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Sustainability Assessment for Asparagus Farms that Work with a Community-Supported Agriculture Model in Turkey

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Due to the diversified nature of agricultural systems, it is difficult to handle the sustainability aspects of different farming practices. With an intention to evaluate the sustainability of the community-supported agriculture (CSA) model in Turkey, the current study focuses on asparagus farms and designs farm-specific sustainability indicators that would be helpful for the farmers. The framework developed for this purpose consists of 20 environmental, 8 economic, and 17 social sustainability indicators derived and adopted from extensive literature. The indicators are then used to form survey questions to gather data directly from the farmers. The results show that these farms are sustainable in some aspects, mostly from a social sustainability perspective, and not in others. In order to be fully sustainable, they need to make alterations in some of the agricultural practices on the farm, diversify their production, measure their environmental impacts on air, soil, and water, and most importantly define successors for their farms in order to keep asparagus production for the years to come.

1. Introduction

The concept of sustainability is a complex matter. The definition specifies the intention of meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987). When applying this concept to different fields, it takes different forms. In agriculture, sustainability is mainly assessed through indicator-based tools. This provides the researcher with a deeper understanding of a farm's sustainability. Due to the diversified nature of agricultural systems especially on small family farms, it becomes difficult to apply the same set of tools to evaluate different types of farming practices.

This study tries to overcome the aforementioned struggles by focusing on a specific type of farm, asparagus farms in Turkey, which fits the definition of family farms and runs with a CSA-like system. Designing sustainability indicators that are farm-specific will prove to be helpful for the farmers in order to assess the sustainability of the farms and take necessary measures to maintain their existence. The framework developed for this purpose consists of 20 environmental, 8 economic, and 17 social sustainability indicators. The indicators are used to form survey questions to gather data directly from the farmers.

This paper aims to answer the following research question: How do subscription-based CSA-like family farms in Turkey achieve and maintain sustainability?

The focus of the paper is on the two asparagus farms, located in Muğla and Eskişehir provinces of Turkey. Based on the sustainability indicators developed in line with the purposes of this study, the sustainability aspects of these farms are evaluated and compared with each other. The two farms selected as case studies are highly representative of asparagus farming at the national level as 1079 tons of asparagus were produced in 2020 according to the Turkish Ministry of Agriculture and Forestry, and the surveyed producers accounted for more than 90% of the total production in the same year.

The target of this research is to develop a useful tool for the asparagus farmers, for them to gain awareness about the sustainability measures, and to extend farm life by passing the farm business to next generations. To the best of our knowledge, this research is the first one of its kind on the sustainability of the CSA model in Turkey, especially with a focus on asparagus farms, as the literature on this subject is extremely limited. The study highlights the sustainability indicators as well as the findings and possible suggestions for the further development of small asparagus farms.

The paper is designed as follows: The remaining parts of the Introduction section discuss the working principles of community-supported agricultural farms, their advantages, and disadvantages, followed by their adaptation in Turkey. The following sections include a literature review on the sustainability of CSA farms, a materials and methodology section featuring the indicators designed for the assessment of asparagus farms, and a results section that discusses the findings related to the sustainable actions in the asparagus farms in Turkey as well as the shortcomings of the study. Finally, the conclusion section summarizes the research and provides some suggestions and reflections on maintaining sustainability.

1.1. Definition of community-supported agriculture

Community-Supported Agriculture (CSA) is a type of arrangement between a farm and its members or subscribers, where they purchase a share of the products harvested each season for a "guaranteed market" where the production costs and any non-predictable risks involved are shared by both parties (Cone & Myhre, 2000). CSA program is a leading example of how we can create a locally sourced alternative to the globalized ways of sourcing our food. In the CSA model, the community develops a close relationship with their food and the person producing the food, which is perceived as an alternative way to food production (Watson, 2019). In many of the forms of definitions made for CSA, the most significant points are the benefit and risk-sharing factor and the close relationship established between the producer and the community.

Everyone involved with CSA understands that there is no specific equation to this model. Every farmer that adopts the CSA model, develops their own formula based on their targets, resources, and expertise and moves from that point on (Groh & McFadden, 1990). There may be written agreements between the farmer and the community, or it may rely on mutual trust and verbal agreements. The total payment may be made in advance, or they may be collected in instalments. Based on this information alone, it can be concluded that this is a process that varies from farm to farm (Lamb, 1994).

Essentially, CSA is defined as the direct relationship between the consumer and the producer (CSA Network, 2018). It is a practice that has grown tremendously all over the world since it first appeared in Switzerland in 1978. In this modern age of grocery shopping at the supermarket, CSA provides a piece of reality as to where our food really comes from and who exactly produces it.

