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Sustainable value: the perspective of horticultural producers in Arctic Norway

RESEARCH ARTICLE

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Abstract

Aiming for sustainable development of food value chains several assessment methods are developed, however it seems challenging to go from assessment to actual change. A solution proposed is increased stakeholder involvement also in the assessment phase. The perspective on sustainability varies depending on several variables, among which the geographical context where the producers are located. The perspective of the latter is of paramount importance as these are the actors on who, ultimately, possible changes towards sustainability depend. In this article, we applied a qualitative approach to investigate the farmers' perspective on sustainability, in the horticultural production in Arctic Norway. We found that many of the premises for sustainable food production are present. The main challenges are lack of long-term planning, dependency of rented land as well as fluctuating yield and income. Producer's network is essential for development as well as introduction of technical improvements. The study shows the importance of contextualisation of sustainability, as well as pointing at concerns about trade-offs between sustainability dimensions and themes in the proposed model. The research contributes to method development by demonstrating how a qualitative approach is a fruitful method to unravel the complexities of sustainability in food production.

Keywords: sustainable food production, SAFA, farmers' perspective, horticulture, arctic food
JEL code: Q01

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1. Introduction

Although a debated term (Mooney and Hunt, 2009), 'sustainability' is said to be a 'consensus frame' (Brunori *et al.*, 2016), meaning that it is something that we all find to be true and good, and kept in general terms, it is something that everyone can agree on. A plan for sustainable development includes both a timeframe and a broad focus covering the three dimensions 'economic growth', 'social inclusion', and 'environmental protection' (first defined in Brundtland, 1987). For food production the United Nations sustainability goal number two states that, 'it is time to rethink how we grow, share and consume our food' (UN, 2015). The same document stresses that the success of its implementation will depend on countries' own sustainable development policies, plans and programmes, and that all stakeholders are expected to contribute.

Food value chains are complex interconnected systems – no part of the food chain acts in isolation. Any decision at any level has a wider impact (Albajes *et al.*, 2013). With the aim to drive food value chains (as defined in FAO, 2014a: 6) towards sustainability several assessment methods have been developed; however, these assessments have not yet spurred changes that contribute to improved sustainability in the food value chains (FAO, 2014b). To ensure positive impact, improved stakeholder involvement as well as to utilise context-specific approaches is suggested (Alrøe *et al.*, 2016). Farmers are key stakeholders in agricultural value chains and their perspectives on sustainability may serve as a bottleneck to develop the value chain in a sustainable manner, being a core actor to take action to improve farm sustainability (De Olde *et al.*, 2016).

The complexities of food production and the food value chain can be challenging to reduce to indicators for quantitative calculations (Migliorini *et al.*, 2018). Galli *et al.* (2016) therefore claim that it is useful to evaluate sustainability as stakeholder perceptions. To unravel the farmers' perspectives, qualitative methods give a rich material to analyse, and Galli *et al.* (2015) concluded that this methodology can: 'help identify issues to deal with and critical gaps, thus representing a starting point for further empirical research'. To understand the perspectives of the key stakeholders in the value chain, with their hands-on practical and theoretical knowledge, will provide a good basis to look at strengths and shortcomings on the road leading to a more sustainable production.

In this article, we contextualise the farmers' perspective of sustainability in relation to horticultural production in Arctic Norway that includes the three counties Nordland, Troms, and Finnmark. Farming in Arctic Norway is challenged due to a short and cool summer season, however climatic change is predicted to give longer growing season but worsening the harvesting conditions due to increased autumn precipitation (Uleberg *et al.*, 2014). Other challenges are long distances to market, their dependence of rented land, small areas due to topographic features that make large scale farming challenging. However, the technical developments have been considerable, and a determinant for further expansion in a high-cost and climatically challenged area like Arctic Norway.

The research question is: What is the horticultural farmers' perspective on sustainability in Arctic Norway? In this paper 'perspective' describe how a person in his or her particular context understands the world. To be able to investigate the research question we used the Sustainability Assessment of Food and Agriculture systems (SAFA) guidelines (FAO, 2014b) as a starting point, and conducted semi-structured interviews, where the questions were broad and open, and the interviewee to a large extend could define the content. With the new knowledge gained, we aim at identifying the most important challenges for improved sustainability of horticulture production in this specific context, as well as looking at the interrelations between the dimensions and issues. Based on this we will provide policy and practitioner's recommendations for improved sustainability of horticulture production in Arctic Norway. In addition to these empirical aspirations, the article contributes to method development by using a qualitative approach to unravel the farmers' perspectives where the qualitative analysis contributes by contextualising the SAFA themes.

The rest of the article is organised as follows, in part two we clarify our theoretical framework that will make the basis for later discussions. Part three comprises the method section where we also include a section

on the empirical context. Part four includes our findings from interviews with farmers, and discussion and conclusion are found in the last two parts.

2. Theoretical framework

2.1 Sustainability in food production

To try to answer what constitutes sustainable food production, there have been a considerable emphasis on developing sustainability assessments, with an implicit goal to assess the gap between the existing situation of food production and the desired situation (Brunori and Galli, 2016). Gaspartos *et al.* (2008) claim that a sustainability assessment ought to integrate all three dimensions of sustainability, consider future consequences and uncertainties of actions, and engage the public to insure impact. This complexity implies that there is not one single method that can give the complete answer (Alrøe and Noe, 2016; Alrøe *et al.*, 2016; Brunori *et al.*, 2016; Gaspartos *et al.*, 2008). Food production is especially complex due to its dependence on environmental conditions, like the quality of their soil and on climatic conditions. Socioeconomic factors are also broad since food production and its value chain affect, and is affected by, rural communities and government, and contain value-adding activities towards the consumers (Alonso, 2015).

