it or not, and feedback can be collected.
- Thirdly this web-based tool will be developed over five years. Indeed the facilitation framework is placed on the roadmap that is future-oriented (Chapter 7). Again, as the future trend research shows (Appendix G), agriculture is expected to become more digitalized in the near future. Then, farmers will increasingly require to adapt their working style to the most advanced technologies.

6.4 Empower farmers to increase participation

According to Stacey et al., creating an online community of learners with similar dimensions to workplace communities of practice should ensure that the outcome enhances participation. Mainly, sharing many points of commonality in contexts and purpose will increase users' willingness to learn, share and then increase the chance to effectively apply the learned knowledge (Stacey et al., 2004).

To further accomplish the goal of increasing active participation in using a new tool and putting farmers in the condition to discover new ways of learning and practice, the concept provides four main goals (figure 10):

Enable

Enable farmers to access information independently from cooperatives easily; the platform should be developed internally and then shared with farmers in a second place. All the information (regarding BSF, its methodologies, and tools) must be attained to farmers as soon as the contract is signed. In fact, after signing a contract, to reach as many farmers as possible, they will receive printed material with all the access information to the platform via mail.

Enhance

The second goal is to enhance the way Barilla communicates information to farmers. Farmers need to perceive Barilla's interest in delivering information; therefore, the farmer's attention and the fundamental role they play in the supply of durum wheat for the company (Appendix F).

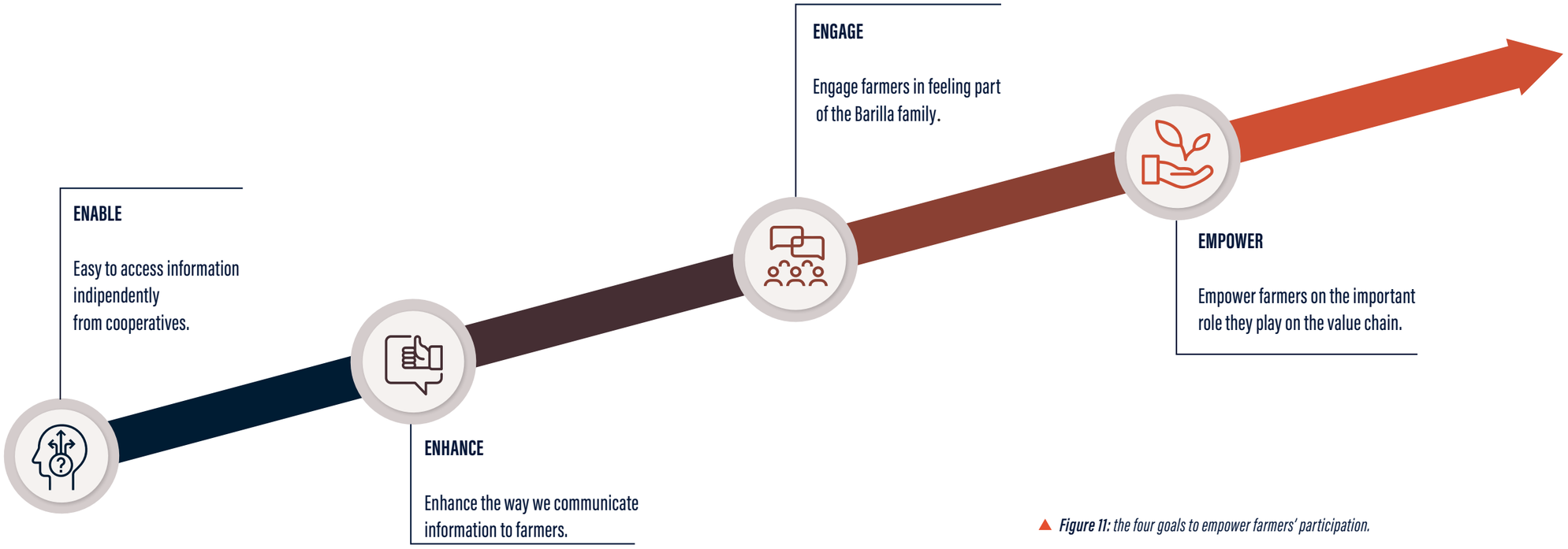
Engage

By enhancing the way farmers perceive the company, the following goal is to engage farmers in feeling part of the Barilla family. The company should convey all the values they convey to the employees to farmers.

"Our values are the ingredients that characterize and enrich the group's choices and actions every day and inspire the activity of all our people." (Barilla, 2019).

Empower

By considering all the contracted farmers as actual employees, Barilla will empower farmers on the crucial role for the Barilla supply and value chain. Consequently, Barilla will create a sense of belonging and participation while creating trust in a company that can give farmers better perspectives for their future and economic stability.



▲ ***Figure 11:*** *the four goals to empower farmers' participation.*

6.5 The attention is on communication

Reaching farmers and convincing them to adopt new methodologies may be challenging because it rarely happens that farmers adopt a new methodology immediately he hears it (van den Ban, 1964). Trusting a computer (e.g., DSS) for suggestions over agricultural practices might slow farmers' willingness to adopt such tools or discourage them from improving their techniques and better managing their resources.

Consequently, the challenge for the company is to convey a clear message, focused on accessible, clear, and transparent communication through the platform. Furthermore, bearing in mind that the roadmap to implement the educational model will be spread in five years in the future, the platform's target group can be identified as relatively young farmers, thus capable of using devices such as laptops or smartphones. Furthermore, given the recent developments of other agricultural machinery such as driverless tractors, drones, or just last-generation tractors, farmers are expected to adapt their abilities to these kinds of tools (see future trends analysis, Appendix E).

Despite the previous recommendations, communication and storytelling will play a key role in creating the platform. So the very first notion is: make it personal.

The intention is to convince farmers in the earliest phases of their contact with the platform that they will gain their future with these tools. Evidence has already shown that a conjoint application of crop rotation and DSS reduces carbon footprint and costs by about 10%. By learning methods, farmers will be allowed to gain a safer future, both from an economic and environmental point of view (e.g., preserve their soil for future generations).

Secondly, the platform should look simple, easy to use, and trigger their attention. The aim is to mainly focus on farmers' latent need to have guidance.

In the last instance, farmers will receive financial rewards when they complete the learning process. The suggestion is to decrease the bonus on their quality on the contract for the first year and deploy the difference to create a "learning bonus."
Fictionally, if the contract bonus would be 15 euro per tonne of the high-quality product without the platform, it could become 13 euro per tonne, and the 2 euros left per tonne can be given at the end of the earning process.

The aim is to put farmers in the condition of earning more just by involving in the learning process.

6.6 Mind the gap between contract and tools

In order to make the concept work, there is the need to mind the gap between the moment farmers sign the contract and the moment in which farmers deliver their product. The meaning is that there is a lack in the information Barilla provides to farmers after signing a contract.

Currently, after signing a contract, farmers do not have further information on the guidelines of sustainable agriculture developed by the company or on the DSS availability. Farmers can ask about the availability of such tools when they sign their contract within the cooperative. However, when the cooperative (or consortia) sells fertilizers, it is even more complicated for farmers to learn about the DSS. This happens because the cooperative has a few interests in promoting a tool to reduce the overall amount of resources, including fertilizers.

Therefore, to mind the gap, farmers need to be enabled by Barilla to find all the relevant information independently from the cooperatives and consortia. For example, what happens in Italy could happen in any country where cooperatives also provide other kinds of services to farmers, such as fertilizers.

6.7 The platform

When searching in a browser “Barilla Sustainable Farming”, much disparate information appears on many websites (Figure 12).

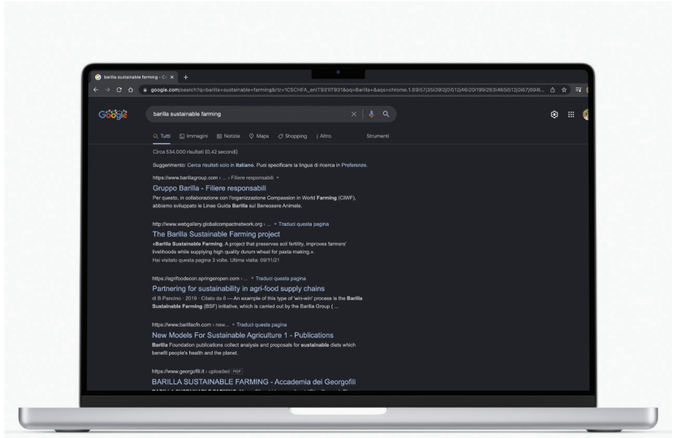


Figure 12: results on Google when looking for “Barilla Sustainable Farming”

On the platform, users can find all the information about the Decalogue, the code of sustainability, and DSS. So the first answer to the problem is to enable farmers to find all the information they need after signing a contract.

The platform aims to be a tool to understand tools; yet, it generates enough knowledge to fill the gap between contracts and obligations for farmers. It is different from a conventional website; only farmers who sign a contract with Barilla can access it: in this way, it creates exclusivity, to convey the interest that Barilla has only for the trusted farmers.

6.8 Features of the platform

In the platform, there are three main areas.

I. ***General information.*** Here farmers can find information about the Barilla Sustainable Farming projects, how it works and what Barilla expects from farmers. Additionally, farmers can find all the sustainable guidelines and the manual on using the DSS and the Decalogue for sustainable agriculture. The DSS itself should be integrated into the platform, so farmers can access it only through it, making it easier to access (figure 15). Lastly, the platform provides valuable planning tools, such as planning tools or general information on the country’s legislation (laws, fund possibilities, allowances).

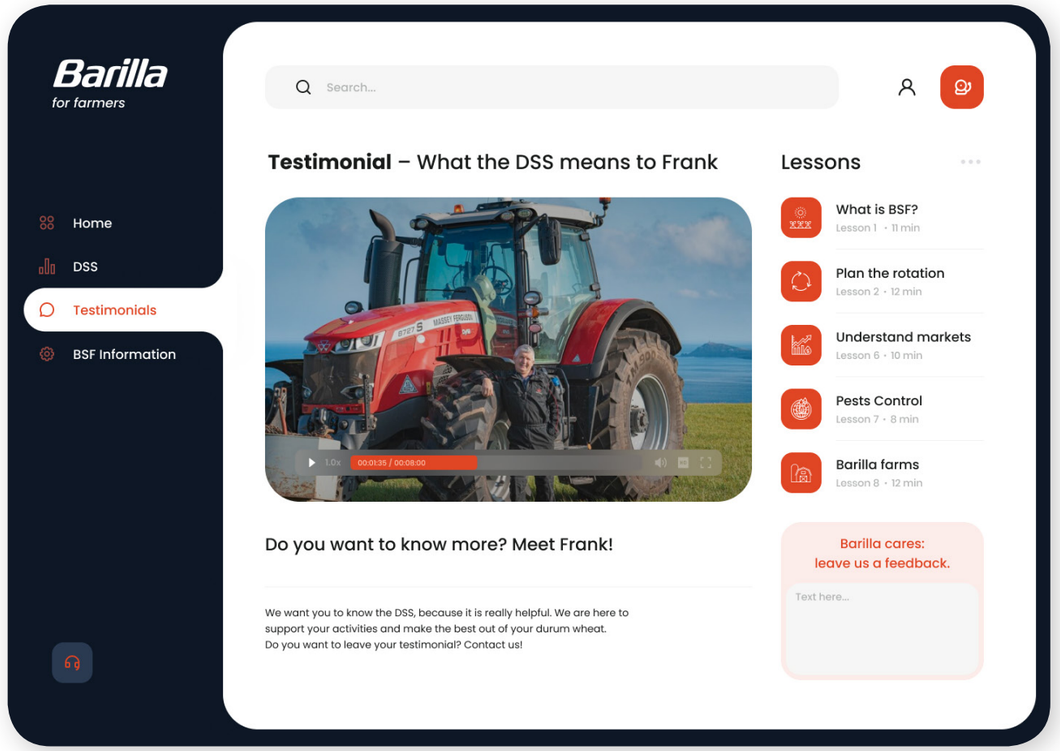
II. ***Online facilitation.*** To ease the amount of information and how information is displayed, farmers can find a section with video tutorials (figure 13). Video tutorials should be very practical but at the same time short and precise. The videos must be set on the “microlearning” model. Microlearning refers to a learning strategy designed using short learning content and short activities that make a mini-course (Alqurashi, 2017). For example, the rules of the Decalogue or the DSS features can be explained using a set of short videos. Again, microlearning is helpful for suggestions on inserting data in the DSS or interpreting them (figure 13). Microlearning is beneficial because it was designed to suit the limits of the human brain concerning its attention span and avoid information overload.

   Testimonials will support these video tutorials (figure 14). In the video testimonials, other farmers that apply the guidelines and the DSS will give a personal overview of the BSF projects. This communication between “similar people” creates a convivial virtual environment for the user to see the effectiveness of the results explained by a colleague.

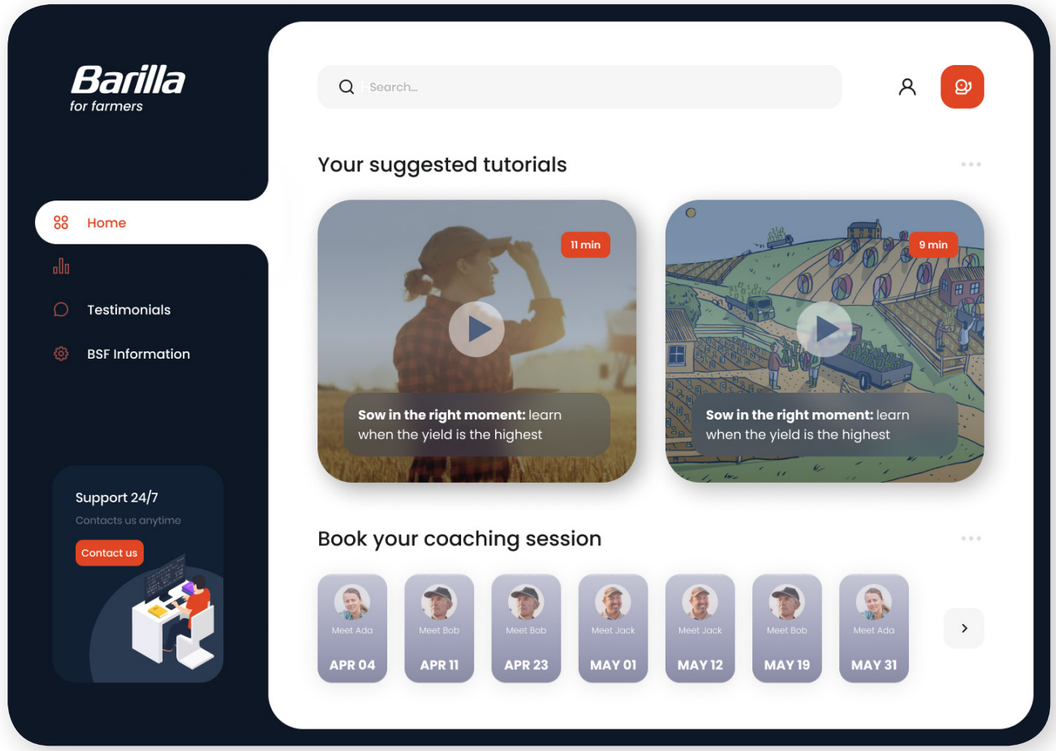
III. ***Offline facilitation.*** The last area of the platform includes coaching sessions. Coaching sessions will be organized directly

from the platform, and farmers will schedule them. Then, farmers will obtain a one-to-one coaching session to evaluate their needs. Afterward, a group workshop will be organized. The main themes that will be covered in these workshops will be:

1. the applications, usage, and management of the Decalogue
2. The DSS, collecting and inserting data, reading graphs, and interpreting data.



▲ ***Figure 14:*** *Testimonials page, where farmers can watch videos and leave feedback.*



▲ ***Figure 13:*** *homepage, where microlectures are displayed and coaching sessions can be booked.*

▲ ***Figure 15:*** *proposal of an integrated version of the DSS in the platform.*

6.9 The educational journey

The educational user journey is the completion of the creative process: it shows, in each step, what farmers are expected to do in order to complete the educational path. In the end, the farmer will have a more comprehensive understanding of all the BSF features and possibilities.

Keeping in mind the need to mind the gap between the contract signature and the four steps that Barilla should take into account to empower farmers to be more participative, the educational journey is a tool for Barilla to implement the platform, keeping track of what farmers should do throughout the entire process.

Who?

The educational journey is built from the farmers' perspective, therefore from the users' point of view. In this way, it is possible to iterate the process with farmers and improve its application. The target group is young farmers, who will be leading farms that now belong to their parents in a decade.

How?