1.2. Advantages and disadvantages of community-supported agriculture

Most of the research done on CSA model farming indicates two main advantages. The first one is that these farms produce high-quality, highly nutritious foods and promote sustainability. The second is that there is a direct relationship between the farmer and the consumer, with no middlemen to increase the prices or cause a delay in the receiving end of the fresh produce, as farm to table is the key factor in this type of farming.

McMurray et al. (2017) indicates the benefits of physical participation involved in a CSA model farm that allows the consumers to witness the growing process. This enables consumers to help the farmer with their

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share of the farm as well as gain a first-hand experience in the farming business. CSA not only provides a close and first-hand connection between the farmer and the consumer, but it also allows consumers to actually witness where and how their food comes to their tables. This first-hand experience also allows like-minded shareholding consumers who share similar values and interests to interact with each other. Together they support their local community and economy (McMurray et al., 2017). CSA model has become an applicable system that supports the consumption of locally produced foods such as fruits and vegetables. CSA's significant impact on the individuals entails them making healthy food choices and gives them a chance to support their local producers and contribute to their financial wellbeing as well as creating an environmental impact (MacMillan Uribe et al., 2012).

Establishing this connection between food and the community through the CSA model will require that the risks and rewards of the farm will be shared equally. Through the membership system, individuals can benefit by purchasing a portion of the harvest, when the farm has a particularly good season and they also share the risks in the case of crop failure (Lamb, 1994; Cone and Myhre, 2000). Research on CSA reveals a few drawbacks that result in high turnover rates among the members. These drawbacks include factors such as a limited variety of products, produce only available in its respective seasons, a limited amount of produce offered, inconvenient pick-up times, therefore waste resulting from missed pick-ups as well as not knowing how to process the excess amount of the same type of produce (Cone & Myhre, 2000; Cooley & Lass, 1998). In the case of courier services, there is also a wastage resulting from the packaging, not to mention the carbon footprint occurrence resulting from using these types of services.

Another challenge is that building a CSA farm requires some sort of previous research in order to attain success for the farm. The most fundamental information for this structure is for the farmer to know what kind of food products the nearby community needs, and what kind of financial limits they have. It is also important to know how much financial support the farm needs in order to stay sustainable. A pledge between the farmer and community members needs to be established. The community also needs to understand the farmers' needs in order to form a relationship that will be beneficial to both parties (Lamb, 1994). One of the economic challenges a CSA farmer faces is to price the shares accurately. The price of a share needs to be affordable for the members and has to include all the necessities a farm has, including the purchase of all the supplies and the wages of the farm owner and workers (DeMuth, 2008).

CSA farms are generally established on lands that are in close proximity to their members, in urban and suburban areas. This need results in higher costing land that adds to the challenges of the CSA farm (Nehring et al., 2006). Since land is the most fundamental necessity for a farm, farmers struggle to decide whether to rent or own a farm that is large enough to finance its operations as well as provide enough food for the community. CSA farms diversify the way they cultivate the land with a focus on intensive farming. This results in higher value and labour-driven yield to provide farm sustainability even on a smaller piece of land (Tubene & Hanson, 2002). Additionally, CSA farms may borrow loans to finance their operations, which may result in a downfall if the anticipated crop yield is not sufficient.

1.3. Community-supported agriculture model applications in Turkey

Turkey has a population of 84.7 million as of 2021. The surface area of the country is 785.40 sq km, out of 383,270 sq. km is dedicated to agricultural land. The value of production in agriculture in 2019 is close to 196 billion, and agriculture still provided work for 18.4% of the total workforce (Turkstat, The Summary of Agricultural Statistics Publication & World Bank Country Profile, 2020).

Agricultural farms in Turkey, whether small family farms or large industrial farms sell their products to a wholesale company, which organizes the marketing and distribution of the produce to open-air markets and supermarkets. The end consumer visits one of these distribution channels to shop without ever meeting the farmer and knowing where the food is coming from. Introduction of models close to community-supported agriculture was a revolutionary development in Turkey, especially for the urban population. Consumers have become more conscious of their food consumption and concerned about sus-

tainability, specifically young families with newborn babies. Small farms that directly reach the consumers that produce organic or natural products became the height of produce shopping for the aforementioned urban families.

The first examples of CSA started through the Buğday Association. Their first project BAHÇE was launched in 2005 on land allocated to the association. The project's scope aimed to create an accurate production-consumption model in Cumhuriyetköy near İstanbul on a 30-acre land, providing fresh seasonal produce to the nearby community. The produce, that is the outcome of the project, was shared among all the shareholders and the participants. Shareholders followed the project all throughout the year and received packages from the farm's fresh produce. CSA continued to grow slowly around Turkey. There was another initiative in Ankara, called Güneşköy, which started in 2006 and continued for a few years.