A timeframe is implicitly built into the definition of sustainability and is therefore also an important part of sustainability assessments. This factor is however not unproblematic and is discussed in research. Bond and Morrison-Saunders (2011) found this as the most problematic issue concerning sustainability assessments, since 'there is no consensus on what appropriate timescales should be'. In sustainable agricultural production the notion of the timeframe is crucial, for instance a destructed topsoil takes thousands of years to regenerate, surplus CO_2 emitted only accumulates in the atmosphere continuing to cause global heating basically infinitely and plastics basically never disappears since it only will break down in smaller pieces. Aiming for a sustainable production can therefore never be a short-term project.

What sustainable food production is, depends on the context, both geographical as well as on socio-cultural factors. In assessments, the choice of indicators and the weight put on each indicator will depend on local conditions (Alrøe *et al.*, 2016). Therefore, according to Schmitt *et al.* (2016) when performing an assessment, it is important to have knowledge about all flows and actors in the chain, geographical factors as well as economical and socioeconomical factors. With an extensive knowledge of the context the researcher can understand how the context effects the performance in the value chain (Schmitt *et al.*, 2016). Coteur *et al.* (2016) find that each individual agricultural sector operates in different contexts, depending on 'the farm type, the attitude and skills of a farmer or advisor', and their analysis shows that context plays a major role when conducting sustainability assessments of farms.

In addition, as research progresses and we gain more knowledge, as well as when new concerns emerge in society, the thought of what sustainability is, is changing (Alrøe and Noe, 2016). A quote from Brunori *et al.* (2016): 'sustainability is not a status to achieve, but a never-ending process' summarises this challenging task.

2.2 SAFA in research assessing the sustainability in food production

The Food and Agricultural Organisation (FAO) has developed a comprehensive framework and indicator-based tool called Sustainability Assessment of Food and Agriculture systems (SAFA) (FAO, 2014b). This tool includes a guideline and a thorough book of indicators with descriptions including relevance, unit of measurement, how to measure it, rating and its limitation. SAFA uses a widely accepted language for sustainability for it to be globally applicable. SAFA also includes a fourth sustainability dimension: governance. In addition, governance is seen as a horizontal dimension that relates to the other three dimensions since management is very important for ensuring adequate sustainability performance in farms/companies (Schader *et al.*, 2019).

Because of its comprehensiveness, data to assess the various indicators can be limited, or might take considerable time and resources to obtain (Jawtusch *et al.*, 2013). Jawtusch *et al.* (2013) stress the importance of the expertise of those who conduct the assessments and interpret their results.

SAFA is however widely utilised and Boinisoli *et al.* (2019) made an overview of studies that implement SAFA methodology. They found that SAFA was utilised in various ways, from complete sustainability assessments to sustainability assessments using some of the indicators. They also noted that both qualitative and quantitative methods were utilised in these studies, and that the results were mainly visualised in a spider web graph where the chosen sub-themes were graded according to its level of sustainability performance.

One of the steps in SAFA is 'contextualising the particular study'. This is done in different ways in empirical studies. In a large EU-project GLAMUR (EU, 2016), (Brunori *et al.*, 2016) they chose to change and expand the number of dimensions to five; 'Economic', 'Social', 'Environmental', 'Health' and 'Ethical', identifying 24 sustainability attributes connected to these dimensions. In each case-study (in total 39 value-chains) between 4 and 9 of these attributes were investigated further through both qualitative and quantitative measures. Theurl *et al.* (2017) identified 13 factors characterising winter harvest systems in Austria, and Al Shamsi *et al.* (2018) used 7 themes divided into a total of 20 indicators to assess the food sovereignty in Sicily and United Arab Emirates. The SAFA framework thus allows the selection of relevant themes and indicators from an extensive list. This way the assessment will be tailored made for each study.

2.3 Stakeholders in assessments – values and involvement

Much research emphasize that assessments fundamentally are based on values (Alrøe and Noe, 2016; Gaspartos and Scolobig, 2012; Thorsøe *et al.*, 2014). A challenge in assessing sustainability in food value chains is stakeholders' different values and different thoughts about what constitutes sustainable food production and a sustainable food value chain. Some of these differences are due to the stakeholders' different interests. Some stakeholders are involved in producing raw material or processing foods, some are involved in transport, we are all consumers, and most of us are influenced to varying degrees of different effects in the life cycle of food (Alrøe *et al.*, 2016). If the underlying values in the assessment are unknown, overlooked or where values are incompatible, two main problems arise: wrong measurements, and no impact on the transition towards sustainability due to failed policy being adopted. The environmental researcher Donella Meadows, goes as far as warning that choosing wrong indicators to measure sustainability by can cause serious errors (Meadows, 1998). This can happen for instance if policy makers are making plans for sustainable development based on distorted results leading to for instance unsustainable food production, or according to Gaspartos (2010) might lead to both political cost and economic loss. A challenge can also be that the assessments are not measured in a way that is understandable to end users (Gaspartos, 2010).