The educational journey is based on a learning hierarchy of needs model, derived from Maslow's original learning hierarchy of needs model in 1943. The pyramidal model (see figure 16) was re-conceptualized and adapted to suit the online (and partially online, in the case of the graduation project) learning environment (Milheim, 2012).
The learning needs are met through five distinct levels:

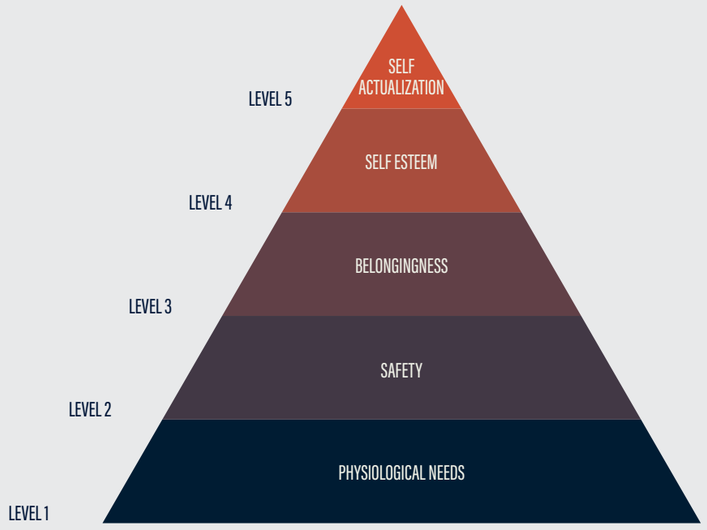
Level 1: physiological needs
The participants will have to access the internet through a computer, tablet, or smartphone.

Level 2: Safety
The environment they will participate, increases farmers' willingness to learn. In this education journey, farmers will both experience online and offline experiences. The online will happen in a comfortable environment they will choose, while the offline will happen on proper farmland, therefore another well-known environment.

Level 3: belongingness
The sense of belonging to a group of similar people will increase the willingness to participate in the learning process (Stacey et al., 2004). The needs in this phase (which will happen in the offline facilitation sessions) are collaboration, instructor presence, personalized feedback, a community of learning, and technological tools (e.g., the DSS).

Level 4: self-esteem
Farmers in this phase should understand that the DSS and the sustainable guidelines exist to support and help them, not substitute their work. As a result, farmers will gain self-esteem and the acceptance to apply these tools. In self-esteem level, feedback and an inclusive climate are the essential features.

Level 5: self-actualization
Reaching this point, farmers will achieve the understanding of actualizing the learning process. Through the process, they should have understood the importance and the values of the BSF tools and methodologies to apply what they learned.



▲ ***Figure 16:*** *the Maslow's learning hierarchy of needs model.*

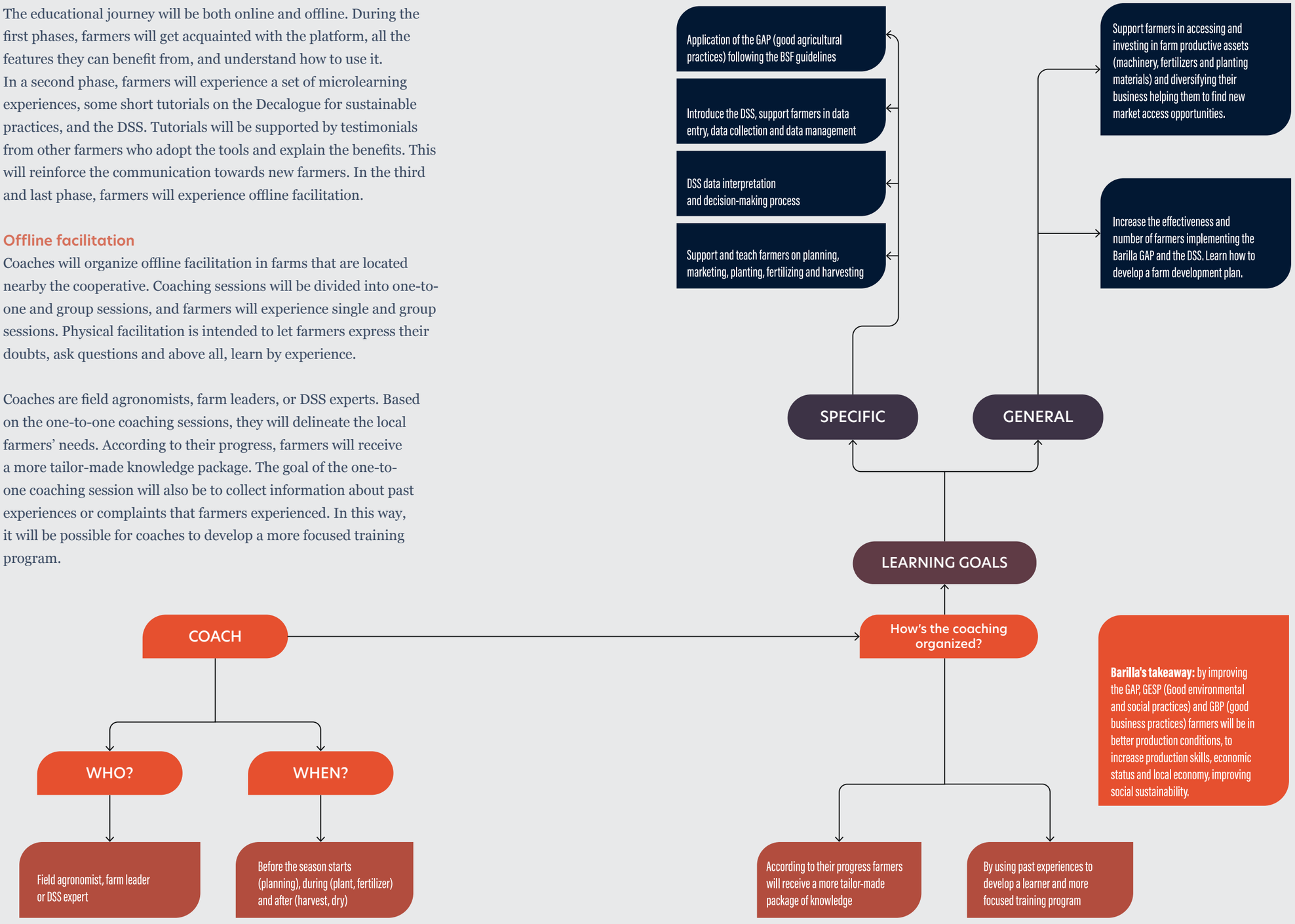
Where?

The educational journey will be both online and offline. During the first phases, farmers will get acquainted with the platform, all the features they can benefit from, and understand how to use it.
In a second phase, farmers will experience a set of microlearning experiences, some short tutorials on the Decalogue for sustainable practices, and the DSS. Tutorials will be supported by testimonials from other farmers who adopt the tools and explain the benefits. This will reinforce the communication towards new farmers. In the third and last phase, farmers will experience offline facilitation.

Offline facilitation

Coaches will organize offline facilitation in farms that are located nearby the cooperative. Coaching sessions will be divided into one-to-one and group sessions, and farmers will experience single and group sessions. Physical facilitation is intended to let farmers express their doubts, ask questions and above all, learn by experience.

Coaches are field agronomists, farm leaders, or DSS experts. Based on the one-to-one coaching sessions, they will delineate the local farmers' needs. According to their progress, farmers will receive a more tailor-made knowledge package. The goal of the one-to-one coaching session will also be to collect information about past experiences or complaints that farmers experienced. In this way, it will be possible for coaches to develop a more focused training program.



▲ ***Figure 17:*** *the offline facilitation framework, developed as part of the concept.*

6.10 User journey map

The user journey map is the main secondary deliverable for this graduation project. It is intended to be a document to visualize the overall path that farmers will undertake using the platform. It is designed from a farmer's perspective. Therefore, it focuses on how farmers will interact with the platform and experience the educational journey.

The user journey map is the outcome of an ideation session, where results from the desk research, the interviews, and assumptions try to foresee a possible educational journey, given the impossibility to iterate the actual journey. Therefore, the user journey map comprises a likely scenario where farmers could access all the platform's features.

The user journey map develops horizontally for each step that farmers undertake (see next section). There are also pain and gain points, emotions, user values, and an explanation line for each step.

Phases

The phases explain each macro action farmers will go through; starting from discovering the Barilla Sustainable Farming projects, farmers will undertake a journey through the educational model until experiencing the facilitation sessions.

Main touchpoints

There are some contact places and touchpoints where farmers will collect knowledge for each step.

Gain points

Gain points are assumed positive advantages farmers will encounter for each phase.

Pain points

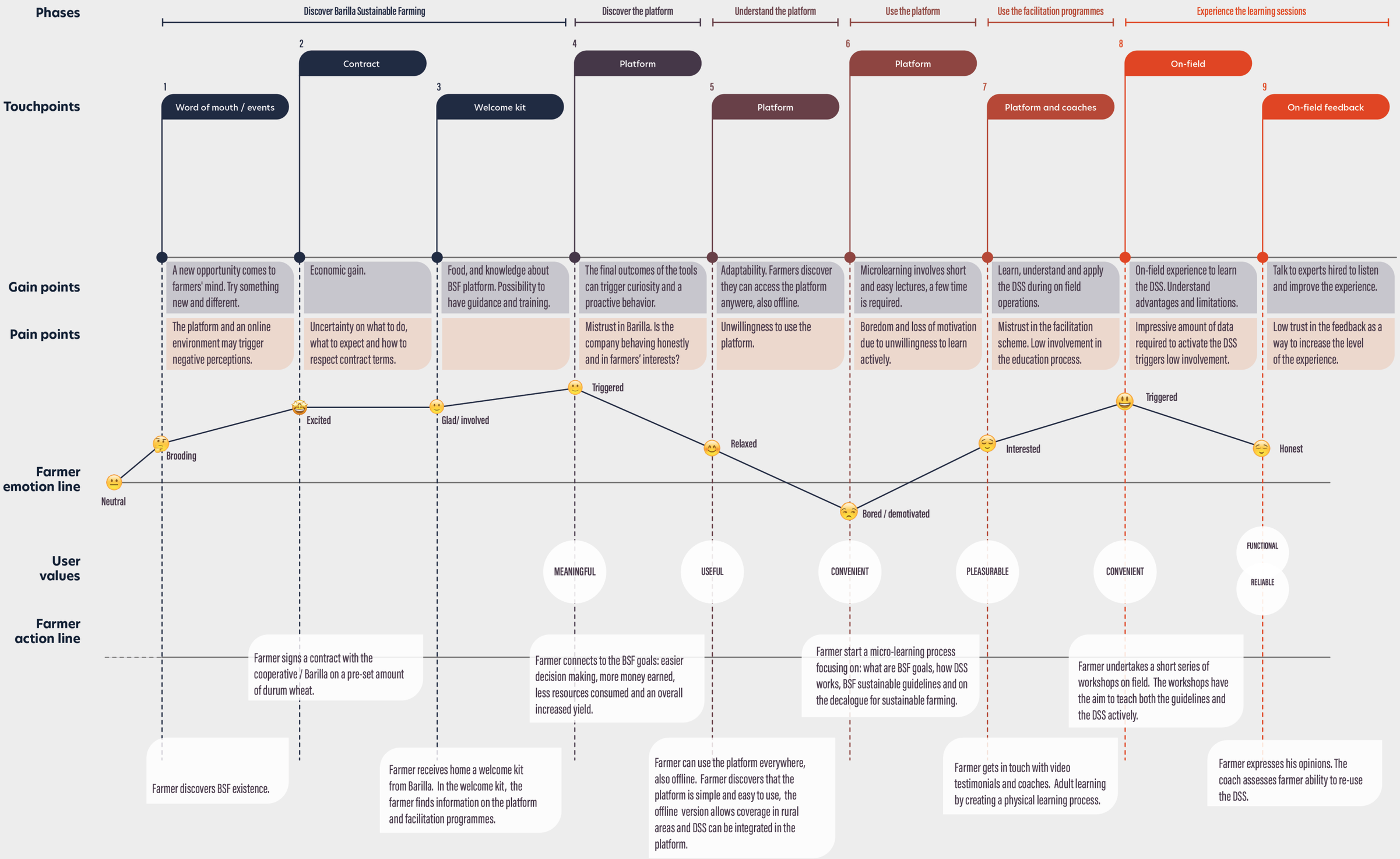
Pain points are assumed problems faced by the prospective actions farmers will undertake for each phase. Pain points include any problems they may experience along their journey.

User values

For some steps, farmers will gain values related to the action they encounter.

Farmer action line

This last line explains each step more in-depth.


Phases
Discover Barilla Sustainable Farming
Discover the platform
Understand the platform
Use the platform
Use the facilitation programmes
Experience the learning sessions
Touchpoints
1
Word of mouth / events
2
Contract
3
Welcome kit
4
Platform
5
Platform
6
Platform
7
Platform and coaches
8
On-field
9
On-field feedback
Gain points
A new opportunity comes to farmers' mind. Try something new and different.
Economic gain.
Food, and knowledge about BSF platform. Possibility to have guidance and training.
The final outcomes of the tools can trigger curiosity and a proactive behavior.
Adaptability. Farmers discover they can access the platform anywere, also offline.
Microlearning involves short and easy lectures, a few time is required.
Learn, understand and apply the DSS during on field operations.
On-field experience to learn the DSS. Understand advantages and limitations.
Talk to experts hired to listen and improve the experience.
Pain points
The platform and an online environment may trigger negative perceptions.
Uncertainty on what to do, what to expect and how to respect contract terms.
Mistrust in Barilla. Is the company behaving honestly and in farmers' interests?
Unwillingness to use the platform.
Boredom and loss of motivation due to unwillingness to learn actively.
Mistrust in the facilitation scheme. Low involvement in the education process.
Impressive amount of data required to activate the DSS triggers low involvement.
Low trust in the feedback as a way to increase the level of the experience.
Farmer emotion line
Neutral
Brooding
Excited
Glad/ involved
Triggered
Relaxed
Bored / demotivated
Interested
Triggered
Honest
User values
MEANINGFUL
USEFUL
CONVENIENT
PLEASURABLE
CONVENIENT
FUNCTIONAL
RELIABLE
Farmer action line
Farmer discovers BSF existence.
Farmer signs a contract with the cooperative / Barilla on a pre-set amount of durum wheat.
Farmer receives home a welcome kit from Barilla. In the welcome kit, the farmer finds information on the platform and facilitation programmes.
Farmer connects to the BSF goals: easier decision making, more money earned, less resources consumed and an overall increased yield.
Farmer can use the platform everywhere, also offline. Farmer discovers that the platform is simple and easy to use, the offline version allows coverage in rural areas and DSS can be integrated in the platform.
Farmer start a micro-learning process focusing on: what are BSF goals, how DSS works, BSF sustainable guidelines and on the decalogue for sustainable farming.
Farmer gets in touch with video testimonials and coaches. Adult learning by creating a physical learning process.
Farmer undertakes a short series of workshops on field. The workshops have the aim to teach both the guidelines and the DSS actively.
Farmer expresses his opinions. The coach assesses farmer ability to re-use the DSS.

7. THE ROADMAP

The chapter explains the roadmap and how to read it.
Plus, it has been divided for each
horizon, to better understand each part.

Introduction

The concept of the facilitation framework, including the platform, constitutes the first development of this graduation project.

However, the first scope of this graduation project was to bring the BSF projects abroad, overcoming the barriers outlined by the different countries. Thus, considering the new design direction explained in Chapter 5, the roadmap will focus on implementing the facilitation framework in Turkey and Russia for the second part of the concept development.

Indeed, based on the research insights of Russia and Turkey, farmers in these two countries require more guidance to succeed in implementing the BSF tools. Then, as previously stated, in Turkey, 20 trials already exist. Hence, the roadmap will focus only on implementing the facilitation framework; in Russia, instead, since the BSF projects have not yet been implemented, an expansion strategy is also proposed. The expansion strategy aligns with the first scope of the project.

7.1 Introduction on the roadmap

The roadmap spreads on a timeline that starts in 2022, and it develops for seven years in Turkey and eight years in Russia. Specifically, since Barilla already has 20 active BSF trials in Turkey, the path is shorter (six years) because the expansion strategy has already been applied in the past years. In Russia, instead, since no trials have been started for durum wheat, more time is needed to plan a trial settlement. Also, in Russia, current evidence disproves that contract farming is legal (Chapter 3). Therefore the strategy was readapted to implement a BSF trial.

Excluding the time needed for a BSF project settlement, the supposed

period of six to eight years is based on the fast expansion Barilla has performed in Italy from 2010 until today and on the insights obtained by the discussions with the supervisory team.

7.2 The vision

A vision needs to be created to guide Barilla's development of the facilitation framework. The vision constitutes the goal that the company should reach at the end of the operations explained on the roadmap.

Envisioning the future of the BSF projects allows Barilla to shape the future operations they could follow to realize the subsequent development of the BSF projects. In the end, the vision is the primary driver of the roadmap and essence of this graduation project.

The vision develops on the scopes of the graduation project; it envisions the ideal result the concept that the company should pursue:
Aside from the interest in expanding the BSF projects abroad, the two separate pieces of research showed the focus on farmers and their limitations in expanding their educational horizons. The vision reflects the conclusion of the research: unfocus the attention on economic and environmental sustainability to focus on farmers' social drivers. By improving the attention on farmers' needs, the goal is to increase environmental and economic sustainability by applying the tools and guidelines.