The CSA initiative that started in Turkey also flourished among small-scale family farms, where the initial system of membership was introduced but not continued in the following years. The URGENCI report generated in 2016 refers to these types of farms as CSA-like systems or CSA-like initiatives. The significant aspect of CSA is that a direct relationship between the consumer and the producer remains intact; however, the agreement between the two parties relies on a subscription model and mutual trust. The major disadvantage of the CSA system practiced in Turkey was the fact that the consumers only share the benefits from the farm but do not get affected by the negative consequences and undertake no responsibility towards the farm owner (URGENCI, 2016).

The CSA initiative got on a strong start in Turkey. However, the ownership system did not last long. The newer farms established in the new millennium adopted the subscription system that grew mainly by word of mouth among like-minded consumers who all want to have access to natural foodstuff that is produced by someone they can interact with.

2. Literature review: Three pillars of sustainability in community-supported agriculture

Community-supported agricultural farms are very important in terms of their contribution to sustainability. Hansen (1996) documented that their size and the nature of the work make it imperative that the three pillars of sustainability, namely environmental, economic, and social pillars, all carry equal weights when considering the well-being of the farms as well as their contribution to nature and to society. Furthermore, maintaining a sustainable agricultural business requires a balanced equation, where the farm helps protect and boost nature, provides food for human consumption, and must be economically viable. This will ensure that the farms are sustainable and can provide a livelihood for the farmworkers as well as the community surrounding it (Hansen, 1996). The multifaceted nature of sustainability should be examined from the perspectives of the farm being an operation that generates profit (economic pillar), the equal and fair distribution of the profit among all the employees including the farm owners (social pillar) and being a part of the ecosystem without harming the environment (Gómez-Limón & Sanchez-Fernandez, 2010).
The sustainability of agricultural farms requires the combination of all three pillars of sustainability when being assessed. Each pillar adds a different dimension to the sustainability factor. Environmental sustainability is insignificant if farms are not well-linked to the community, which is a component of social sustainability and vice versa (FLINT Project, 2015). Economic sustainability has direct relations with both environmental and social sustainability, especially when it comes to agricultural practices or creating employment. Production of goods and services, which are part of economic viability of a farm, is not sustainable if social and environmental costs are high (FLINT Project, 2015).

2.1. Environmental sustainability

It is fundamental to understand that farms need to maintain their livelihood while preserving environmental sustainability in their use of natural resources (CSA Network, 2018). CSA advocates argue that, by re-establishing the relationship between food economics and society, CSAs will reinstate the home agricultural economy by moving towards an ultimate achievement of ecological sustainability and pulling back from the global supermarket (Schnell, 2007).
Natural resources are vital to human existence. Especially in the case of food production, the long-term,

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irreversible damages to nature cannot be fixed or replaced by any monetary means. The farmers who do not take the long-term damage they are causing to the environment into account need to be monitored and coached by an outside agent. The beginning of the 20th century marks the time when sustainability became a consideration for society hence giving birth to the concept of environmental sustainability. The initial environmental sustainability assessment was measuring the impact of agricultural practices on nature (Valtýniová & Křen, 2011).

According to Hamrin (1983), natural resources and the environment are the foundations on which future economic activity will be built. If we seriously take this explanation into account, preserving the environment while trying to keep economic sustainability will be crucial in order to maintain and improve farming activity on sustainable grounds.

Environmental sustainability is to protect the natural resources while maintaining good farming practices that do not harm the environment including people (Goodland, 1995). This concept is referred to as "limits to growth", which creates a balance between how the soil is maintained to produce our food, and how much food is produced. This ensures that the land is not over-cultivated and depleted from its nutrients and minerals, and the farm adheres to traditional farming practices which are agro-ecological (Paul, 2016; Meadows et al., 1972). On this subject, OECD implies certain criteria that require efficient use of renewable and non-renewable resources that do not exceed the land's long-term uses and the assimilative capacity of the hazardous substances into the environment (OECD, 2001).

In order to promote environmental sustainability, the practices of conventional agriculture that include the use of chemicals, soil degradation, decline of farming communities, surrendering the old-fashioned agricultural values, and lack of safety of the farmers need to be abandoned and alternative farming practices needs to be established through the CSAs. Also, the number of CSAs needs to increase, allowing for many smaller farms rather than a few larger farms which tend to do more harm to the environment (Dahlberg, 1991).

2.2. Economic sustainability

The UN Food and Agricultural Organization's SAFA (Sustainability Assessment of Food and Agriculture Systems) Guidelines (2014) sheds a light on sustainability factors including economic sustainability. The guide focuses on a few aspects starting with the investments. Investment is the starting point for any business. Investments help build the businesses and ensure their growth both physically and economically. This growth opens the channels for social development and the protection of natural resources.