To make sustainability assessment reach their potential, sustainability assessments should consider the values of the different stakeholders (Gaspartos *et al.*, 2008). Stakeholders are defined as 'those who will bear the consequences and carry out actions for change' (Alrøe and Noe, 2016). The range of stakeholders are particularly varied when environmental issues are concerned (Govindian, 2017). Stakeholder involvement ensures that 'the 'right problem' gets addressed in 'the right way'' (Maasen and Lieven, 2006). Involvement is considered especially important in issues concerning sustainability since this in its nature is context bound and needs to be translated as well as implemented by a variety of stakeholders for change to occur (Triste *et al.*, 2014). Triste *et al.* (2014) list four advantages stemming from stakeholder involvement: increased awareness of problems and possible solutions from the actors that will need to implement the changes, more accurate holistic outcomes when including several viewpoints, increasing support for the assessment results, as well as learning opportunities.

2.4 Farmers' perspectives on sustainability

In an agricultural food value chain, a key stakeholder would be the farmer. The farmer will to a high degree affect how sustainable the other actors in the value chain will be able to perform or how consumers will value the food products. The farmer will also bear the consequences of an unsustainable practice, both in a short and long term. Coteur *et al.* (2016) writes that farms' aim for sustainable farm practices is the premise for improved sustainability in the food value chain. In addition, the farm level is a main driver for sustainable rural development (Schader *et al.*, 2016).

If the farmers do not know what constitutes a sustainable production, i.e. a consciousness of the combined effects of economic, social and environmental factors, this hampers the world-wide strive towards sustainable food production. Bonisoli *et al.* (2019) in their study did not find a deep interest amongst the producers about sustainability of the local agriculture. Also, Schader *et al.* (2016) stresses that 'in order to enable farmers to make sound decisions, all dimensions of sustainability need to be considered'. Knowledge about what comprises a holistic sustainable production then needs to be present.

Schader *et al.* (2014) claim that there are two prevalent perspectives on the term sustainability in food and agricultural research; the business or farm perspective that describes 'whether the farm is able to sustain itself for an extended period of time', or the societal perspective that describes 'whether a farm contributes to a sustainable development of society' (Schader *et al.*, 2014). However, investigating various assessment methods Schader *et al.* (2014) found that the different methods tended not to have a clear distinction between the two perspectives. But, in their studies on farm sustainability, Coteur *et al.* (2016) find that the importance of using assessments that focus on farm development is emphasized by farmers

Qualitative methods have the advantage of giving a rich material to analyse, which allow the researcher to unravel the farmers' perspectives on sustainable food production. Such studies can reveal very valuable knowledge about how actors view sustainability and can be important for understanding how to ensure impacts from assessment results, as well as to identify critical issues and trade-offs (Brunori *et al.*, 2016). In addition, the social dimension seems difficult to capture in a quantitative way (Brunori and Galli, 2016; Röös *et al.*, 2019). De Olde *et al.* (2017) find that different assessments cause different results, and when selecting an existing tool, indicators and procedures are predefined. With semi-structured interviews the questions are broad and open, and the interviewee can, to a large extend, define the content. When choosing a more participatory process, semi-structured interviews can ensure that misinterpretations of the results is avoided (Schmitt *et al.*, 2016).

3. Methods

The empirical part of this study concerns the horticultural farmers in Arctic Norway. This case is chosen since little research is conducted on the sustainability of Arctic horticulture, and due to governmental focus on increasing this production. The main author's 20-year experience as a project leader in this field as well as on her educational background in horticulture, provides a good understanding of the context and the related peculiarities. Positioning herself as a competent and concerned researcher has enabled her to establish and further develop good trusty relations with the farmers and local food producers contacted for this study. Her involvement in the field responds also to the call for inquiry methods where action and engagement are viewed as particularly valuable for transition towards sustainability (Eksvärd, 2010).

3.1 Case studies with in-depth interviews with key stakeholders

This study takes a qualitative approach to gather a rich insight into the research topic and context. The method chosen to understand our cases is in-depth interviews with farmers about their perspectives on sustainability. In this study, semi-structured interviews were chosen, meaning that the topics and main questions is defined before the interview session, but leaving room for deviating from the interviewer's

guide to pursue interesting topics that may arise in the interview situation (Justesen and Mik-Meyer, 2010). As a background for developing the interview guide, the SAFA guidelines (FAO, 2014b) were utilised. Here the concept of sustainability is divided into four dimensions: 'good governance', 'economic resilience', 'social well-being', and 'environmental integrity' (Figure 1). And, divided into 21 themes and 58 sub-themes.

The themes used in the currents study were selected after an initial mapping of the value chain, utilising agricultural statistics, national policy documents, reading various project reports, as well as using our extensive knowledge about the value chain in question. The result from contextualising the horticultural production in Arctic Norway was that we kept the four dimensions in SAFA, including having the 'good governance' dimension as a horizontal principle especially important for the performance in the other dimensions. We initially selected 15 themes (Table 1) that we considered relevant, and used this as a base for the interview guide. We chose not to include themes in SAFA that we considered more relevant to companies than farms, for example 'accountability', 'corporate ethics' and 'rule of law', as well as themes not considered relevant for the Norwegian context or in horticulture such as 'cultural diversity', 'fair trading practices' and 'animal welfare'. 'Initially participation' was put in the 'social well-being' dimension, since we regarded it primarily as farm interaction with society. Other themes were included, or rewritten from Figure 1, for instance the themes 'future prospects' and 'local society'.