The future vision

"I see a future where farmers will apply the BSF guidelines responsibly and in a comprehensive understanding of the responsibilities and the benefits in applying the guidelines. As a result, they will feel part of the Barilla community of suppliers and know the importance of their role in the supply chain. In the end, farmers will mature a complete understanding of using tools such as the DSS as support during the cultivation phase. They will recognize its advantages in applying what is learned during the process."

7.3 How to read the roadmaps: horizons

The vision forms the basis for the strategy to implement the facilitation framework in Russia and Turkey. In order to reach the goals of the vision, the roadmaps are divided into four horizons.

Horizons act as smaller visions, each with a distinct goal to reach. Before explaining the horizons, it should be clear that both the roadmaps that share the same structure have the same future vision. The future vision is the end goal of the roadmap, the arrival point for Barilla: the future vision coincides with both Turkey and Russia.

Horizon 0

Horizon zero refers to the moment in which Barilla will accomplish the first trial of a BSF project. More precisely, H0 has already been met in Turkey; indeed 20 farms have already adopted the BSF projects. In Russia, H0 still needs to be met, therefore H0 is more relevant in the roadmap for Russia.

Horizon 1

After having established a successful BSF project trial, Barilla will focus on the BSF expansion. In Turkey, the expansion focuses on spreading the BSF project to one or more cooperatives through umbrella contracts.
The end goal of this horizon is the platform launch. The aim is to target young emerging farmers that are willing to increase their skills on GAP and DSS.

Horizon 2

The end goal of Horizon 2 is to implement online facilitation through online support for farmers, microlearning tutorials, and testimonials from other farmers that adopt the BSF methodologies. This will require time for the collection of the material and evaluate the responsiveness of farmers. Farmers will receive a temporary bonus if they finish the online facilitation.

Horizon 3

The goal of H3 is to start the on-field facilitation. Farmers will be involved in the process of coaching sessions and workshops. They will also take part in iteration sessions, and they could also become coaches after they finish the trial period.
The scope is to create participation through physical activities, to show farmers that Barilla wants to see a real improvement in cultivation methods. Using the tools is a choice, but it can create a better situation for all farmers.
The goal is to create a favorable environment for all those farmers who use online tools and create a better trust for those who use offline tools.

7.4 Roadmap organization

The roadmap develops vertically for each horizon and horizontally for each macro section, where suggestions and steps for the company are placed. The horizontal lines are:

Vision goals

As previously stated, horizons act as smaller visions, each with a distinct goal to reach. The vision goals represent the company objectives according to each horizon. The vision is intended to define the goals to implement the facilitation model through the use of the platform. The vision goals derive from the platform concept described in Chapter 6. Based on the research and interviews insights, the scope is to create an engaging, stimulating, and productive virtual environment for farmers.
Besides, each vision goals act as a “guideline” to drive Barilla through the other lines in the roadmap.

Intervention areas

This line shows the tasks the company, for each horizon, will have to intervene in to manage the platform implementation.
The intervention areas come from a creative process, which has been carried out to set the strategical challenges needed to implement the platform. Further information can be found in Appendix*.
The creative process started by defining the strategic challenges defined by the scopes of the graduation project.

Then, for each strategic challenge, objectives were defined. The last step consisted in defining capabilities assessment for each strategic objective. In this way, some decisional drivers or areas of interventions were defined to select the most relevant to place on the roadmap finally. The aim is to define which areas Barilla should ideally intervene to launch and establish the platform in each roadmap.

Product-service development

The product service development is the central area of the roadmap because it shows, from the company's perspective, how the platform will evolve across the three horizons. To improve the platform, the company will have to include more learning materials and organizational skills. The platform will start in the first horizon only with some content and will increase the level of features during the time.

In this area, for each horizon, it is possible to see all the relevant features the platform should implement across each horizon. The decisions were taken based on the creative process followed to design the platform concept for the product development part. Indeed, product service development focuses on the platform's contents for each horizon.

Participation path

The roadmap below the product service development focuses on the user, but again from the company's perspective.

The participation path comprises the four phases Barilla should achieve to empower farmers to be participative.
In four main steps, the participation path aims to help Barilla to increase the communication with farmers. It is explained in chapter 6. Together with the product service development, the participation path is based on the development of the concept, and it shows what goals Barilla should achieve for farmers for each horizon.

User values

This section refers to the intended values Barilla should convey to farmers while using and experiencing the platform. According to the participation path, the aim is to increase the user values while the platform is being used. It focuses on needs not currently satisfied by farmers when experiencing the BSF project. Values come partially from the Cultura analysis and the interviews.

Value proposition

For each phase of the product service development, the value proposition focuses on the values that should convince the farmers to use the platform. In each horizon, the value proposition develops based on the features that the platform proposes.

Business model (only in the Russian roadmap)
In order to accomplish the vertical integration model in Russia, Barilla needs to buy land; therefore, a business model section was added. The two countries have different organizations, and the roadmap differs.

Roadmap: Horizon 1

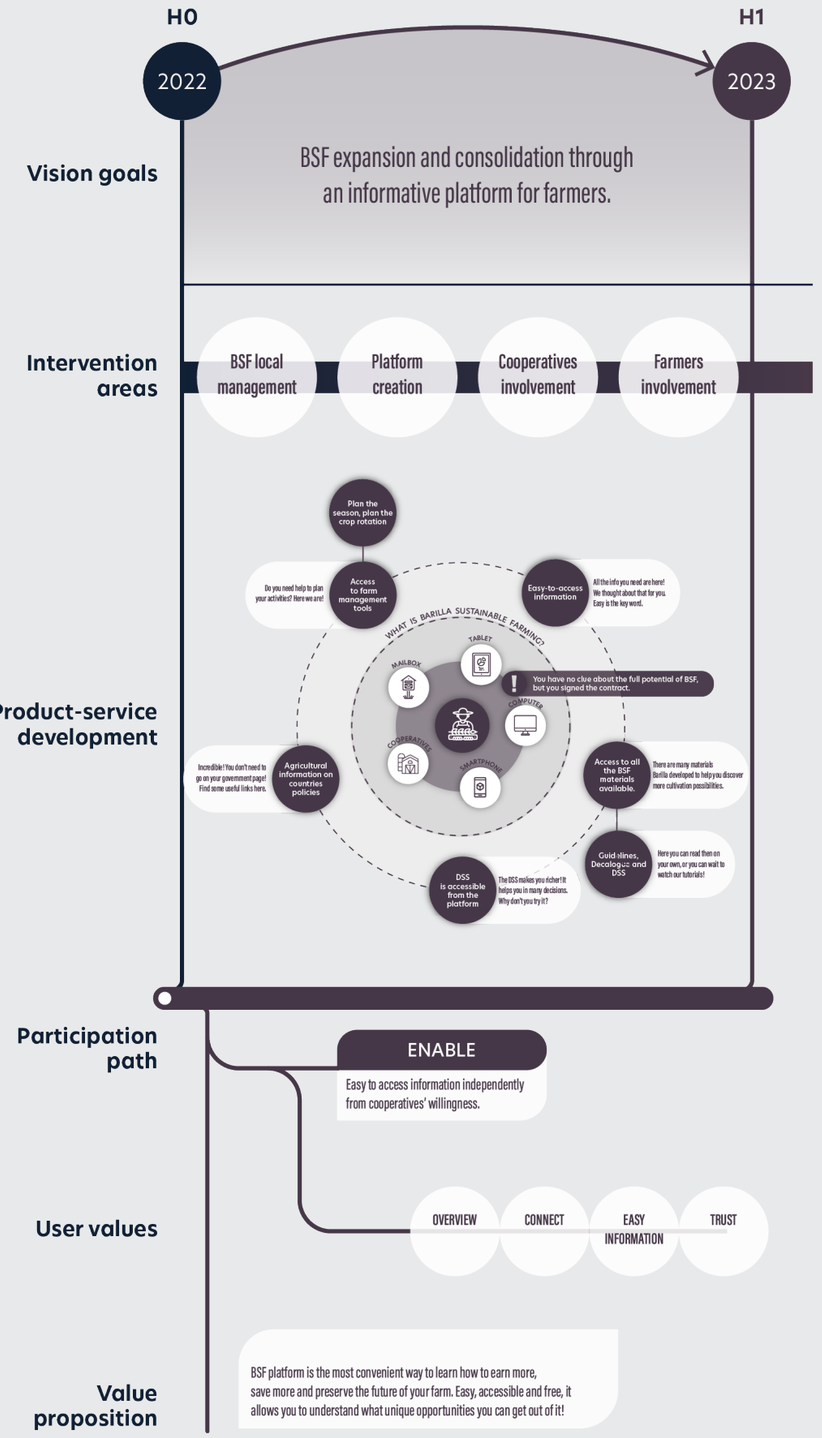
H1 in Turkey is focused on strengthening the presence of BSF. During the initial phase, the scope is to create the platform, launch it online, and add all the disparate content currently findable online (see figure 12).
Then, farmers will start joining the platform through a consolidation plan where Barilla tries to extend the number of covered cooperatives.

When the first horizon is met, the platform will contain easy to access information, where farmers are enabled to find every available information on the BSF projects, including the DSS. Furthermore, all the papers and scientific evidence collected by Barilla will be available on the platform.
Yet, besides BSF-related information, farmers will also find useful information about governmental measures, laws, funds, and loans (when available). The aim is to put farmers in the condition to use the platform because it adds the value of saving time because Barilla already took care of unifying all the information in one place.

In the end, some management tools are included in the service, such as crop rotation and cultivation season management.

Participation and user values

In the first phase, to increase farmers' participation, the aim is to enable easy and accessible information from the company.
Then, the focus is on having a complete and clear overview of the BSF projects panorama; by accessing easy information, the value creation focuses on easing the connection with the company and building trust towards the information provided by Barilla.



Roadmap: Horizon 2

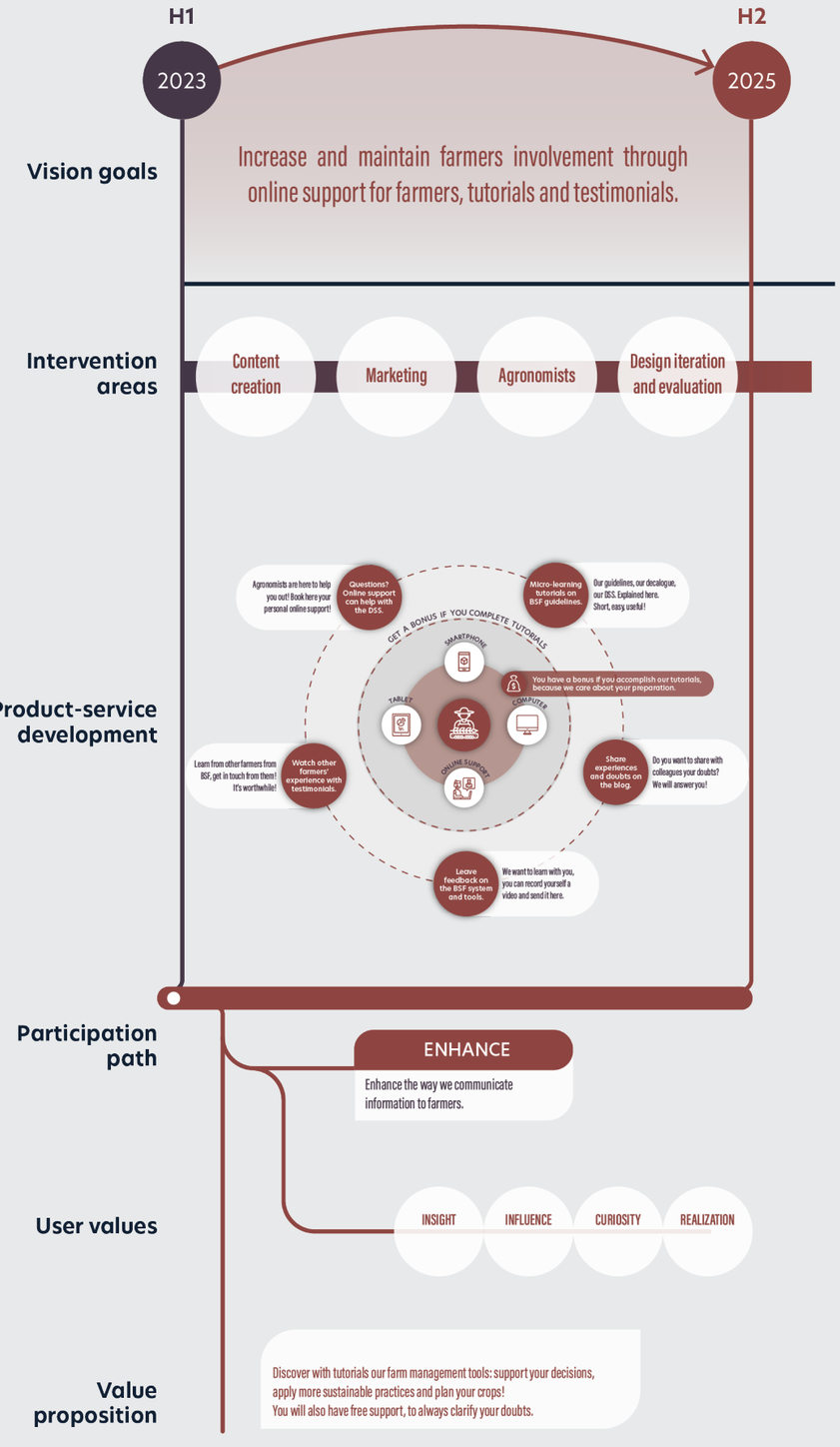
To accomplish the goal of horizon two, Barilla has to create virtual content for the platform. Creating the content will require agronomists or DSS experts, also because, in H2, a new platform feature would require online support for farmers.

Then, target marketing will help to reach farmers more effectively: for example, mail sonorization or specialized agricultural magazines can serve this purpose. Finally, iteration and internal evaluation will be introduced to collect data, feedback, usability, and verify whether farmers adopt the platform or not. Iteration is helpful to understand how to improve the various features.

The new addons of the platform will include:
online support (questions on the guidelines and tools),
microlearning tutorials (for example, on the different rules of the decalogue for sustainable agriculture)
testimonials from other farmers (increasing the credibility of the tools, if proved by other farmers).
A feedback collection area.

Participation and user values

With microlearning and online support, the aim is to show commitment and attention in enhancing Barilla's communication with farmers. Yet, farmers will have the possibility to interface with other farmers (testimonials) because usually, farmers trust direct evidence from colleagues (van den Ban, 1964).
Indeed, the goal is to increase the creation of new insights to update the cultivation practices. The influence of discovering new tools and methodologies will also spark farmers' curiosity to finally realize that there are better ways to cultivate, according to the company goals and the obligations of the contract.



Roadmap: Horizon 3

Involving new academic areas allows Barilla to expand the borders towards understanding farmers' behavior and attitudes when experiencing new practices. Human-related matters should be developed and the agronomic ones to increase the overall results of the BSF projects.

Later, on-field facilitation will finally occur; so, the company needs to organize in loco workshops that require coaches. Coaches will prepare the workshops' content to facilitating farmers' application of the methodologies and the DSS. Also, in H3, workshops iteration is proposed to increase farmers' level of engagement and participation.