The subject of investment is vital both on the community end and on the farmer end. The farmer has to invest in a piece of land, workforce, equipment, and raw materials. Their initial expenditure will be large and the return on investment will be long-term. On the other hand, the pre-payments received from their shareholders will be their initial earnings but on the consumer end, they are considered the community's investment in the farm (FAOSAFA Guidelines, 2014). Financial profitability is another major issue to ensure the economic sustainability of the farm. Therefore, the critical issue here would be to follow the right pricing strategy for the shares. The price of a share should cover all the base costs, as well as retain a profit for the farmer. This requires the farmer to make a budget and divide the total costs by the number of shareholders. This type of pricing is called cost-plus pricing. Another type of pricing strategy is competitive-based pricing which allows the farmer to decide on their share costs based on other farmers. The farmer may decide to stay competitive by offering cheaper prices or equivalent prices. The last type of pricing is customer-based pricing where the customers' willingness to pay determines the cost of the shares (FAOSAFA Guidelines, 2014; McMurray et al. 2017). A farm's ability to stay sustainable in economic terms relies on the farm owners and the community surrounding it.

2.3. Social sustainability

Social sustainability could be referred to the well-being of the farm members and the community surrounding the farm, along with the whole of the society with which the communities reside (CSA Network, 2018). Both the farming community and the surrounding community share the same common values; therefore, social sustainability is the most important

and the most long-lasting sustainability factor that includes social values, associations, integrity, and establishments. It is vital for the survival of the communities both in the past and the present (Black, 2004; Diamond, 2005).

Present-day communities' associate agriculture with conserving the traditions and practices of a region which can be directly related to the social sustainability factor. Suffice it to say that, regardless of the importance of social sustainability within the society of a region, the literature covering this topic is very limited (Gaviglio et al., 2014). Increasing awareness towards ecological issues causes environmental assessment in agriculture to hold greater weight, compared with economic and social sustainability. Therefore. while the framework developed to assess the environmental issues is corroborated, the economic and social sustainability factors lack such a framework (Chatzinikolaou and Manos 2012).

CSA provides a direct consumer and producer relationship that is declared a contemporary model of food provision (Balázs et al., 2016). We can also concur that building a symbiotic relationship with a farmer and procuring high-nutritious, high-quality food directly from the farm is in fact a lifestyle that the CSAs are providing. In return, the community is providing support for the farm (Lamb, 1994; DeLind, 2003). CSA provides cost-effective ecologically safe food to urban consumers, which helps farms to make a decent income without getting involved with third-party distribution channels (Möllers & Bîrhală, 2014).

3. Materials and methods

There are two main approaches to assessing sustainability. The first is the "bottom-up" approach where systematic participation is mandatory to understand the key sustainability indicators (Spohn, 2004). The second approach is the "top-down" approach that defines the overall structure of sustainability and it is further categorized into groups of indicators (Spohn, 2004). This research focuses on a "top-down" approach with indicators developed by the authors specifically for asparagus farms.

These methods help researchers to assess the sustainability performance of the farms through a holistic approach, where the information is gathered through a wide range of indicators that serve the purpose of understanding the sustainability on the farm level (De Olde et al. 2016; FAO, 2013; Schader et al. 2014).

Generally, agricultural sustainability is measured with indicator-based tools (Gaviglio et al., 2017). Despite the fact that there are quite a few different assessment methods, conceptual and methodological problems are still recurring, especially when similar methods are applied to different types of farms. Therefore, designing an indicator tool that is specific to the type of farm would be more beneficial to measure the positions of sustainability. This will result in a more accurate measure of sustainability and could benefit the farmers on an individual basis.

There is a study that only examines the differences between various methods and their effectiveness on different types of farms. The accounting methods of indicators in the literature have focused on farms and their impacts on the environment, economy, and social life for various types of farming including agricultural farms, livestock farms, and forestry (Girardin et al., 2000). It provides enough information to the researcher when the decision needs to be made on which sustainability method should be used in future research.