To get a representative selection for the interviews we turned to the statistics from the Norwegian Agriculture Agency's list of subsidies receivers related to land use in 2017. We selected farms that had production volumes estimated to give a significant portion of an annual salary for one person, and found 58 horticultural producers that produced either more than 2 hectares potatoes, 1 hectare vegetables or 0.5 hectares berries/fruits. We also wanted to interview farmers from all three production systems; berries, vegetables, and potatoes, as well as having a geographical distribution in the Arctic region, and a variety of end-markets

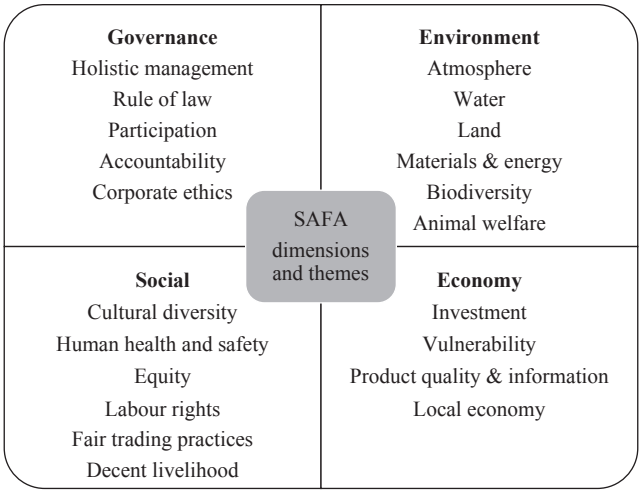

Figure 1. SAFA dimensions and themes.

Table 1. SAFA dimensions with themes contextualised for this study.

Good governance	Economic resilience	Social well-being	Environmental integrity
holistic management	local economy	local society	energy
future prospects	vulnerability	participation and network	waste and recycling
	long-term profitability	labour condition	soil
	product quality	health and safety	water
			biodiversity

for their products ranging from sales based on customer 'self-harvest' to selling through a wholesaler. In addition, we interviewed only conventional producers since only 5 of these 58 producers were certified for ecological production. Considering this, we selected ten farms for the interviews (Table 2).

Geographically the farms were located in Nordland and Troms County. The ten interviewed farmers produced about 40% of the total potato area in Arctic Norway and about 20% of the total area utilised for berries and vegetables (Table 3). In addition to interviewing the farmers we also had an initial interview with the regional wholesaler. The interviews were conducted from June-September 2019.

Apart from one interview, which was made by telephone, all interviews were conducted in person by the main author. The interviews were recorded and later transcribed, and the anonymity of each interviewee was sought by leaving out names or places that could identify the specific farm. The interviews were set to last about one hour, and the interview guide was divided into three parts. Each interview started with initial talks about the general background of the farm/company. The producers were then asked what sustainability means to them, and how questions pertaining to sustainability affect the production on the farm/in the company. Finally, more detailed questions concerning the selected themes from the SAFA guidelines were discussed. This third part took about 2/3 of the time allocated to the interview. The transcribed interviews were coded in NVivio 12 (QSR International, Burlington, MA, USA). The analysis was focused on content analysis were both the content (farmers' perspectives on the various themes) as well as the context were analysed. The analysis also focused on identifying interactions between the perspectives on the various themes and dimensions, as well as on drawing implications from these analysis on policy development for the specific context.

Table 2. Interviewees main product(s) and age.

Company / Farm	Potatoes	Vegetables	Berries	Other income	Interviewee	Age
C1	wholesaler				C1a	35-55
					C1b	35-55
F2		x	x	external work	F2	<35
F3		x		livestock	F3	<35
F4	x			livestock	F4	>55
F5		x		livestock	F5	>55
F6			x	livestock	F6	>55
F7	x			livestock	F7a	>55
F7					F7b	35-55
F8			x	external work	F8a	>55
F8					F8b	35-55
F9			x	tourism	F9	>55
F10	x	x		processing	F10	35-55
F11	x			external work	F11	35-55

Table 3. Production on the interviewed farms compared to the total number of horticultural farms in Arctic Norway.[1]

	Potatoes	Vegetables	Strawberries	Other berries
Total production in Arctic Norway	428 ha	46 ha	15 ha	9 ha
The 10 interviewed farms – production	82 ha	18 ha	3 ha	2 ha

[1] Data from 2018, production-subsidies for agricultural companies. Available at: https://data.norge.no

3.2 The context – the horticultural value chain in Arctic Norway

Since 2001 there has been an increased focus on developing the local food value chains in Norway. Increased value creation locally was the aim in the beginning of this period, but later governmental documents focus increasingly on sustainable production. The White Paper 11 (Norwegian Ministry of Agriculture and Food, 2017) emphasizes that increased agricultural production should be based on Norwegian resources, and the White Paper 39 (Norwegian Ministry of Agriculture and Food, 2009) states that Norwegian agriculture and food production shall be conducted in a climate-friendly manner. Since the Agricultural negotiations in 2012 the government earmarked has funds to support development of 'Arctic agriculture', and in the agricultural negotiations in 2019 there was an agreement to nationally establish a special focus on the horticultural sector to increase production and demand for Norwegian-produced horticultural goods.

Plant production in Arctic Norway is challenged due to a short growing period and cool summer temperatures, however the 24-hour light period in the summer compensates for some of the lack of warmth in the growth period. Due to climatic change a prolonged growing season is expected due to higher average temperatures, however increased precipitation in the autumn worsening harvesting conditions is also expected (Uleberg *et al.*, 2014). Artic Norway is geographically a region characterised by long distances where transport and logistics are a considerable cost for the producers. One of the main traits is that the farmers are dependent on land rental, since the ownership structure is such that there are many landowners, few farmers, and small land units (Kvalvik *et al.*, 2011). Due to this, in addition to topographical factors where only 3.6% of Arctic Norway area is arable, large-scale volume production is challenging. Another challenge is that there is only one wholesaler receiving potatoes and vegetables left in the region. Table 3 shows the total production area in 2018.