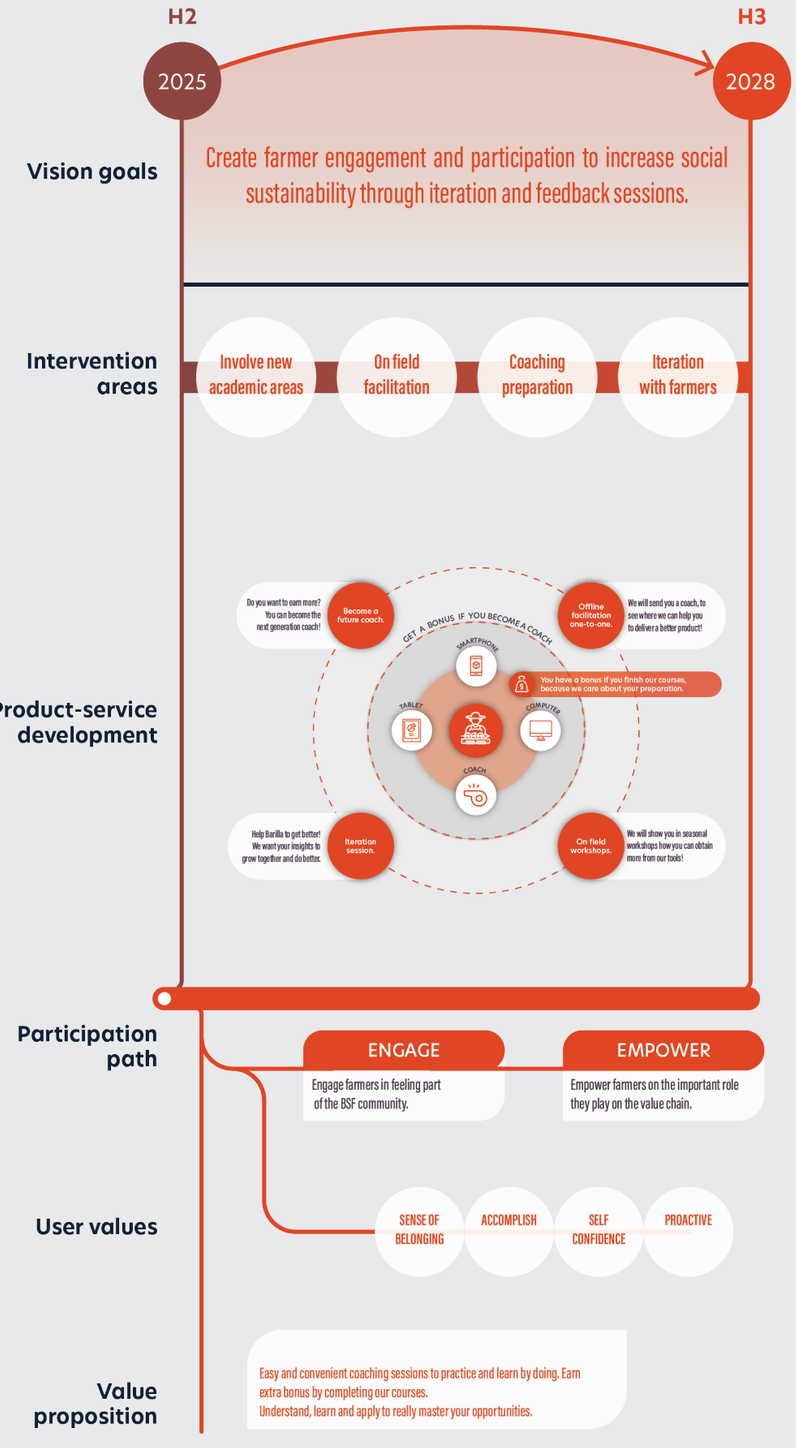
In order to allow farmers to join the workshops, the platform will evolve to book workshops online (see figure 13). Temporary bonuses will be offered to farmers who finish the courses within the first year of contract signature.

Offline facilitation will happen both one-to-one and in groups. Indeed, according to the educational framework (figure 17), coaches will develop the group sessions based on the outcomes from one-to-one coaches. In the end, farmers could also decide to become coaches themselves and help Barilla to accomplish the future vision.

Participation and user values

By enabling farmers to join workshops, the intention is to create a sense of belonging to the Barilla people (and the BSF community). Finally, farmers will empower the understanding of their role in the pasta supply and their value for the company, which in turn created many tools to support farmers' activities.

A proactive engagement will finally increase the application of tools and methodologies because farmers will understand the tools, their applications, and the importance of using them.



Roadmap: Horizon 0

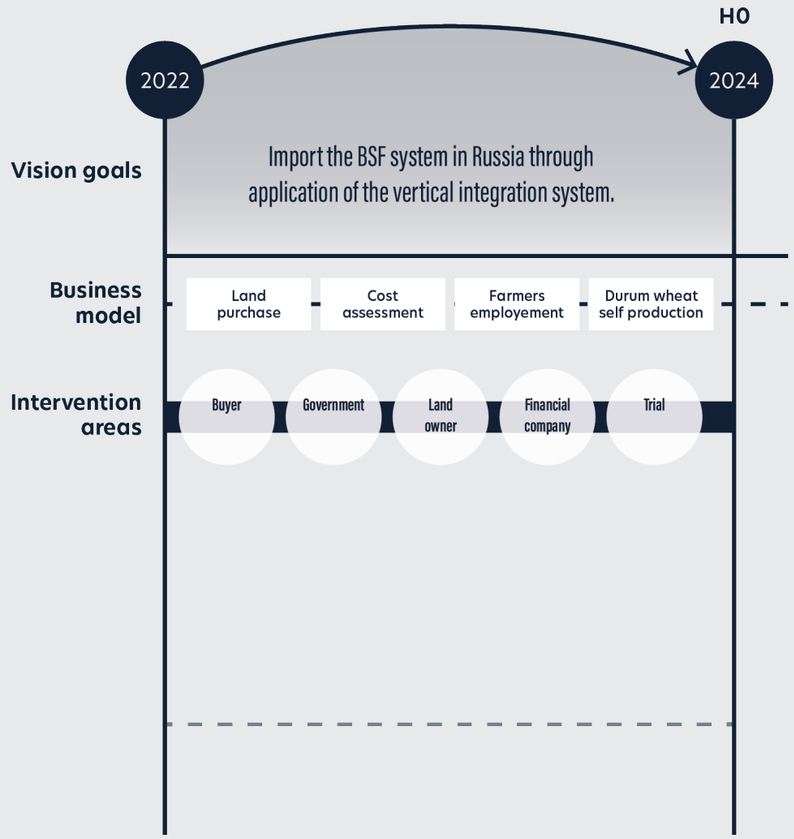
Since in Russia, no legal evidence was found on the possibility of creating farming contracts, a new horizon was added to propose the introduction of the BSF projects through vertical integration.

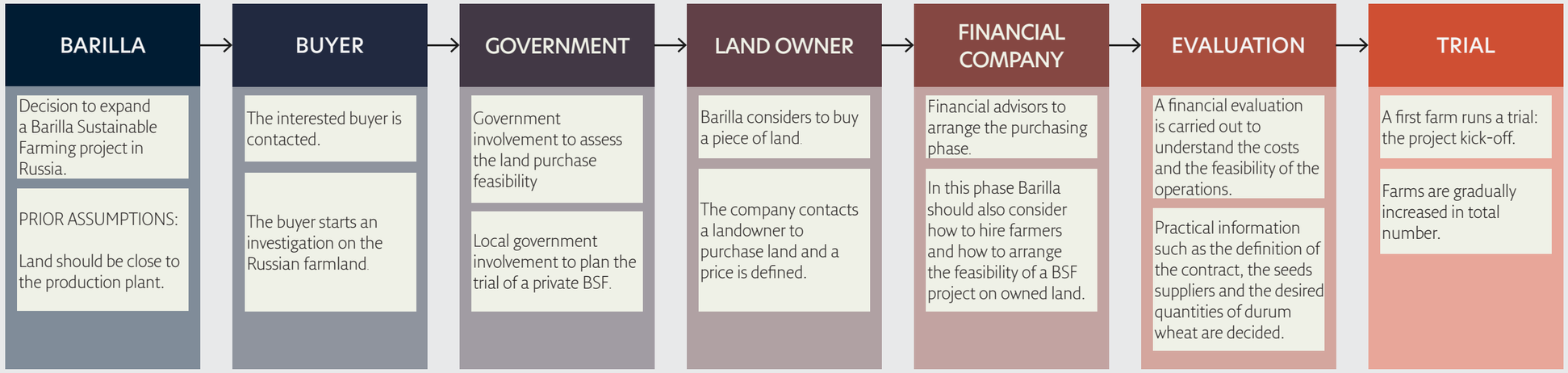
Then, purchasing land would be the first step, together with a cost assessment.
After, farmers would be employed instead of contract, and the durum wheat produced internally. Therefore, finances will allow the acquisition of assets such as machinery, equipment, and materials.

Intervention areas

The buyer will be more engaged or supported by the company because of the complex task of purchasing land.
The government needs to check the actual feasibility of the operations. In this regard, a financial company will also be helpful to derisk the operation and guarantee liquidity (see vertical integration block model in Appendix H).

Finally, the trial can start on a piece of owned land to assess the overall feasibility of the vertical integration framework.





Roadmap: Horizon 1

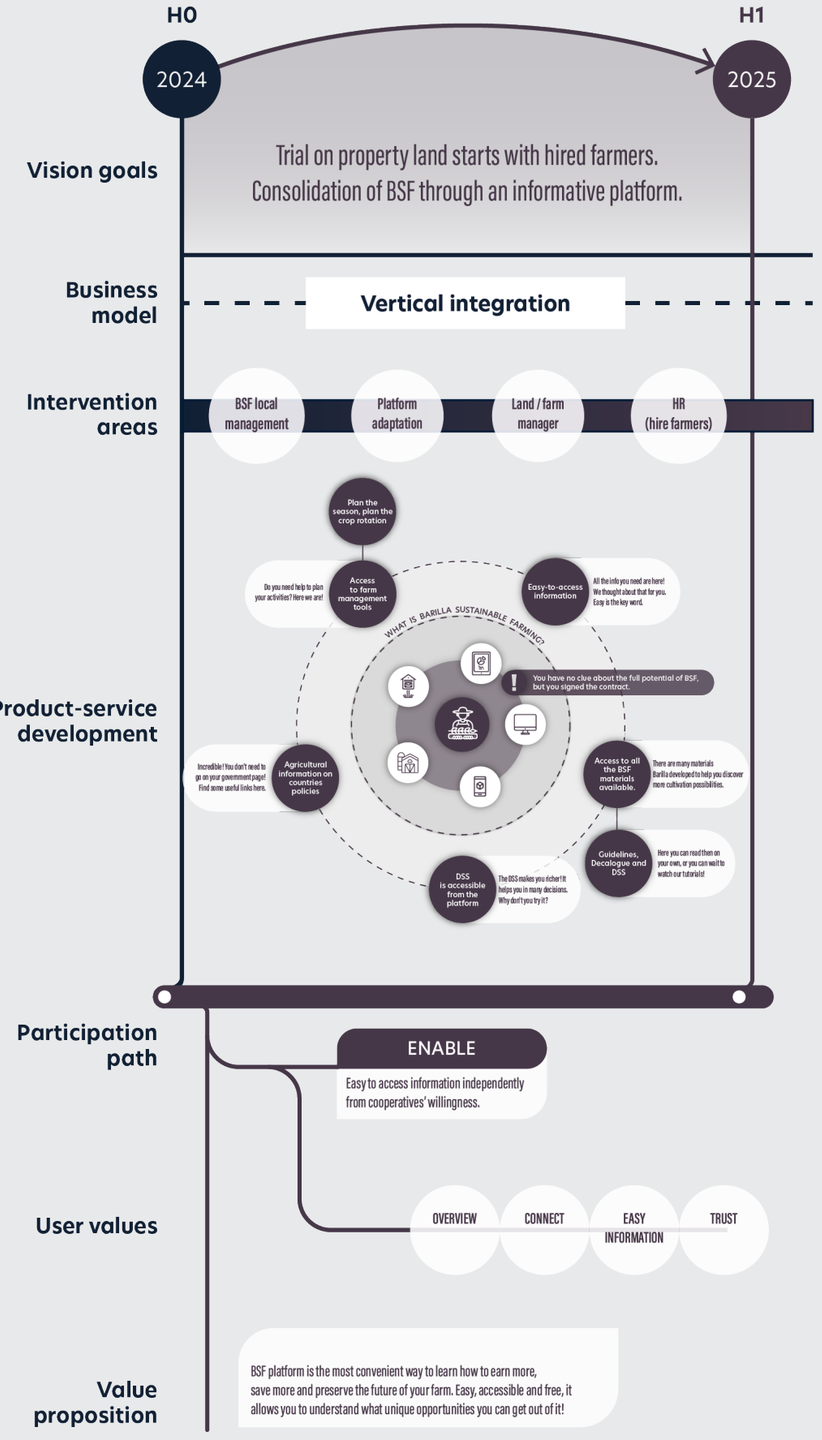
H1 in Russia is focused on starting a BSF trial on a piece of owned land. During the initial phase, the scope is to adapt the platform from the Turkish one, launch it online, and add all the disparate content currently findable online (see figure 12).
Then, farmers will start joining the platform as part of their employment contract with the company (farmers will be hired, then Barilla can operate the platform as a management tool to support the working activities).

When the first horizon is met, the platform will contain easy to access information, where farmers are enabled to find every available information on the BSF projects, including the DSS. Furthermore, all the papers and scientific evidence collected by Barilla will be available on the platform.
Yet, besides BSF-related information, farmers will also find useful information about governmental measures, laws, funds, and loans (when available). The aim is to put farmers in the condition to use the platform because it adds the value of saving time because Barilla already took care of unifying all the information in one place.

In the end, some management tools are included in the service, such as crop rotation and cultivation season management.

Participation and user values

In the first phase, to increase farmers' participation, the aim is to enable easy and accessible information from the company.
Then, the focus is on having a complete and clear overview of the BSF projects panorama; by accessing easy information, the value creation focuses on easing the connection with the company and building trust towards the information provided by Barilla.



Roadmap: Horizon 2

To accomplish the goal of horizon two, Barilla has to create virtual content for the platform. Creating the content will require agronomists or DSS experts, also because, in H2, a new platform feature would require online support for farmers.

Then, a land manager will be hired to control the vertical integration performances. Finally, iteration and internal evaluation will be introduced to collect data, feedback, usability, and verify whether farmers adopt the platform or not. Iteration is helpful to understand how to improve the various features.

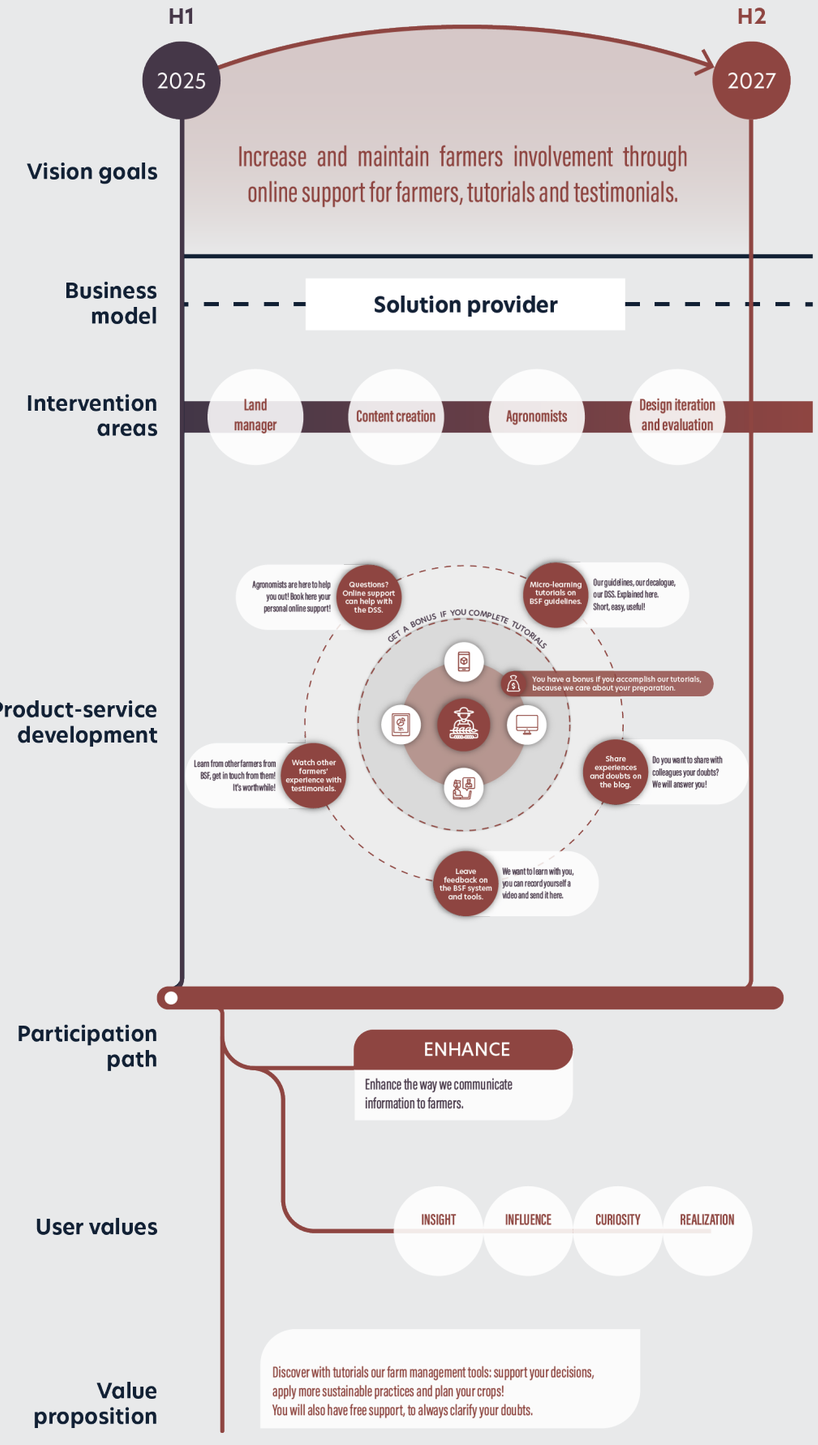
However, since the company is the solution provider, farmers can be asked to use the platform and the courses as a trainee course for the job preparation.