Compared to the existing literature, the present study is based on a set of sustainability indicators, inspired by the indicators designed and summarized by Gaviglio et al. (2017) among others. The indicators used for this research were revised to fit the conditions of the farms in Turkey and were applied to the farms that produce asparagus. The indicator-based framework has been adopted for the evaluation of the environmental, economic, and social sustainability of the family-owned asparagus farms. The data was collected directly from the farm owners via conducting surveys, due to the time constraints of the farmers and the ongoing intensity of the asparagus season. Although the farm owners were the primary source of information, they were reluctant to share certain information and, in some cases, did not have the accurate information. A family farm, as described by the Food and Agricultural Organization (FAO), is a way of life. It is an operation that combines the family members with the

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farm while incorporating functions of sustainability (FAO, 2014). "Family farmers have the potential to promote the environmental sustainability of agricultural systems thanks to their understanding of local ecologies and land capabilities, and to their preservation of seeds and other genetic resources" (FAO, 2020, p.4-5). Based on these definitions the two asparagus farms were evaluated for their contribution to the environment, increasing food security, providing employment, and reducing poverty aligning with United Nations' sustainable development goals.

Family farms of today represent the sustainable food economy. They are the models for advocating a healthy lifestyle through naturally produced agricultural products. Each family farm possesses different qualities in terms of products, agricultural practices, and natural resources. Each farmer's products meet the different needs of consumers who are critical and demanding. Among many other qualities, a family farm should have professional integrity. Their responsibility to employees and consumers lies in sustaining the family farm for future generation farmers and consumers. Therefore, the sustainability indicators were developed to consider the social as well environmental and economic sustainability (Ikerd, 2006). If developed and used effectively they may impact the good farming practices in a positive way, enabling the farms to meet the needs of current farm owners without compromising the needs and uses of the future generation farmers. In this regard, explaining and promoting good farm practices through the use of relevant and well-developed sustainability indicators that take into account the three pillars of sustainability, will prove to be helpful.

The revised indicators used for this research were categorized into three sustainability themes, followed by components and indicators. Finally, indicators were detailed further with sub-indicators. Each indicator and sub-indicator were checked for precision, recurrence, and constituents and refrained from requiring sensitive information from the farmers. The number of indicators was kept to a necessary minimum to be able to collect a sufficient amount of information that only focuses on sustainability. These indicators were used in formulating survey questions that were used to gather data from the farmers.

The research executed by Gaviglio et al. (2017) on Italian farms, has listed the technical limitations that have burdened them during their research. These limitations may hold true for any research that is done on small-scale family farms. The first limitation is based on the data collection. Data collection relies on interviews carried out with the farmers who do not always provide sufficient or measurable information. This was also a valid limitation for the current research on asparagus farms. The second problem is that since each type of farm, dairy, produce, and meat; is different the same sustainability indicators may not give the same or similar results that will aid with the sustainability research. Finally, the agricultural systems applied are different which also results in variances in how sustainability may be measured based on the type of farm. As an example, the management of livestock effluents is a valid indicator for an animal farm but not for a produce farm. Yet the effluents will also differ whether the farmhouses cattle or poultry. To overcome the final two limitations, farm-specific indicators were designed (Gaviglio et al., 2017).

3.1. Environmental Indicators

Operating in line with the principles of nature and preserving the agricultural operation systems have been the main focus of scientific literature when assessing the environmental sustainability of a farm (Gaviglio et al., 2017). However, components of environmental impact may not be measured at the farm level. In certain cases, the farmers may not be aware of the wide-ranging consequences of their agricultural systems, such as greenhouse gas emissions, soil erosion, and water and soil contamination.
Agrosystem sustainability is important in agricultural research therefore it is also important to develop ways to measure the environmental impacts (Tellarini, Caporali, 2000). Indicators were developed to measure different aspects that are affected by these negative impacts mentioned in the previous paragraph (Bockstaller, Girardin, 2003). In an effort to create awareness among the farmers, they should be encouraged to manage their own farms based on the environmental sustainability indicators, which will allow them to realize any wrongful practices and take corrective measures (Valtýniová & Křen, 2011).

EN1 – Diversity of crops. This component tries to

identify the plant diversity at the farm. In terms of growing different types of asparagus or planting a different species that would benefit the soil for asparagus growth, may be helpful to keep the soil nourished as well as utilizing the farm during off-seasons.

EN2 – Space and land management. Ownership of the land poses an important criterion in terms of the sustainability of the farms. Also, in terms of soil quality, identifying and taking precautions for possible erosion zones needed to be addressed in order to understand how the farmland is being managed.

EN3 – Agricultural practices (Gaviglio et al., 2017). All the sub-indicators under this component have a direct effect on the sustainability of the soil and the environment. Inadequate agricultural practices damage the soil the most in the long run, therefore the correct assessment of these indicators will identify how environmentally sustainable the farm is.

EN4 – Natural resource (Gaviglio et al., 2017). Water usage and management are very important indicators for any type of farm therefore it is a vital measurement of sustainability. This should be analysed together with the type of irrigation systems used on the farm.
EN5 – Energy (Gaviglio et al., 2017). The soil-heat cultivation system is used for asparagus. Hence pointing to the utilization of both thermal and electrical energy. It is important to indicate the amount of energy used on the farm as well as the usage of renewable energy if available.