The technical developments have been considerable, and a determinant for further expansion in a high-cost and climatically challenged area like Arctic Norway. Improved plant material and planting procedures have also altered the possibilities for production in this region. A challenge is that specialised production puts great demand on the competence of the producer as well as on the need for larger investments in greenhouses, production tunnels for berries, and specialised equipment for agronomical operations, sowing and harvesting.

In general, the agricultural sector in Norway is strongly regulated by law in issues concerning worker rights and wages, health and safety, accounting and audits, etc. The specific issues concerning quality control in agricultural production is found in the 'Quality system for the Agriculture'[1] where every farmer must submit annual self-audits and where demands for documentation is high.

4. Findings

4.1 Farmers perspective on the concept of sustainability

To get information about the initial and intuitive perspective, the farmers were asked about their understanding of the concept of sustainability and how they relate this understanding to how they run their farm. This was done to gain insights into how farmers relate to this societal goal for food production in general, what dimensions of sustainability they were concerned about and how this affected their production.

The main impression is that the term is not something that they use much in their everyday life and work, however a common acknowledgement is that: 'the word itself, you don't hear it every day, you do it automatically' (F2). Several of the farmers also point to the concept as being very wide, and something that can be misused: 'it becomes an empty phrase, such as politicians use' (F9). In addition, one farmer mentions a frustration among farmers since: 'for many farmers it is difficult to understand, to be defined as a 'climate-bad-guy', because it is so far from what one feels like engaging in food production' (F7b). When asked what

[1] Kvalitetssystem i Landbruket, available at: www.matmerk.no/no/ksl/om-ksl

they would include in the concept sustainability responses from all the ten farms included the 'environmental' dimension, seven included the 'economic' dimension and five included the 'social' dimension. Four of the interviews included all three dimensions. In the 'economic' dimension the farmers focus on gaining a positive economic result for their farm as well as discussing socio-economic factors. In the 'social' dimension the farmers talk about buying local goods and services, using local resources and discusses the social benefits of their production. Then, in the 'environmental' dimension the farmers focus on issues related to maintaining the natural resources, especially in connection to agronomic practices, and to produce what they have the best natural conditions for producing. Having a long-term focus is also mentioned here.

All farmers relate their understanding of the concept 'sustainability' to the management of their farm. Sustainability is mainly related to economic and environmental issues and often these issues are set up against each other as a balancing compromise: 'it should sustain my economy, that can be superior, but it should also be seen in relation to the environment and that part' (F4).

4.2 Contextualising sustainability in horticultural production in Arctic Norway using SAFA

After the general discussions about the concept 'sustainability', the questions based on the SAFA framework were discussed. The main findings in each dimension are presented in the following sections.

■ *Good governance*

Good governance relates to farm management. Two themes were considered relevant in the context of horticulture production in Arctic Norway: 'holistic management' and 'future prospects', and our findings show that both themes are considered important for the overall sustainability on the farm, and that there are potential for improvements in both.

All the farmers interviewed wanted continued production on the farm, but several factors challenge this wish. We also find age differences, where older farmers are concerned since continued production relies on new farmers taking over the production when the farmer wants to retire. Traditionally, the children continued farm production after their parents, but were the children do not want to take over an extra concern for the future production is present. This kind of uncertainty put strains on the possibilities to plan long-term and for leading the farm in a direction suitable for the ones who will take over: 'it is a bit difficult now when it is getting so close to the finish line (…) is it sustainable to invest in a tractor for two years, or in a seed drill, should I rent that service until things are more clear? Then it becomes even more difficult for the person who is considering taking over, to make that choice' (F5). Dependency on rented land can also be a challenge on the ability for long tern planning, and is a special concern for one of the farmers: 'this year the plan was to only have turnip and some root swede, but then I got hold of more land, and then I had more. But next year, what do I get then?' (F2). On one of the farms, another uncertainty about continuation is that there is only one wholesaler left in the region, leading to very long transportation of their potatoes, and they are questioning the sustainability in that.

A second point important for the 'governance' dimension is how the farms are run, plans made and followed up. From the ten interviewed farmers we perceive a lack of long-term planning, especially plans that are more formalised in writing**.** However, this seems to work since as one farmer says jokingly: 'well, mainly it is just myself in the management, so it works well' (F10). However, when it comes to the economical part more written plans are made, and, especially when larger investments are needed**.** In addition, the high requirements for rule of law documentation also leads to an enforcement for planning.

■ *Economic resilience*

Economic resilience relates to economic issues on the farm. Four themes were considered relevant in the context of horticulture production in Arctic Norway, 'local economy', 'vulnerability', 'long-term profitability', and 'product quality'. For the 'local economy' we find that this theme is closely related to 'local society' under the 'social well-being' dimension. Our findings show that 'vulnerability' and 'long-term profitability' are highly related, and one of the main focuses for the farm practices and for the farms ability to work on overall sustainability. The theme 'product quality' is a continuous work for the farmers and for the wholesaler, but can also be included in the theme 'long-term profitability'.