The new addons of the platform will include:

- Online support (questions on the guidelines and tools),
- Microlearning tutorials (for example, on the different rules of The decalogue for sustainable agriculture)
- Testimonials from other farmers (increasing the credibility of The tools, if proved by other farmers).
- A feedback collection area.

Participation and user values

With microlearning and online support, the aim is to show commitment and attention in enhancing Barilla's communication with farmers. Yet, farmers will have the possibility to interface with other farmers (testimonials) because usually, farmers trust direct evidence from colleagues (van den Ban, 1964).
Indeed, the goal is to increase the creation of new insights to update the cultivation practices. The influence of discovering new tools and methodologies will also spark farmers' curiosity to finally realize that there are better ways to cultivate, according to the company goals and the obligations of the contract.



Roadmap: Horizon 3

Again, in Russia, involving new academic areas allows Barilla to expand the borders towards understanding farmers' behavior and attitudes when experiencing new practices. Human-related matters should be developed and the agronomic ones to increase the overall results of the BSF projects.

Later, on-field facilitation will finally occur; so, the company needs to organize workshops that require coaches in loco. Coaches will prepare the workshops' content to facilitating farmers' application of the methodologies and the DSS.

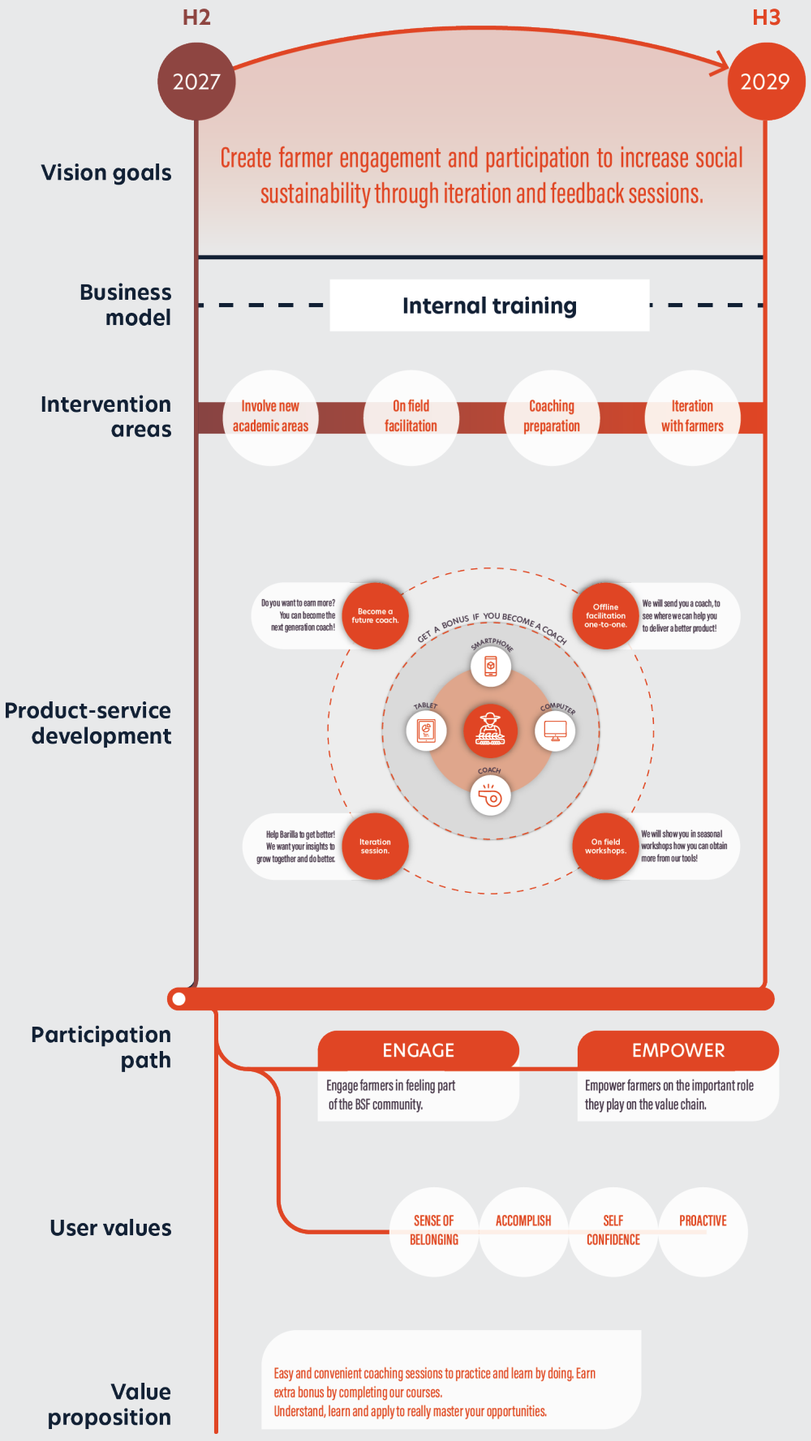
In the business model, the offline facilitation can be intended as employees training because the workshops will happen on owned land with contracted farmers.

Offline facilitation will happen both one-to-one and in groups. Indeed, according to the educational framework (figure 17), coaches will develop the group sessions based on the outcomes from one-to-one coaches. In the end, farmers could also decide to become coaches themselves and help Barilla to accomplish the future vision.

Participation and user values

By enabling farmers to join workshops, the intention is to create a sense of belonging to the Barilla people (and the BSF community). Finally, farmers will understand their role in the pasta supply and their value for the company, which in turn created many tools to support farmers' activities.

A proactive engagement will finally increase the application of tools and methodologies because farmers will understand the tools, their applications, and the importance of using them.



ROADMAP FOR TURKEY

H0 2022 — H1 2023 — H2 2025 — H3 2028

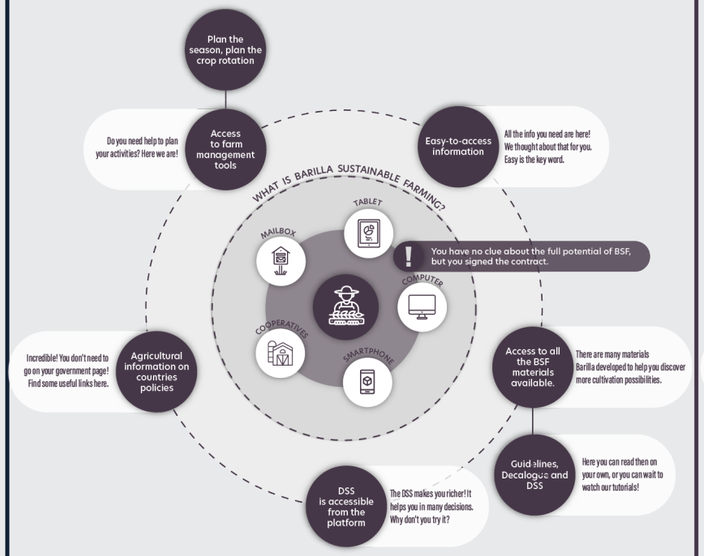
Vision goals

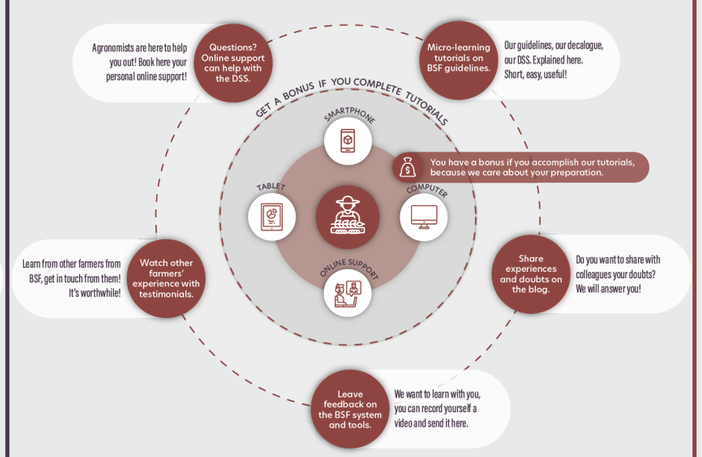
- 2022–2023: BSF expansion and consolidation through an informative platform for farmers.
- 2023–2025: Increase and maintain farmers involvement through online support for farmers, tutorials and testimonials.
- 2025–2028: Create farmer engagement and participation to increase social sustainability through iteration and feedback sessions.

Intervention areas

BSF local management · Platform creation · Cooperatives involvement · Farmers involvement · Content creation · Marketing · Agronomists · Design iteration and evaluation · Involve new academic areas · On field facilitation · Coaching preparation · Iteration with farmers

Product-service development





Participation path

ENABLE
Easy to access information independently from cooperatives' willingness.

ENHANCE
Enhance the way we communicate information to farmers.

ENGAGE
Engage farmers in feeling part of the BSF community.

EMPOWER
Empower farmers on the important role they play on the value chain.

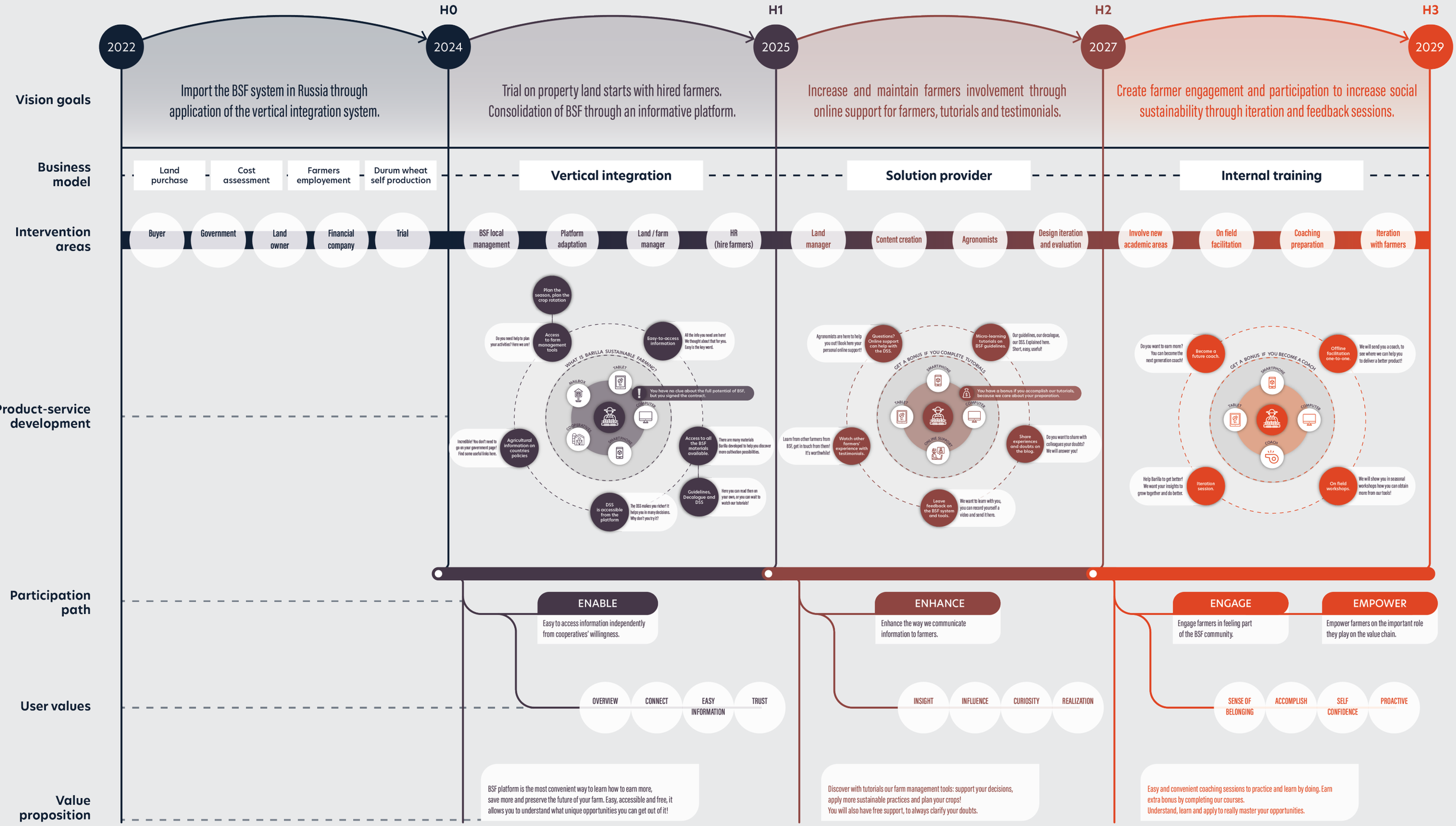
User values

OVERVIEW · CONNECT · EASY INFORMATION · TRUST

INSIGHT · INFLUENCE · CURIOSITY · REALIZATION

SENSE OF BELONGING · ACCOMPLISH · SELF CONFIDENCE · PROACTIVE

ROADMAP FOR RUSSIA



DELIVER

The deliver phase is the last phase of the double diamond diagram. It consists of generating the best solution from the concept. Iteration is the main goal of this phase, and in this graduation project, the concept was evaluated internally.

The graduation project aims to understand if the concept would be implementable and how the company could adapt it to the real environment. Thus, recommendations are based on internal evaluation.

8. INTERNAL EVALUATION AND RECOMMENDATIONS

Internal validation was carried out with the BSF project manager. In this chapter internal validation and further recommendations are addressed.

8.1 Internal evaluation

The graduation project focussed on bringing BSF abroad and swaying farmers to adopt the BSF methodologies and tools. Then, Turkey and Russia were selected to implement an educational model among the initial group of considered countries. The educational model focuses on facilitating the utilization of the BSF tools. However, bringing both the educational model and the BSF projects in these two countries is challenging.

In the this section, the internal validation carried out with the BSF manager is carried out, thus based on a final interview with the company. Based on the experience of the manager, the internal evaluation considers all those factors that might be taken into account if the project would be implemented by the company.

8.2 Geopolitical situation

Turkey

The geopolitical situation of Turkey is harming the BSF projects expansion. As previously elaborated, Barilla already brought 20 trials in Turkey, more precisely in Thrace, the most advanced region of the country. However, due to a substantial devaluation of the Turkish currency, Barilla is forced to slow down the expansion.

Russia

In Russia instead, Barilla has an ongoing evaluation regarding the BSF projects. Thus, the BSF projects are still far from being implemented. Furthermore, in Russia often farmers are isolated from other farmers and seldom interact with other farmers. Yet, most of the Russian farmers produce wheat for self-consumption.

Furthermore, in both countries, the low level of education and digitalization can further threaten the potential application of the facilitation model developed during the graduation project.

8.3 Internal suggestions

In both the roadmaps, the time span could be extended, given what was discussed above, because the actual implementation of the educational framework should take into account a period of digitalization of the rural land.

Secondly, since farmers have low chances to access the internet, a further possibility is to invert H1 with H3 in the roadmaps. But, then, the level of digitalization constitutes an issue that needs time to be solved. Then, to reach out to some learning goals for farmers, it would be more effective to directly send a coach to teach farmers how to apply tools and methodologies. This would be more effective to create an overall understanding of the BSF methodologies.

8.4 Recommendations as a strategic designer

As a strategic designer, I followed my intuition to create value by bringing a new perspective. I found it more relevant to create a new kind of proposition for the company for two main reasons:

- **Getting a new direction to develop the BSF projects further;** for the first part, I believe that the company can only improve the related social value before further increasing the economic and environmental goals. Namely, if a theoretically complete network brings value to farmers, it does not necessarily mean that it can work practically. Farmers demonstrate to be stubborn and difficult to convince, so to create a maximized strategical value for the entire company, there is the need to pass through farmers' minds.

- **Create a farmer-centred solution, stressing the importance of understanding farmers before pretending to apply tools such as the DSS;** secondly, the relevant part of the project, besides the actual possibility to realize it, regards the unfocus from a company-oriented perspective towards a more farmer-oriented one. Indeed, given the difficulties in reaching out to farmers, it is influential in reaching out to farmers directly. Furthermore, remembering that without farmers, the BSF projects wouldn't be possible, a more emphatic understanding of the target group would help Barilla to shape the projects better soon. Therefore, the project revolves around an educational framework to create the consciousness that farmers need to be contacted and understood more in-depth to create a tailor-made solution to fully integrated BSF projects.

8.5 Social sustainability

Given the low levels of education and digitalization, Barilla should focus on human-centred values. The successful expansion of the BSF in Italy has an important economic core that creates more opportunities for farmers. However, we have to bear in mind that the tools that BSF provides are in line with an overall advanced agricultural system. In Russia and Turkey, as evidence from the research shows in Chapter 3, education and digitalization are shallow. For Barilla implementing BSF successfully will require more time and commitment than in Italy because the average level of farmers is not adequate for the proposed projects.

However, like this graduation project tries to demonstrate, Barilla has much room to work on people. For example, further research could focus on new ways to help the farmers who have already adopted the BSF project in the digitalization process; moreover, the company could include more social-based studies in the academic institutions that collaborate with them.