EN6 – Pollution and emissions. This component will indicate whether asparagus farming yields any waste material, as well as greenhouse gas emissions and whether the asparagus plant or the farming practices associated with it have a tendency to pollute the soil.

Table 1. Environmental Sustainability Indicators

EN1	**Diversity of crops**
EN1.1	Crop diversity
EN1.2	Asparagus diversity
EN1.3	Crop quality
EN2	**Space and land management**
EN2.1	Farmland ownership
EN2.2	Ecological buffer zones
EN2.3	Environmental and landscape safeguard
EN3	**Agricultural practices**
EN3.1	Seed provisions
EN3.2	Fertilization
EN3.3	Pesticides
EN3.4	Proper tillage practices
EN3.5	Soil protection
EN3.6	Irrigation systems
EN4	**Natural resources**
EN4.1	Water resource management
EN4.2	Organic matter management
EN5	**Energy**
EN5.1	Energy dependence
EN5.2	Usage of renewable energy
EN6	**Pollution and Emissions**
EN6.1	Organic waste disposal
EN6.2	Waste disposal
EN6.3	Emissions / Greenhouse gases
EN6.4	Soil contamination

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3.2. Economic Indicators

The essential survival of agricultural farms depends on economic sustainability (Lien et al., 2007). The farms discussed in this research utilize a CSA-like model, although they do not receive any economic support from the consumers. Farm expenses solely rely on the earnings and possible government loans and subsidies. Farms must continuously keep their operations growing in order to survive against the competition and also need to come up with other ways to create earnings that might set them apart from the rest.

EC1 – Economic viability (Gaviglio et al., 2017). The Farm's earnings derived from the total amount of goods and services sold is the deciding factor for the viability of the farm.

EC2 – Endurance. This component considers the employment of the family members and the earnings for the employees to measure if they can endure the farm work and sustain their living standards with the income received from the farm.

EC3 – Autonomy. Farms receive loans and subsidies from the government and bank loans. These pose a constraint for the farmer, especially if these loans are used for a new investment to grow the farm business and increase production. For example, the increasing demand for asparagus, of both individuals and commercial businesses, may force the farm to lease more land to increase asparagus production capacity, resulting in taking a loan from the bank.

EC4 – Diversification (Gaviglio et al., 2017). This component measures whether the farm can follow innovation and adapt to the new technology to be more productive. Also diversifying the farm activities may be beneficial in increasing the income for the farm.
EC5 – Multi-functionality (Gaviglio et al., 2017).

This component will help determine looking at the farm from a different perspective and incorporating non-agricultural activities that will economically improve the farm. As an example, harvest activities will benefit the farm economically in the short run and in the long run by building a customer base of individuals and chefs that have a chance to witness the growth and harvest of asparagus at first hand.

3.3. Social Indicators

A farm's integration with the surrounding landscape and society is one of the main factors in accessing its sustainability (Zahm et al., 2008). The small farm is a reflection of the family, and the family is a reflection of the local community, which is a part of the whole society. The farm's position is very important within the local community, especially in the case of cultivated asparagus. Asparagus is widely known or consumed in neither of the asparagus farm locations. Establishing a connection with the local community both as a

Table 2. Economic Sustainability Indicators

EC1	**Economic viability**
EC1.1	Value of production
EC2	**Endurance**
EC2.1	Farm ability to generate income
EC2.2	Income per family worker
EC3	**Autonomy**
EC3.1	Economic autonomy
EC3.2	Loans and leases
EC4	**Diversification**
EC4.1	Diversification of the production
EC4.2	Business diversification
EC5	**Multi-functionality**
EC5.1	Multi-functionality

business and as a farmer is an important indicator to measure the sustainability of the farm in the social aspect. Initiating the social relationship also aids in the economic and environmental aspects of the farm.

SO1 – Quality. This component takes into consideration the qualities that will make a farm product and the production technique stand out from the competition. Additionally, historical architecture located on the farmland would add a social value to the farm, overall affecting all the stakeholders.

SO2 – Family ownership. A family farm is owned and operated by the family and the employees also become a part of that family. An important fact to consider is the intergenerational succession of the farm to determine sustainability in the long run. It is imperative to measure the vitality of the farm through the family members and continue to prosper with the continued support from the community.

SO3 – Short supply chain and related activities (Gaviglio et al., 2017). Building a consumer base is one of the challenges a small farm faces especially if its products are sold directly to the end-user. The short-supply chain requires marketing skills to be able to promote the product to the right target group. Building the customer base and participating in activities such as fairs, assemblies, community-supported events, and the like will aid in introducing the product and receiving attention.