The farmers seem to agree that there is quite good money to be earned from horticultural production in Arctic Norway: 'I would never produce potatoes if it wasn't money to be earned from it' (F7b). However, horticultural production in Arctic Norway can be a risky business and the yield and the revenue fluctuates**.** The production subsidies are area based and for horticultural crops, in addition, based on yield. Since the area is small for many of the producers, especially in berry production, if the yield is low there is very little security in the governmental subsidies. The fluctuating yearly income means fluctuating taxation and one of the farmers suggest the horticultural industry should consider: 'to put some in a fund (…) for the bad years, as in forestry, they have five years average income tax returns' (F10).

The horticultural farmers are closer to the market than producers of meat and milk**.** Of the interviewed farmers, six sell the main part of their produce to the wholesaler. Selling to a wholesaler reduces some of the risks, and the work with selling and processing their production: 'if we didn´t have the guarantee of market access through the agreements with (the wholesaler) then we would never have taken such risks on our own' (F7b). These farmers make only one-year detailed production plans with the wholesaler, and this could lead to some uncertainty. However, since there is a potato deficit in Arctic Norway this is not a big concern for the potato producers. For the vegetable producers selling to the wholesaler the market situation has been more unpredictable. The produce that is not sold through the wholesaler is sold directly from the farm either to shops, horeca or directly to the customers. This is how all the berries are sold, where two of the producers rely for a large part on 'self-harvest'. One challenge mentioned is selling their products to the supermarket when they at the same time has price dumping on horticultural produce selling berries, potatoes or vegetables for a very low price to attract customers. For the produce sold directly to the customers, it seems that price is of less importance. Some of the vegetables produced is sold at direct markets and this can give a much higher income per weight, however, the work load can be high.

Much of the business models are chosen with the aim of reducing the risks from horticultural production and securing long-term economic surplus for the farm. All the farmers practice various ways for the farmers to secure income. On five of the farms horticulture production is combined with livestock: 'milk and meat production are the base, the stable, and then the other is gambling, like a 'Lofot-fishery', you can do well and you can do badly' (F7a). Having a combination with livestock especially, is crucial for being able to employ year-round full-time workers on the farm. Four of the interviewed farmers also rely on income from external jobs**.**

Product quality and improved processing is an important issue in the economical dimension, to ensure that as much of the produce as possible can be sold for human consumption and as high-value products. For products that are only utilised fresh, as the local turnip, the percentage wastage is high, but for products that can be processed, such as root swede that is peeled and processed the percentage wastage is lower. For field-grown berries, the weather conditions to a high degree, determines how much berries are wasted**.** When selling through a wholesaler the quality criteria for fresh saleable products are strict, and the producers that sell directly to the customers are more flexible for setting their own quality criteria.

■ *Social well-being*

Social well-being relates to how the farm interacts with society. Four themes were considered relevant in the context of horticulture production in Arctic Norway, 'local society', 'participation and network', 'labour conditions', and 'health and safety'. Our findings show that the farmers consider that they have a positive impact on the theme 'local society' and that 'labour conditions' and 'health and safety' aspects are good. The theme 'participation and network' is found to be a key element for sustainable development on the farm.

Having a tight producer's network seems to be one of the most important factors for farm development and job satisfaction. The farmers also recognise it as an opportunity to buy better equipment, for efficiency as well as being positive for the social aspect. Farmers situated far from the wholesaler can feel that they lack a network of horticultural farmers. Many of the farmers participate in various development projects that gives them added network regionally and nationally, in addition to being active in farmers associations. A few are also involved in local chamber of commerce, although one farmer recognises that it should be a stronger focus for farmers to interact with other industries.

Most of the farmers say that they feel they have a very positive impact on the local society and that the local society appreciate their work. For one of the berry farms that sells the berries directly from the farm, this generate customers for the local shop as well as other activities in the village. There is however a difference in how agriculture is perceived in their local commune, farms in typical industry or fisheries communes feel less appreciated. All the farmers who are selling produce directly to the customers are saying that they get much positive attention and appreciation from customers for producing local produce**.** One of the farmers who is selling his produce to the wholesaler is saying that he feels his largest contribution to society is: 'it is more that one contributes in the larger scale regionally, in northern Norwegian scale, by keeping up the production, and contributing to locally produced food' (F11). Most of the farmers are saying that they are very conscious about buying local goods and services.

In addition, the farms provide job opportunities. Except one, all farms rely on full time or short-term hired employees. Combined the ten farms has approximately 16 full time employees, 10 that are employed part time for a large portion of the year, as well as estimated about 40-50 seasonal workers. Farms are therefore, for this region, a quite large employer. A challenge is to get local workers, and two of the farmers are talking about how the countryside has changed: 'we no longer have access to workers from the village, we have to get seasonal workers from abroad' (F11). Most of the workers are from Eastern Europe, but some of them have moved to Arctic Norway with their families. Many of the farms also rely on help from their families and by working long days themselves in the high seasons**.**

All the farmers say that health and safety is a focus for them, and in particular when hiring people**.** It seems that there is a focus on training for new workers and that some, more complicated operations are only done by the farmer. Some has also visits from their local health and safety adviser through the farmers Agricultural Services Organisation, and two of the farmers say that they have had visits from the labour inspection: 'it is also a good experience (...) it is very good that they also are concerned about agriculture' (F7b).

■ *Environmental integrity*

The environmental integrity dimension relates to the farm's impact on nature. Five themes were considered relevant in the context of horticultural production in Arctic Norway, 'energy', 'waste and recycling', 'soil', 'water' and 'biodiversity'. Our findings show that the farmers are working consciously on all these themes, also due to the high rule of law requirements for documentation.