8.6 Iteration with farmers

Understanding farmers is essential, too. For each country, Barilla should collect insights from farmers to understand how and where they could improve in the overall process of BSF. For example,

assessing the needs of farmers could lead to a deeper understanding of why farmers struggle in sensing and applying BSF methodologies. In turn, understanding farmers' needs with qualitative research (therefore carried out through an academic organization) can lead to the co-creation of a new model to make the BSF application more effective. Thus, the recommendation is to also zoom out from the BSF objectives to gain further insight on farmers' points of view.
In general, a more design-driven perspective can generate new ideas and insights on how the project can further succeed to bring a more effective understanding of the tools, especially in countries where agriculture is still rearward.

8.7 Economic considerations

Although strategic designers should also consider the economic value of their projects, this graduation project has not evaluated the investments.

The BSF projects have proven their economic gain for all the actors involved. Still, regarding the solution for the project, it is more difficult to assess the required investment and especially the return on the investment. For Barilla, it would mean to understand if an overall improvement of the understanding of the tools would bring gain in the end, assuming that all farmers involved use the provided tools.

Given the evident economic gain for both the company and farmers, Barilla should now focus on creating added value for farmers and set new human-centred goals: a possible goal could direct on new farmers that every year use the DSS and gain from it. It is undoubtedly more challenging to estimate an economic value when talking about people and their attitude towards new methodologies. Still, the correlation between the financial gains and more farmers adopting BSF tools more efficiently is evident. If all the farmers that signed a contract used the BSF tools effectively, ROI would be maximized.

Limitations

Farmers are the target group of this project. However, the sample of farmers interviewed for this graduation project is limited to the Italian farmlands.

Due to the wide range of countries analyzed, it was not possible to reach out to more farmers in the six months duration of the project. Furthermore, even if possible, there would also be language limitations in Russia and Turkey. Limiting the qualitative data to only Italian farmers made comparing countries and related agricultural environments less reliable. Indeed, most of the collected data come from desk research and information obtained during the interviews with the company. Such a complex context would require more time to assess the reliability of data and the project's feasibility.

9. FINAL REFLECTION

This last chapter develops the discussion part and the reflections within and beyond the context of the project

Discussion on the context of the project

Before starting my experience at TU Delft, I wished to strictly work with sustainability. This project was a realistic opportunity to show my value as a strategic designer. Unexpectedly, during the research, I discovered that environmental sustainability could not exist without people who believe in it.

Before engaging my last semester at TU Delft with this graduation project, I did not find available professors to undertake this path with me. So, in a desirous attempt to find a committee, I sent an e-mail to the Design Organization and Strategy department, and I effectively built this graduation project. Beyond my national pride in creating this graduation project with Barilla, I found in this project a trigger to increase the already relevant strategic value of the BSF projects for the company.

As a strategic designer, I have always tried to ponder my choices based on the intention to deliver a reliable concept. From this concept, I hope to give the company a new perspective that drives their choices while expanding the BSF projects abroad.

The role of Design Thinking

In December 2020, during a phone call with Mr. Ruini about the idea of a graduation project on Barilla Sustainable Farming, we spoke about the interest in bringing the “Design Thinking” practices within the BSF projects.

However, what does Design Thinking mean?

Design thinking is a very appropriate thought process and cognitive tool to tackle innovation problems so that these can be solved in original and unexpected ways, to the point that “design thinking can be used to create everything” (Dell’Era et al., 2019). Therefore, the

designer's role is to explore all the possibilities and find a creative way to solve the problems issued by the client.

In this case, one of the issues to be tackled concerns the partial inefficiency of the company to convince farmers to adopt the tools that the company has developed to support the farming activities to maximize profits and the number of raw materials produced.

Regardless, Barilla Sustainable Farming turns out to be a successful strategic move from the company. Despite the intractable problems that may relate to farmers' cultural, social, and educational issues, the network of contracts creates a sustainable environment to bring safe supplies of durum wheat.

As a strategic designer, I should also consider the company's investments for such a project and then use the ROI (return on investment) to evaluate the operation's success (Calabretta et al., 2018). However, Barilla has already proven the economic value of the BSF projects when adequately applied by farmers: therefore, what is the challenge that, as a strategic designer, I had to tackle?

Design Thinking focuses on a changing of perspective, on finding new ways to look at a problem. Barilla has excellently executed the BSF projects but mainly reached economic goals. One can argue that a company needs to focus primarily on economical-related goals. Notwithstanding, part of my role as a strategic designer consisted of combining the most important drivers of a project (in this context, the three pillars of sustainability, economic, environmental, and social) with possible niches to exploit, aiming to solve a significant problem for the company. Therefore, the outcome of the graduation project has highlighted, through research and interviews, the need for Barilla to extend BSF projects goals towards farmers.

What do we learn from this project?

Sustainability is a term that can often create misunderstanding and misjudgment, especially when pulled over by a big company's name. In addition, we often hear about greenwashing, companies attempting to show fake environmental sustainability used as a marketing tool trying to sell more.

Applying sustainability to well established and complex supply chain is not straightforward as it seems, significantly when the volumes of produced goods exceed a million tonnes (like Barilla does with pasta). It is always essential to bear in mind the company's commitment to such operations, especially if the efforts are made for actualizing a real added value and not a mere marketing tool.

Companies are created by people, which is one of the most critical assets that compose the belief of a whole corporation. Being people the value carriers, the shift to bring a natural, sustainable environment in our lives starts from them. We can identify people as designers as well as the involved stakeholders. Then, this graduation project attempts to unfocus on environmental and economic sustainability and focus more on the social aspect of sustainability.

What designers should learn about sustainability concentrates on integrating a new mindset: instead of focusing on the most common aspects of the environment and economics, designers should focus more on the social side of sustainability. Most important is the role of social sustainability, namely the understanding of the role people have in a given context and what we should change to increase overall sustainability. For instance, farmers play a crucial role in giving us safe and healthy food.

Still, why do farmers play such an essential role in our society, but most people do not recognize it? Yet, we, as daily consumers, often give for granted where food comes from because what we see in supermarkets is extra-processed food that passes through many complicated steps to track.

Then, how can we change the perception of the farmers?
Values in our community are shaped and influenced by the people

who compose it; therefore, to create a better awareness of the importance of this primary target group, a mind shift needs to start from someone.

I believe that this "someone" could be companies and big multinationals, given the massive amount of sourced food. Big corporates have enough potential, power, and influence to lead the mind shift. As I could perceive within Barilla, the people who first need to change perspective are the leaders of such companies, who have the duty and responsibility to work for a more inclusive and socially sustainable environment for all the actors playing in their reality.

Reflection

Besides the context of the project, throughout the past two years, our world has faced the challenge of the Covid-19 pandemic. Farmers, like anyone else, had to face the new societal requirements, such as a faster and stronger need for digitalization.

Online working and learning will increasingly reshape our lives habits, and this also reflects farmers, even though they spend much time in their fields. I believe that despite the slower digitalization process that is happening in rural areas (and especially in countries like Turkey and Russia), societal needs will move in the direction of a more connected world. Then, even if the farmer's target group would work against this process, at a certain point also farmers will succumb to the new hyper-connected reality. Thus, the project outcome, although not fully implementable at present, could give Barilla a different perspective that could serve as a starting point to look at new possibilities for the future development of sustainable projects.

Sustainability in agriculture

Barilla acts as a cutting-edge company for agricultural sustainability improvements. Indeed, during the context exploration for the project brief drafting, there was little evidence of similar projects. Competitors such as Unilever, Nestlè, or Danone also created similar projects, but none of them was expanded nor successfully implemented as Barilla did with the Barilla Sustainable projects.

The challenge of integrating sustainable farming is, in general, very critical for the world's population safety in terms of food security. Preserve soil health, reduce environmental pollution, and reduce emissions are some examples. What I admire of Barilla's goals is that they are actively working to increase sustainability also in less developed countries. Indeed, from a company perspective, it is easier to increase sustainable agricultural practices in developed countries, given higher educational levels, higher income, up-to-date technology, and higher governmental support. Apply the same sustainability in countries where agriculture is now advanced as it was forty-fifty years ago constitutes a commitment that other companies should imitate and iterate the same way.

My personal growth after this project

I have mostly worked in teams throughout my student (and intern) career; this graduation project allowed me to interface with my skills and abilities like never before. Anyhow, even if this was a solo project, I found the confrontation with other professionals and designers extremely useful.

During the graduation process, there were moments where uncertainty drove the scene, where knowing where to go seemed impossible. It was only by walking through the process step by step that it was possible to deal with uncertainty and then learn to trust my skills and intuition as a strategic designer. Besides, my motivation pushed my job to always look for quality and meaning in developing a project that could give some inspiration to the company.

Personally and professionally, I can finally admit that I could undertake other projects on my own.

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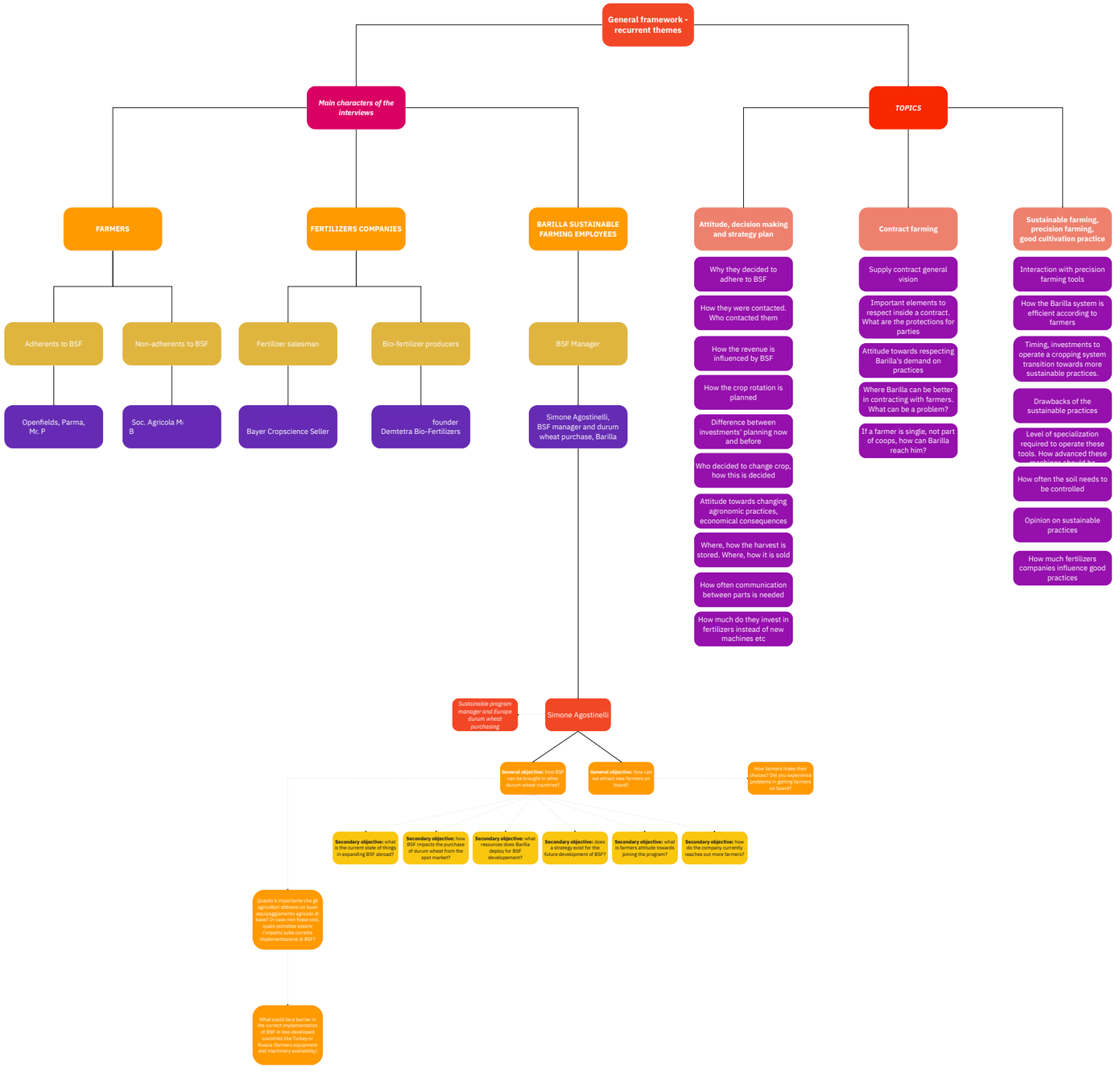
APPENDIX

APPENDIX A: INTERVIEWS ORGANIZATION AND FRAMEWORK



APPENDIX B: MAP OF BARILLA'S PRODUCTION SITES

APPENDIX C: PESTEL ANALYSIS

POLITICAL & LEGAL

		Canada	United States	France	Spain	Turkey	Russia
Opportunities		▪ Governmental stability ▪ Laws are clear and accessible ▪ Local laws simplify governmental intervention ▪ Strong grant funding are available to farmers ▪ CUSMA[9] ▪ Geographical access to contract farming laws[10 11]	▪ 10,3% of farmers are under contract in wheat production[1] ▪ New Generation Cooperatives can be targeted ▪ Contract farming is managed locally ▪ CUSMA[9] ▪ Regional legislation for contracts	▪ Open dialogue with regional institutions ▪ Cooperatives are well organised and very common ▪ Supportive tax system to reduce tax burden[3] ▪ Organic farming's biggest increase worldwide[4]	▪ EU funds are less taxated[3] ▪ Spain has the second lowest tax burden in the EU-15 [14]	▪ Government is retiring from the agricultural development[6] ▪ Private sector is freer to act[6] ▪ Government push to privatization of the agricultural sector [5]	▪ State policies have facilitated an increase in grain and wheat[8]
Risks		▪ Farmers have easy access to contract farming guidelines ▪ Decision-making is guided ▪ Guidelines for farmers on contract farming available [10 11] ▪ Food safety regulations may affect the future exports of durum ▪ European list of non allowed substances [12] ▪ European ban for glyphosate by December 2022 [13]	▪ US Farm Bill ▪ High risk with new Farm Bills ▪ Barely impossible wheat production without glyphosate[2] ▪ Increased customer concerns regarding residue levels, food safely, labeling, etc. ▪ Contractual framework has multiple levels ▪ Every state of the federation needs more individual attention, different contracts and different needs ▪ European ban for glyphosate by December 2022 [13]	▪ Trade unions of farmers	▪ Trade unions of farmers ▪ Dry land is expected to become even drier	▪ Agricultural basins govern the allowed varieties ▪ Cooperatives are statal ▪ New urban areas threatens rural development[6] ▪ the Turkish seed market is mainly controlled by 400 companies where the most powerful 30 are multinational [6]	▪ Policy outcomes are influenced by the efficacy of state policy and state capacity[8] ▪ Present-day state is interventionist in agriculture ▪ Agriculture is influenced by the efficacy of state policy levers even in a privatised agrarian sector[8]
Barriers		▪ High political influence from the ministry of Agriculture and Agrifood	▪ High political impact on agriculture ▪ In some countries contract farming is limited	▪ EU funds are taxated[3]	▪ Taxation is not supportive[3]	▪ Alignment laws to european standards are destroying rural land and small farmers[6] ▪ Central government requires registration of contracts[7] ▪ new sets of regulations enforced threatening to destroy the rights of peasants by interfering with their access to seeds, land and political rights [6] ▪ Turkish law on seeds (2006) is largely against farmers, who must buy defined seeds from privates [5]	▪ High federal influence and intervention on agriculture[8] ▪ Russian government has officially banned the cultivation and breeding of genetically modified crops[15] ▪ 'high' policy impact to grain storage and grain transportation[8]

References can be found at pageds 154 and 155.