SO4 – Work and employees. One component of being a part of the local community involves employing the local workers and providing them a high quality of life to be able to sustain their employment and decrease a possible turnover. Training of the employees will likely affect the work and the final product. This is vital in the case of asparagus farms as harvesting is fragile and requires close attention. For this purpose, female temporary agricultural workers are preferred for their ability to handle asparagus. This component will also provide information about the demographics and the background of the farm employees.

SO5 – Social development (Gaviglio et al., 2017). Cooperating with other small farms, cooperatives, and marketplaces may be useful in reaching a larger consumer base. Being a part of an association or an organization helps the small farms get together to exchange ideas, discuss new trends and innovations, and aid the farm owners to gain a wider spectrum of the changes taking place in the agricultural sector.

SO6 – Education and Culture (Gaviglio et al., 2017). This component focuses on the social acceptance of the farm product, namely asparagus, within the society. Teaching the nutritional benefits of asparagus and accrediting a cultural significance to the product will profit the farmer.

4. Results and discussion

4.1. Findings related to the environmental indicators

The farm located in Eskişehir (Farm A) has a larger farm area and production compared with Farm B located in Muğla. Both farms are mono-crop plantations with the difference being that Farm A grows two kinds of asparagus, purple and green, and additionally sells products derived from asparagus such as canned or frozen asparagus. Based on their sizes the quality of the products is improved differently. Farm A complies with the Global Good Agricultural Practices (GLOBALG.A.P.) standards, which is an international farm assurance program. Farm B improves its standards by complying with organic food production standards and with traditional farming practices.

Asparagus is viable on the same land for ten years, after that time the land has to fallow for two years in order to regain fertility. In order to continue farming, both farm owners will seek to lease neighbouring lands to continue with production.

Farm A sows green manure plants for soil cover to provide natural nitrogen for the asparagus. In times of insufficiency, herbicides, insecticides, fungicides, as well as chemical fertilizers, are used in compliance with GLOBALG.A.P. standards. Farm B only uses organic waste material such as animal effluents provided by the neighbouring cattle farms and does not use any pesticides.

Farm A and Farm B both use proper tillage and have proper drainage in the soil. Both farms have implemented drip irrigation systems in their farms to prevent water loss. The wastewater accumulated in neither farm is used for other purposes, therefore it is

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Table 3. Social sustainability indicators

SO1	**Quality**
SO1.1	Quality of the products
SO1.2	Rural buildings
SO1.3	Stakeholders
SO2	**Family ownership**
SO2.1	Family ownership
SO2.2	Community
SO2.3	Farm successors
SO2.4	Vertical farming practices
SO2.5	Internal and external threats
SO3	**Short supply chain and related activities**
SO3.1	Short food supply chain
SO3.2	Related activities
SO4	**Work and employees**
SO4.1	Sustainability of the employees
SO4.2	Demographics of the employees
SO4.3	Training
SO5	**Social development**
SO5.1	Associations and social implications
SO5.2	Cooperation
SO6	**Culture and education**
SO6.1	Educating the consumer
SO6.2	Cultural significance of products

treated as waste, which does not contribute to sustainability.

Energy usage did not receive sufficient information. Compared with the heated soil used to grow asparagus in Germany (Soode et al., 2014), the farms in Turkey do not use thermal energy to grow asparagus. The only energy usage relies on electricity that is limited to the season.

It can be deduced that based on the answers given to the pollution and emissions questions, there is not a consensus among the farmers regarding their greenhouse gas emissions (GHGE). This may result from different farming practices. Neither of the farms has officially measured the amount of GHGE; therefore, this section does not provide sufficient information regarding the farm's contribution to pollution and emissions. Product carbon footprint that is derived from distribution channels such as courier services and the waste resulting from the packaging of asparagus is not reported either.

4.2. Findings related to the economic indicators

Based on the economic indicators both farmers have stated that they are earning profits and are able to plough back the profits in order to grow the business. They are both eligible to receive subsidies from the government, but the subsidies were either not received or were not sufficient to help them economically. Complete economic autonomy is not yet achieved in Farm A.

The multi-functionality indicator showed that both farms are willing to increase their economic viability through non-agricultural activities that would not only bring in more income but also is a means to educate the consumers and increase their participation in this type of farming system.

4.3. Findings related to the social indicators

Asparagus is a niche product and is not very widely known. When these farms first established their businesses, asparagus was not consumed nor produced by anyone within the community (or in the country for that matter). Both farmers, when they first built their farms, started as an individual; therefore, neither of the farms was inherited as a family business, which does not mean in the future that it will not become a family business for the next generations. On this matter, neither of the farms has identified a successor for the farms which questions the long-term viability and the sustainability of the farms.