For the horticultural farmers diesel for the tractor is the main on-farm source of energy. The land structure is such that each farmer has many small fields, and the fields can be many kilometres apart and lead to much transport. The farmers are aware of this and some say they use 'land-exchange' with neighbours to reduce

tractor driving and to get more suitable land for crop rotation. Energy saving is also an issue while working the land, minimising driving distance by doing many operations simultaneously. Transportation in distribution in the value chain is also an issue, one of the farmers who has a long distance to the wholesaler is considering the sustainability aspect of producing potatoes when: 'I risk that my potatoes are being transported between 1,500-2,000 km from they are produced until they come to the store' (F11). The decentralised settlements are a concern selling berries through 'self-harvest' directly from the farm, where each customer drive long distances.

The two main sources of waste in horticultural production is plastic and biological material. The increased used of fibercovers to improve the microclimate and to reduce the risk of pest damage has increased the problem with plastic waste in horticultural production. Even though this is considered a one-year-cover they try to use it two-three years. However, all say that the local waste management companies have good routines for recycling**.** For the biological waste most of the rotten berries are thrown away in natural compost, the damaged vegetables not harvested, and leafs are mainly ploughed down. In table top production the growth medium is a concern, utilising either turf or far-travelled coco waste. Some of the farmers are also discussing possibilities to utilise biological waste as an alternative source of energy.

In general, the farms in Arctic Norway are small and agricultural land only a small percentage of the total land area: 'even though a large part of the river delta is cultivated, there is still forest left in the delta and it is surrounded by high mountains and forests, so I think that in that area agriculture has relatively little impact on nature' (F11). Still, how the agricultural production affects the soil and water sources locally is of great concern. It is also highly regulated. The farmers are imposed by law to test their soil quality at least every 5 years and to have yearly plans for fertilisation. Taking care of their soil is essential for future productivity and is considered when working in the fields: 'thinking about which machines to use, how big they are and tire width and stuff (...) and as little driving as possible to take care of the soil that will be cultivated later, it is of course important' (F10). Fertilising methods are considered, to fertilise directly were it is needed and in the right amounts. The agricultural impact from runoff to water sources, like river, groundwater and lakes is also regulated by law: 'if you adhere to the laws I think you should be a good and 'clean' production company' (F5). It is noted from many that because of the cool climate less pesticides is needed. However, all the farmers use chemical pest and weed management to some degree. In general, the farmers are cautious about using chemical pesticides, and integrated management such as crop rotation, fibercovers for physically closing out the insects or biological pest control in tunnel production is widely used. Crop rotation is an important part of the agronomic planning for all the farmers, but the lack of suitable land for horticultural production is a limitation for this for most farmers. For potato producers buying clean seed potato is one solution.

Climatic factors challenge production in Arctic Norway, and methods for improving the microclimate is widely utilised. Tunnel production with production-ready-plants is introduced in berry production: 'you can say that with table top and raspberries in pot production, we have ruled out winter problems' (F6). It is also mentioned that new production systems for other crops can give new opportunities to this high-cost and climatically challenged area for plant production. Another issue is to obtain suitable varieties for these conditions where earliness is one of the main features sought. Projects with breeding and selection is done in the network around the wholesaler: ''cause we need adapted varieties, most varieties are developed very far south from us' (C1b).

5. Discussion

The findings presented in Section 4 are discussed in the next section in relation to the farmers' perspective and the implication for the horticultural production in Arctic Norway. Based on such discussion, two tables are elaborated, Table 4 summarises the findings and their implications for sustainability and Table 5 shows the themes our analyses suggest to utilise for future studies of sustainability in this production. This section closes commenting on the qualitative approach used in this study and its contribution to investigate the complex phenomenon of sustainability and sustainability perspectives.

5.1 Farmers' perspective on sustainability

The findings suggest that sustainability is not a term the farmers use in everyday conversation. However, our findings show that the horticultural farmers in Arctic Norway have their own perspectives on sustainability, and that they all relate this to how they run the farm. The interviews reveal that the highest focus is on the environmental dimension. This in contrast to the findings in Bertella *et al.* (2020), where companies often focus first on the 'economic' dimension. The high environmental focus of the farmers might however be explained by their high dependence on environmental conditions. Some also highlights the interconnectedness of the different dimensions of sustainability, especially between the 'environmental' and the 'economic' dimension, both the inherent tension and the synergic aspects. Analysis show a somewhat weaker connection towards the social dimension, although half of the interviews contain issues connected to this dimension. One weakness might be that only four of the ten farmers mention all three sustainability dimensions; 'economy', 'society', and 'environment'. Since sustainable food production is a governmental aim competence building about what constitutes a complete sustainable production system could make the farmers even more conscious about the holistic efforts needed to increase the level of sustainability at the farm.

Schader *et al.* (2014) distinguish between the business or farm perspective and the societal perspective in sustainability analysis. We find that mainly the farmers took the farm perspective although some of the comments have a wider approach that can be viewed close to the societal perspective. From our findings it seems however, that the distinction made by Schader *et al.* (2014), although intuitively comprehensible, maybe is not so easy to distinguish in practice. The farmers seem to conceive both perspectives interchangeable, not explicitly distinguishing between the two perspectives.