APPENDIX C: PESTEL ANALYSIS

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APPENDIX C: PESTEL ANALYSIS

		Canada	United States	France	Spain	Turkey	Russia
ECONOMICAL	Opportunities	• Incentives for agribusiness and corporate farming • Acceptance of contract farming as beneficial for long term planning • Great economical stability[1] • Lower price of durum, if compared to Italy[2]	• Agricultural crisis in Montana and North Dakota • Acceptance of contract farming as beneficial for long term planning	• Acceptance of contract farming as beneficial for long term planning • Biodiversity, organic farming, young farmers and other areas received a welcome financial boost from the EU institutions	• Acceptance of contract farming as beneficial for long term planning • Biodiversity, organic farming, young farmers and other areas received a welcome financial boost from the EU institutions	• low agricultural employment • the government aims to strengthen contract farming in agriculture, towards a more capitalist mindset[9] • Investment in new agri technologies for contractors	• Land is cheap • face low domestic grain prices due to recent large harvests and full elevators[11] • Low income farmers
	Risks	• Higher farmers' income[3] • Low crop differenciation per area • Usage of glyphosate during pre-harvest phase might cause economical loss[4]	• Higher farmers' income • Low crop differenciation per area[6] • Significant quality discounts • EU potential tariff on US goods due to aircraft production subsisides[8]		• Latifundos exist (large cultivated areas)	• Consistent investments need to be done for infrastructures	• Consistent investments need to be done for infrastructures[11] • Putin wants to push exports of 12% (per year) by 2024[12] • Inefficient use of land[11]
	Barriers	• Employement is low in rural areas of Canada • Glyphosate is accepted in Europe until December 2022[5]	• Glyphosate is accepted in Europe until December 2022[5] • Farm Bill's decoupling of production and price supports • Petrol dependent agriculture • Strong world demand for high quality wheat			• Loss of workers, that, due to a heavier industrialization moved from the countryside to the cities to find new job opportunities • Agricultural land is disappearing, the last 10 years, Turkish agricultural land has decreased by 2.7 million hectares[10]	• Low infrastructures availability • inadequate level of investment R&D, and innovation [11] • Poor crop yield • No evidence of contract farming found

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APPENDIX C: PESTEL ANALYSIS

		Canada	United States	France	Spain	Turkey	Russia
SOCIAL	Opportunities	• Good sense of community between Canadians • Acceptance of contract farming as beneficial for long term planning • Higher expertise, more specialized farmers • Acceptance of contract farming as beneficial for long term planning	• Lifestyle farms allow for a wider education of farmers • Consumers want fewer chemicals and additives on ingredient labels. • Higher expertise, more specialized farmers • Family farms are predominant, contracts are a strong point Acceptance of contract farming as beneficial for long term planning	• Acceptance of contract farming as beneficial for long term planning[5] • Higher expertise, more specialized farmers • Cooperatives only work with subscribed farmers	• Acceptance of contract farming as beneficial for long term planning[5]	• Farmers are on average poor[6]	• Unemployment in rural areas • Farmers are on average poor but in growth[7]
	Risks	• Farmers are more aware of what contract farming is an what are the consequences • Large farms tend to save money[1] • Low crop differentiation per area • Size of the land affects the planning and way farmers work[1]	• Strong opinions on traditional methods[4] • Lifestyle farms are consistent part of total farming in US • Profit-oriented farms tend to save money • Size of the land affects the planning and way they work • Low crop differentiation per area			• Peasantry holds 2/3 of the total Turkish farms and are the poorest segment of the population[6]	• State surveys say largest number of agricultural job vacancies are for skilled labour[8] • Conservatism leads to an attachment to Soviet mindset[8]
	Barriers	• Limited changes in decision making • Unsustainable practices still widely applied. Monoculture.[2]	• Every farmer has his own opinions on planning and climate change (USDA commetee) • Difficult to deal with everyone has a different idea or definition. • Unsustainable practices still widely applied. Monoculture.[3]			• Lack of transparency of products' quality by farmers[5] • Need of informatics knowledge. • Lower expertise, poor specialisation • Poor farmers political, economical and cultural rights are violated by the ruling Government[6]	• Lack of qualified workers[8] • Insurance is ineffective and unpopular among farmers[8] • Lack of informatics knowledge. • Lower expertise, poor specialisation[8]

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APPENDIX C: PESTEL ANALYSIS

		Canada	United States	France	Spain	Turkey	Russia
TECHNOLOGICAL	Opportunities	▪ Canada boasts a strong grant funding ecosystem that should serve as a foundation for stronger early-stage investing, including seed-stage investments[1] ▪ Agriculture 4.0 spreading	▪ Agriculture 4.0 spreading				▪ 15% subsidies were offered to agricultural producers to purchase appropriate technical equipment[4] ▪ State policy supports and facilitates the introduction of high-tech machinery and practices[2] ▪ Subsidies exist to implement Agri 4.0 equipment in Russia
	Risks	▪ Adaptation to crop rotation				▪ Age of the current equipment. ▪ Available machinery not up to date.	▪ Age of the current equipment.
	Barriers				▪ Investments for replacing the equipment.	▪ Investments for replacing the equipment.	▪ Investments for replacing the equipment. ▪ World's 2nd inefficient with its arable land, and 5th with its farmland plots[3] ▪ Machinery fleet requires significant upgrades

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APPENDIX C: PESTEL ANALYSIS

		Canada	United States	France	Spain	Turkey	Russia
ENVIRONMENTAL	Opportunities	• Cover soil[1] • Livestock integration[1] • Warmer summers with drought[1] • Incentives on research and experimentation[2]	• Cover soil • Green manure usage	• Organic agriculture is spreading[5] • natural conditions are very favourable for agriculture[5]	• Most of Spanish crop land is not irrigated	• High average yield in Turkey • Good soil health as well	• Warmer temperatures in summer are positive factors for durum cultivation • Increase of agro holdings that buy farms for vertical integration • Start-up farms are common in Russia
	Risks	• Higher risk of glyphosate due to conservation[3] • The harvest is late, no time to dry the durum correctly[3] • Climate change is already affecting canada[1] • Drought during growing period[1]	• Drought during growing period[4] • Since drought is growing there is uncertainty over spring and durum acres. Farmers didn't harvest in 2020 many fields				• Decrease of long term agro-sustainability
	Barriers	• Pests and diseases (fusarium) • Short summer forces the use of glyphosate in the late stage of crops growing phase[3] • Soil protection harmed by desertification • Loss of biodiversity	• Adverse weather cause significant harvest delays and quality issues • Loss of biodiversity	• France has one of the lowest shares of environmental taxes in the EU[6]			• substantial agro-biodiversity loss and increased susceptibility to disease and weather conditions

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APPENDIX C: PESTEL ANALYSIS

		Canada	United States	France	Spain	Turkey	Russia
INFRASTRUCTURES	Opportunities	• Canadian grains railroad connects directly to Iowa[1] • Road net is good and advanced	• Canadian grains railroad connects directly to Iowa[1] • Elevators are connected both with railroads and Canadian elevators network[1]				• New mill to be built by 2023[2] • 10 million ha of arable Russian land is still idle[3]
	Risks	• On-farm storage possibilities. • Own storage usually unavailable • Production-storage capabilites are insufficient • Mills/elevator distance from the farm	• On-farm storage possibilities. • Mills/elevator distance from the farm				• On-farm storage possibilities. • Mills/elevator distance from the farm • the state owns and operates the railroads that transport grain[4] • state-owned and privately-owned grain elevators for storage[4] • deficiencies in grain transportation that create problems for Russia's grain producers and trading companies[4]
	Barriers	• Elevators are the main storage used by Canadians • Storage arrangements need to be agreed	• Elevators are the main storage used by Americans • Storage arrangements need to be agreed				• Underdeveloped infrastructures, especially rural roads[4] • Grain railroad under governmental control and management[4] • Elevators lack of available space[4]

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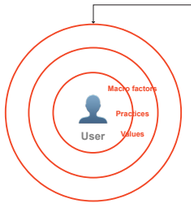
APPENDIX D: CULTURA

Scope: **What cultural aspects will influence the supply contracts for durum wheat?**

How to bridge the gap between the company need and farmers values that reflect their needs?

How to help farmers to feel more central in the company's activity?



CONTEXT: INCENTIVATE THE ADOPTION OF CONTRACTS IN AGRICULTURE

END USERS: FARMERS, UNDECIDED FARMERS, EMERGING FARMERS

LEGENDA:

SOCIO-CULTURAL VALUES:
- What social standards do people share in the intended context?
- What personal values can be identified that differ from those shared values?
- What dilemmas do you observe?

THE MATERIAL WORLD:
- What artefacts (products, services, or things that have been designed) do people typically use in the intended context?
- What symbolic meaning or social significance do these artefacts have in people's everyday lives?

COMMUNITY:
- What concern(s), relevant for the project, do people share in the intended communities?
- What characterizes the community (e.g. who, what, where)?

DIVISION OF ROLES:
- What roles do people have in the intended communities?
- How are duties distributed among community members?
- What characterizes the division of roles (e.g. gender differences, individual/collective interests, or hierarchy)?

RITUALS IN EVERYDAY LIVES:
- What sequences of activities do people participate in?
- What daily routines do individuals follow?
- What special events do people share?

KNOWING THE RULES:
- What rules do people have in dealing with their social relationships?
- What explicit (spoken, written) and/or 'hidden' (unspoken, not written) rules do people practice?

ANGELS VS DEVILS:
- Who is highly esteemed in the community, e.g. a superhero or celebrity? Why?
- Who holds low esteem in the community, e.g. an enemy or anti-hero? Why?

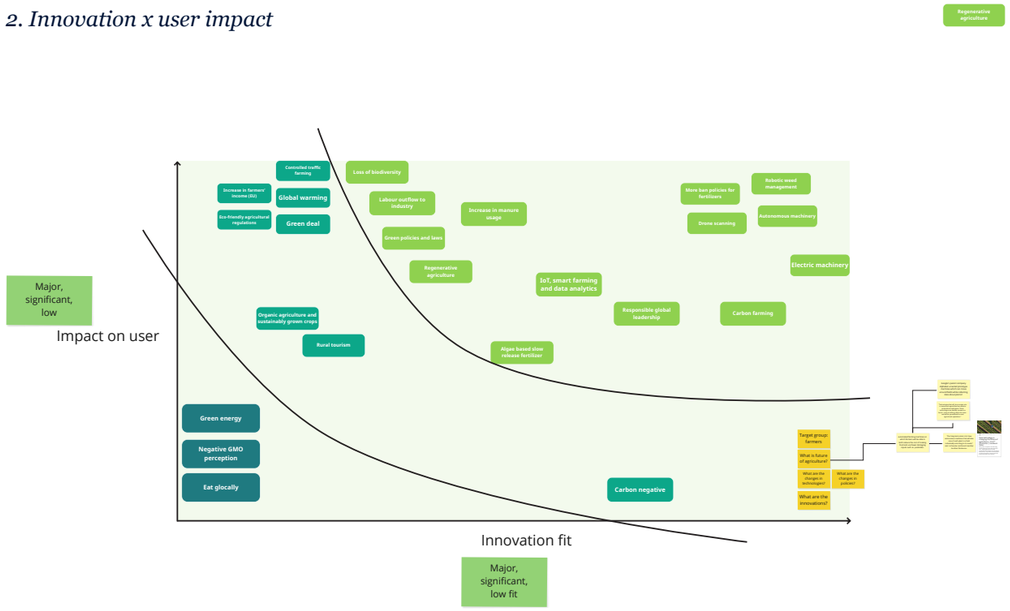
GOALS OF END USERS:
- What short-term goals do people have (individually or as a community)?
- What long-term goals do people want to achieve (individually or as a community)?

MACRO DEVELOPMENTS:
- If you look at the broader picture, what relevant contextual factors do you see (e.g. demography, economy, infrastructure, composition of the population, geographical characteristics, or politics)?
- What developments are expected for the near future?