The farms, as all agricultural operations are directly affected by climate change and have to take necessary precautions to protect their products. Farm A also mentioned the political and economic instability that might impact the farm business.

The great advantage that both farms hold is the short supply chain. By omitting distribution channels, and reaching the consumers directly via direct sales, online sales, and specialized farmers' market sales, they reach their consumers and educate them on the benefits of their products and offer them healthy and nutritious food. Collaborating with cooperatives and like-minded e-commerce businesses also provides a wider platform to introduce this product to a wider consumer base.

Survey questions for the work and employee's indicator reveal that the farm work is seasonal and almost all the work is performed by female workers. The provided answers also affirm that the quality of life in general based on the asparagus farm work is high, this is clearly visible from the low turnover, and the wages received. The training process is handled by the farm owners. Since employees all come from farming backgrounds this training does not take a long time and there isn't a specific training system in place.

4.4. Discussion

A new set of sustainability indicators were developed and tested on asparagus farms in Turkey. The answers provided by the farmers were not quite sufficient to answer the question of the sustainability of asparagus farms thoroughly. Yet, on a component level, the answers to the survey questions provided a general scheme of the practices of the asparagus farms and their contribution to sustainability.

The survey did not provide enough information to indicate the farm's contribution to environmental sustainability. GHGE resulting from farming activities, wastewater management strategies, and the use of chemical materials on the soil were not reported by the respondents as the farm owners did not participate in any official measurement practices to find out their damage to the environment. On this matter, they have both mentioned asparagus as a product suffering from climate change.

Economically, neither of the farms has total control over their operations, but both make a profit and provide a living for their families. Considering these findings, as a business operation, they seem to be sustainable. Economic sustainability is very much dependent on government policies. In the future, any changes in policies that would aggravate agriculture could jeopardize the farm business, regarding not only asparagus but all small farms.

Social sustainability indicators reveal that both farms are in good standing within the community. They both provide work for the locals, especially women workers that make up the majority of the workforce. They both have a wide consumer base made up of health-conscious consumers who want to know where their food comes from. The short supply chain and the CSA-like approach are helpful in connecting with a larger community. Based on the answers provided for the social component, both farms are sustainable with one exception regarding the dimensions of social sustainability. Both farms apply agricultural practices to be able to sustain their farms as businesses as long as the current farm owners are running the operation. Not having a successor identified for both farms raises the question of the long-term sustainability of the business and the farm itself.

5. Conclusion

Community-supported agriculture is a relatively new concept in Turkish society. The concept has transformed into a new model in Turkey. This model con-

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sists of a short supply chain between the farmer and the consumer without the shared outcomes of negative nature. The community converted to the consumer and support converted into the promise that the consumer gives to the farmer for the continued business. In Turkey, there is only a limited number of consumers who embrace the idea of staying connected to the person that produces their food. They utilize this system because sustainability is the main locomotive. They believe in protecting the small farms and are cautious about where their food comes from. This belief is also connected to a better and healthier lifestyle.

Asparagus farms in Turkey is an example of family farms that adopt a CSA-like model and reach directly to the consumers. As most of the world's food supply depends on small family farms, their sustenance is very important for food production. Developing sustainability indicators that are farm-specific helps to measure sustainability in a comprehensive way. The results of the survey revealed that the selected asparagus farms in Turkey are sustainable in some aspects and not in others. In order to be fully sustainable, they need to make alterations to some of the agricultural practices on the farm and, most importantly, define successors for their farms in order to keep asparagus production for the years to come.

The current study has several limitations. Most of the issues pointed out by Gaviglio et al. (2017) are also relevant to the case of the asparagus farms in Turkey. One of the most important issues in conducting this research was the time constraint of the farmers and the ongoing intensity of the asparagus season. That's why the farm owners were surveyed using questionnaires instead of in-depth interviews. Yet, they provided answers to the best of their abilities during the busy and time-consuming asparagus season. Besides, even though the farm owners were the primary source of information, they were reluctant to share certain information and, in some cases, did not have the accurate information. Although the answers were not sufficient to provide an in-depth assessment of the sustainability of the farms, they provided a broad picture of the environmental, social, and economic impacts of asparagus farming executed in a CSA framework in Turkey.

To the best of our knowledge, this research is the first sustainability assessment in the area of asparagus farms in Turkey. The sustainability indicators were specifically developed to gather information on the agricultural practices of such farms to identify whether the farms are sustainable or unsustainable in economic, environmental, and social aspects. It is the authors' wish and anticipation that this study will provide a basis for future research on the same subject.

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Data Availability Statement: Survey questions and answers supporting the reported results are available upon request from the authors.

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