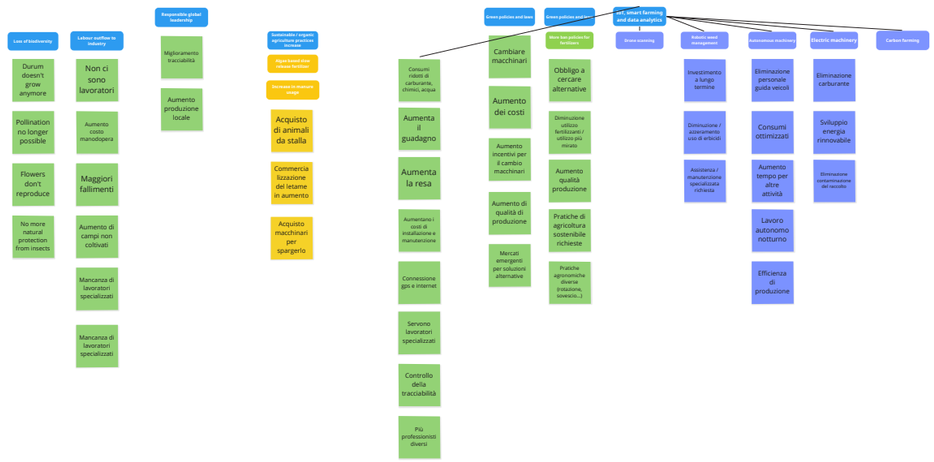
APPENDIX E: FUTURE TREND SCOUTING

1. Cluster all the future trends for agriculture

2. Innovation x user impact

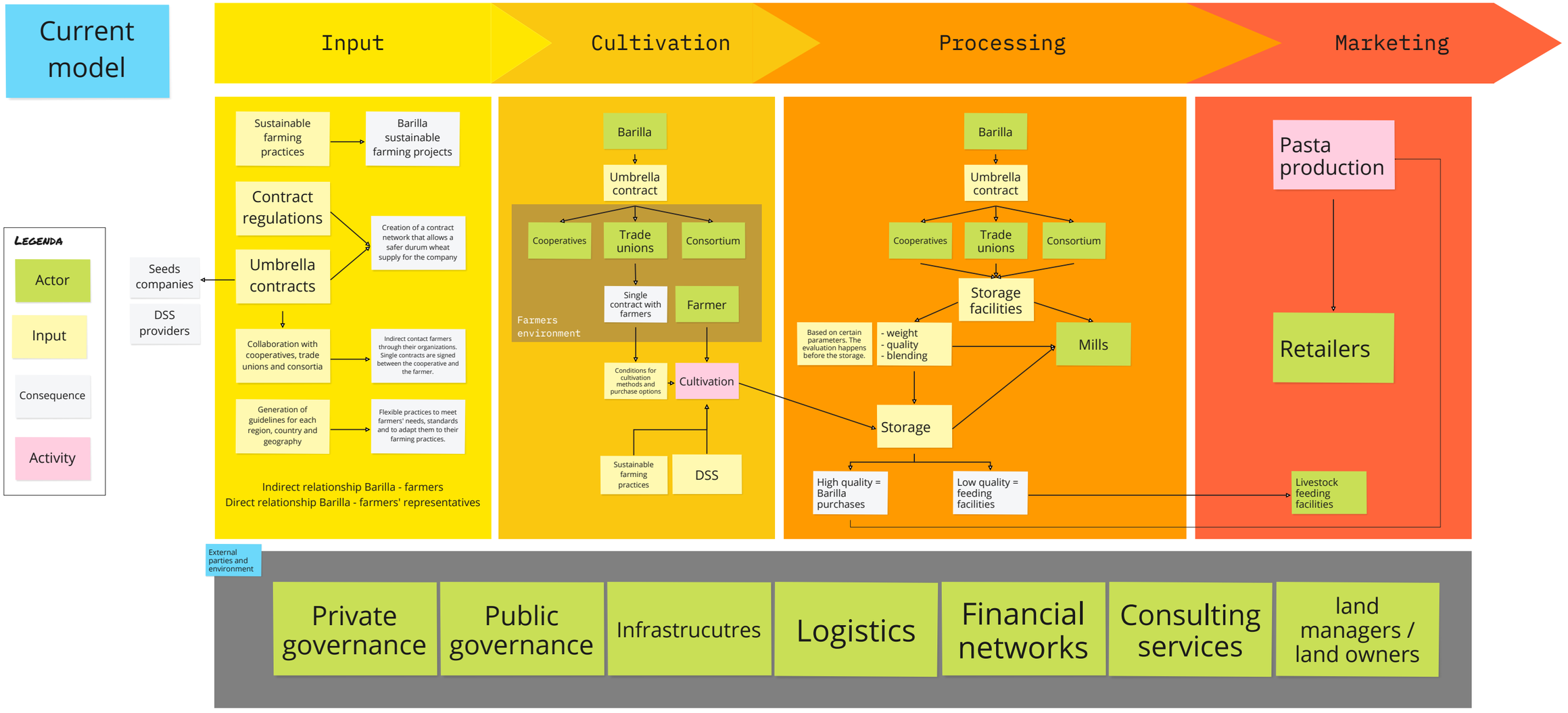


3. User values

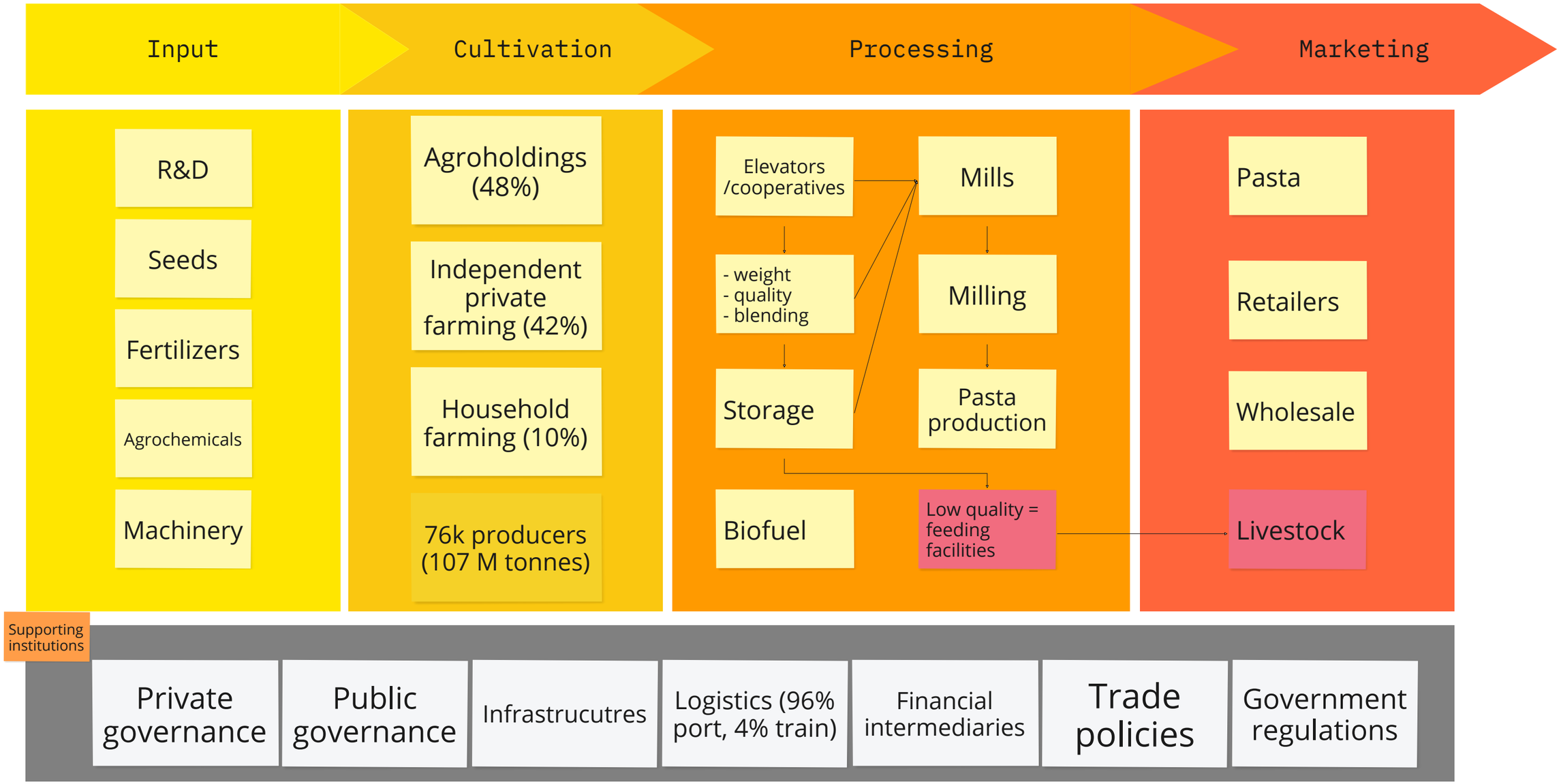


Source: Simonse, Lianne. (2018). DESIGN ROADMAPPING. BIS Publishers.

APPENDIX F: DURUM WHEAT VALUE CHAIN



APPENDIX F: DURUM WHEAT VALUE CHAIN IN RUSSIA



APPENDIX G: DEFINE ROADMAP'S CHALLENGES

1. Set the strategic challenges.

Bring Barilla Sustainable Farming in foreign countries

1. Start from scratch the BSF projects in a strategic country for Barilla
2. Introduce contract farming and increase productivity through BSF
3. Decrease uncertainty in the strategic goods purchase.

Problems

- Farmers may not consider contract farming as a gain
- Low development of the farmland can decrease the pace of BSF development

Opportunities

- Low market access can increase the number of contracts
- BSF creates more values for farmers

Sway farmers to adopt the Barilla Sustainable Farming methodologies

1. Increase SOCIAL SUSTAINABILITY in the BSF value chain
2. Increase value chain inclusivity for the main actors: farmers
3. Help farmers to understand the BSF features and gainings

Problems

- Stubbornness of farmers on the current methodologies
- Farmers' lower level of education
- Cultural issues

Opportunities

- Lower development of agricultural methods may trigger interest
- Increasing social sustainability can increase the wheat production outcomes
- Social development can trigger more people to get onboard

2. Set the objective for each strategic challenges.

OBJECTIVES: BRING BSF ABROAD

1. Understand the agricultural environment and address each cultural barrier
2. Find partners and local companies willing to become shareholders.
3. Understand the reaction from the local community members. Are farmers willing to sign contracts? Are they receptive with the BSF system?
4. Establish BSF with local governments, institutions and structures (mills, elevators...)

Sway farmers to adopt the Barilla Sustainable Farming methodologies

1. Increase the number of farmers that use the DSS in the cultivation process
2. Increase farmers' understanding of their importance in the value chain
3. Increase farmers' loyalty towards Barilla's
4. create a sense of belonging to the BSF people.
5. Create a stronger relation between Barilla and farmers
6. Increase the grain quality and production by addressing social sustainability.

3. Capabilities assessment for each objective

1 Understand the agricultural environment and address each cultural barrier

Manage universities	M
Iteration with farmers	N
BSF local management	L

2 Find partners and local companies willing to become shareholders.

Sales management	L
Buyer management	L

3 Understand the reaction from the local community members.

Iteration with farmers	N
Farmers feedback	N
Universities management	M

4 Establish BSF with local governments, institutions and structures

BSF local management	L
Buyer management	L

1 Increase the number of farmers that use the DSS in the cultivation process

Digital marketing	H	Cooperatives involvement	H
On field facilitation	N		
Design iteration and evaluation of the DSS	N		

2 Increase farmers' understanding of their importance in the value chain

Iteration with farmers	N		
Platform creation (design management)	N		
On field facilitation	N	Online facilitation	N

3 Increase farmers' loyalty towards Barilla's

Iteration with farmers	N		
Platform creation (design management)	N		
On field facilitation	N	Experience design	N

4 create a sense of belonging to the BSF people.

Iteration with farmers	N		
Platform creation (design management)	N		
On field facilitation	N	Experience design	N

5 Create a stronger relation between Barilla and farmers

Iteration with farmers	N
Platform creation (design management)	N

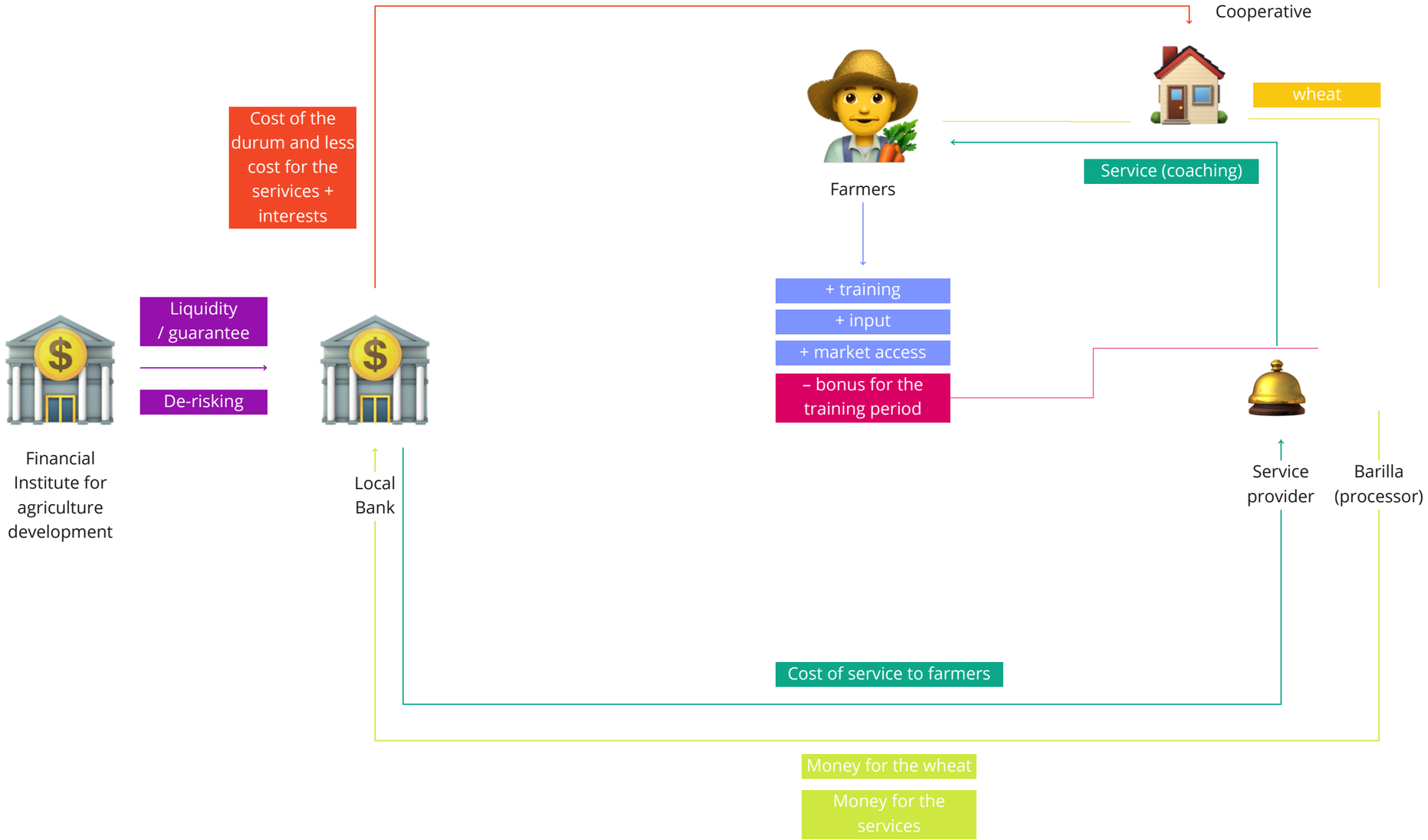
6 Increase the grain quality and production by addressing social sustainability.

Platform creation (design management)	N
On field facilitation	N

Legenda

-	Nothing
L	Low change
M	Medium change
H	High change
N	New capability

APPENDIX H: BLOCKCHAIN MODEL FOR VERTICAL INTEGRATION



Source: Rehber, E. (2007). Contract Farming: Theory and Practice. Icfai Books, 1–167.

APPENDIX I: BARRIERS AND OPPORTUNITIES

Barriers

Generalized barriers	Interested countries
Contractual framework has different levels. Regulations can be dependent on central government or more decentralized between regions, states (federation level) or even on agricultural divisions (Turkey).	**USA** (General contract legislation, specific farming legislation and contract farming, on single state level)**, Canada** (state specific law)**, Turkey** (agri basins) **and France** (rural code and specific regional decisions).
Governments' partial control over contract farming. Some contracts might be affected by governmental decision over the cultivation areas. Most of government want to be aware of contracts' existence.	**USA** (USDA, Agriculture dept. per each country)**, Canada** (Canadian Agriculture Dept.)**, Turkey** (Minisrty) **and France** (Agriculture Ministry and regional governments).
Food safety laws have discrepancies over the allowed values. To import durum in Italy, there is a food safety discrepancy because Italian laws are more restrictive than other countries.	**Canada** (According to Beres et al., there is a difference between Italian and Canadian accepted values for glyphosate --> Italy is less than 10 ppm per billion tonnes and Canada is 5 per million tonnes)
Climate issues. Depending on the country, climate changes as well. This means that different crop rotations might taken into account or different seeds varieties might be tilled instead.	**Canada, Turkey, USA, Russia**
Diseases issues. Some areas widely cultivated with monoculture practices, are mostly subjected to the fusarium fungi infection.	**Canada, USA.** It mainly derives from the Canadian prairies of Manitoba. Indeed in Manitoba durum is barely cultivated.
Income issues. Richer countries with higher average income have a higher cost of workforce. The average cost of cultivation is higher than less developed countries.	**Canada, USA, France, Spain.**
Machinery availability issues. Developing countries are subjected to a lower workforce cost, but since they earn less they also invest less. Machinery is less modern and requires more investment.	**Turkey, Russia.**
Wheat storage issues. Some countries have such poor farmers that they don't own their own silos. This means that the infrastructure could be either private or public, but requires a longer iter to obtain available storage space.	**Russia** (no available space, surplus of production in comparison to the available space) **USA, Canada** (might not have their own silos)
Transportation issues. Less developed countries have less railroads and not asphalted rural roads. This means that the wheat transportation towards harbors / production plants is affected or less efficient (thus more expensive).	**Russia** (no available rural roads, wheat railroad is fully controlled by the government, not enough wagons) **Turkey** (might not have rural roads, especially in the eastern part of the country)
Freedom in contracting phase. Some countries are so developed that the regional law provides them with guidelines, path to follow in order to plan, create strategies and evaluate every aspect of the contract. Farmers have more bargaining power.	**Canada.**
Loss of workers in rural areas. Developing countries above all have a big loss in skilled (and non-skilled) workers towards industrialized areas. Same happens in developed countries, but because small farms tend to fail and close.	**Canada, Russia, Turkey and USA (North Dakota)**
Lack of large farmland. Some countries are based on local agriculture, which means very small farms are available. This is a drawback for Barilla, because it requires more investments and more contracts.	**Turkey and France.**
State centered policies. Ineffectiveness This works for Russia.	**Russia**
Climate change. Some parts of the world, such as Russia, are more willing to be hit by storms or (russia) drought. In particular, if state policies are reactive instead of proactive, there is lack of organization for the upcoming years.	**Russia**
Contract farming doesn't exist. In Russia there is no evidence about the existence of contract farming. It is possible to lease land though.	

Opportunities

Generalized opportunities	Interested countries	Reasons, explaination
Hi-tech machines and practices support through credit from the government. Investments in this sense are supportive for a smarter agriculture.	**Russia.** Both state-run research centres and private sector research on agroholdings are devoted to improving productivity and reducing production costs through the use of drones, pilotless tractors and combines, and sensors	Opportunities are given by the technological direction of investments. Growing in hi-tech agricultural machines allows to compensate the lack of specialized workers. Target directly most advanced farms is a possible opportunity for BSF to be implemented.
In some parts the durum wheat is cultivated on "smaller" land. Alberta, Saskatchewan, Montana and North Dakota are the main durum wheat producers respectively in Canada and USA.	**USA, Canada**	These 4 countries create a quadrilateral of bordering countries. In this area of approximately 1,5 million square kilometers, 70 to 80 % of the durum wheat in both countries is cultivated. Target this area would be an opportunity for BSF to be implemented.
Large farmlands in some areas of the world. Larger farmers mean a larger output for commodities.	**Canada, USA**	Larger farms allow Barilla to produce more amount of durum wheat contracting less farms. This would shorten the time and the bureaucracy for Barilla. Opportunity also for having less contracts, thus less related costs.
Agricultural crisis. Some regions are facing an agricultural crisis, meaning that they are not satisfied by the prices on the market, it's not enough worthwhile for them to continue the production. Farms are failing.	**North Dakota, Montana**	Agricultural crisis helps to find people that need an income. Barilla could ensure some farmers with a higher income in comparison to the spot market, it could be an opportunity to convince and attract more farmers.
Farmers are against corporate farming. Some countries are allowing corporate farming, which doesn't make farmers happy.	**North Dakota, Montana**	Multinationals are striving to vertically integrate farmland into their supply chains. By doing that they try to exploit farmers first, and then to buy their land. In ND it is illegal to buy land, but still farmers are unhappy. Combined with the agricultural crisis, this creates an imbalance (medium-small farms fail, while big farms incorporate their farmland). Opportunity could be the willingness to avoid failure + against corporate farming.
Good transportation options and facilities. Developed countries have a good transportation net. Transportation allows Barilla to rely on a punctual supply (just in time) of durum wheat when needed.	**Canada, USA, France, Spain.**	Canada and USA are well connected through the Canadian Railroad System. It directly arrives in Ames, IA, where Barilla has a production plant. Moreover, European cargo transportation is modern and fast.
Agile access to regulations. Some countries have a good access to regulations, both for Barilla and for farmers.	**Turkey, Canada, USA, France.**	Canada has even guidelines for farmers to write, read and interpret a contract. In some paradigms, such as Canada or Turkey it is also mandatory to have an easy and understandable language. Opportunity is to create and maintain transparency.
CUSMA Moving goods between Canada and USA is almost free of taxes thanks to the Canadian-American tax axis.	**USA, Canada**	Easier to move goods between Canada and the American production plants.
Privatization. Russia and Turkey are allowing more privatization. Turkey more than Russia.	**Turkey, Russia**	Translated "ritiro dello stato da attività come la produzione, trasformazione e commercializzazione nei servizi agricoli nel processo, aumentando il ruolo del settore privato in queste attività."
Low employment. Some countries are experiencing a lower employment.	**Turkey, Russia**	Opportunities to attract more workers in rural areas, or to find locals that were considering to move towards industrialized centers. Obtain local support from local governments, by signing contracts both with farmers and governmental authorities

similar to what happened in ER, because the government aims to strengthen contract farming in agriculture, towards a more capitalist mindset

Barriers and opportunities are divided in such a way to create a generalized framework for a general understanding. Some barriers and opportunities might be encountered for some countries but not necessarily for others. This is a complete and exhaustive overview of all the identified ones. Then, single countries provide a more specific description of barriers and opportunities.