5.2 Implications for sustainability in Arctic Norway

Despite a somewhat lack of holistic focus on the concept of sustainability in the open questions, the more detailed questions based on the SAFA framework on the four sustainability dimensions and related themes, reveal that all the farmers in their everyday work are very much concerned about all parts of the sustainability concept. As is pointed out by the wholesaler: 'I can't say that (the word sustainability) is used much talking to the producers, but that's really what we're working on all the time' (C1a). The need to specifically look at all the various sustainability themes is there for imperative to understand the farmers' perspective of the concept. Table 4 systematises the main findings in our study and their implications for sustainability.

The findings as systematised in Table 4 suggest that the farmers are working on all aspects of sustainability. One important reason for the good performance is due to the high level of public documentation requirements imposed on the farmers. This is also found in Kiełbasa *et al.* (2018) where external pressure from national and EU regulations is the most important factor determining farmers' perspective and practices in the environmental dimension. In Norway, where the documentation requirements are high also in the 'economical' and the 'social' dimension, for example in connection to health and safety, auditing and employment, this might hold true also for these dimensions. The implications for sustainability (Table 4) are discussed below.

The findings relative to the 'good governance' dimension show that there are challenges in the possibilities for long-term planning. Agriculture is a long-term project were many of the operations like crop rotation, making new land and trenching will have effects well into the future. Investments in machines, storages, etc. must also be based on planning for the future. Bond and Morrison-Saunders (2011) found the timeframe as the most problematic issue concerning sustainability assessments, and considering the possible long-term effects of agricultural production, for instance with issues related to top-soil, CO_2 or plastics, time-frame aspects are definitely important. Our findings suggest that the ability to plan for the future is challenging passing from one generation to the next, and for the farmer to plan for a distant future would be virtually impossible. From the ten interviewed farmers we also find a lack of plans formalised in written documents. This can be a shortcoming for producing sustainably over a longer period, possible affecting both economic and environmental performance. However, the documentation requirements from the government forces the

Table 4. The main findings and implications for sustainable production.

Dimension and theme	Findings	Implications for sustainability
Good governance		
Holistic management	Limited formalised planning	Challenge for best practice
	High in rule of law documentation	Leads to a general high level of sustainability
Future prospects	Challenge for long-term planning especially due to generational shifts	Challenging for innovations and investments for improved sustainable production systems
Economic resilience		
Vulnerability	Yield fluctuations leading to income fluctuations	Trade-off between the economical and the environmental dimension
Long-term profitability	Low in economic security	New policy and subside practices needed
	Reasonable income	Innovation and competence
Product quality	Risk reduction production	Prolonged market contracts
	Technical and processing improvements	New products, new markets needed
Social well-being		
Local society	Feel appreciated	Job satisfaction
	Buying local goods and services	Connected to societies also through the economic dimension
Participation and network	To varying degree	
Labour condition	Dependent on foreign workers	Critical for increased/improved sustainable production
Health and safety	High focus	Challenging for sustainability
Environmental integrity		
Energy	Diesel for tractors, focus on reduction	Potential to look at new energy sources
	High distribution mileage	More infrastructure needed
Waste and recycling	High use of plastics, but a good recycling system	Potential for new value streams for today's waste
Land use		
Biodiversity	Highly regulated fertilisation regimes	Trade-off between land use and productivity (e.g. crop rotation)
	Small plots, less pesticides	
	Climatic adaptations	Improved focus on biodiversity
		Technical innovations and adapted plant varieties

producers to document and plan many aspects of production. The 'governance' dimension can be perceived as a horizontal dimension affecting the performance in the other dimensions (Schader *et al.*, 2019). A similar finding is reported by Schader *et al.* (2016) who conclude that farms optimising the governance dimension can improve the overall sustainability performance. Improving the long-term planning and improving routines for more formalised plans can improve the sustainability in the economic, social and environmental dimension of the horticultural production in Arctic Norway.

With regard to the 'economic resilience' dimension, to secure income is an important feature for all the producers, and it is important to note that all the investigated farmers rely on income other than from horticultural production alone. Half of the farms combine horticultural production with livestock. This is also commented by Al Shamsi *et al.* (2018) as a best-practice reducing off-farm input and increasing product range. The producers say however that there is good money to be earned from horticultural production. Findings from Migliorini *et al.* (2018) in regards to horticultural production, showed that one of the main reasons for the high level of sustainability found, is due to positive economic indicators. Our findings show that new policy and subsidies practices should be considered since there is little security in todays practice. For instance, it is mentioned that changes in the taxation systems can decrease the effects of income fluctuations.

There are also trade-offs between the 'environmental' and the 'economical' dimension concerning factors affecting yield levels set against the income levels. In a high-cost country like Norway, where especially the wage-level is high, the focus will be on high-value quality crops rather than on volume. New innovation connected to a high competence level can lead to risk reduction since climatic challenges are reduced as well increased effectiveness in production leading to less manual labour. We also find that market issues such as prolonged market contracts for instance with the wholesaler could improve security, in this context this is especially important for the vegetable producers. A heightened attention to alternative processing to increase the value of the products that do not comply with the quality criteria, is also considered important.

In the 'social well-being' dimension, the farmers feel appreciated for the work they do and that they contribute to their local communities. In a Swedish study Röös *et al.* (2019), 'finding one's work meaningful' was found to be highly important to the farmers, and although not investigated explicitly in this study, the impression from the analysis is that the farmers find their work meaningful much due to their contribution to the local community. The theme 'local economy' found in the economic dimension has a large impact on how the farmers relate to the local communities, through buying locally and producing local food. Most important for the farmer in this dimension, is however to have a good network of producers. Especially for the network around the wholesaler, many new young producers are enthusiastic and ready to learn new production techniques. In the increased production of strawberries in tunnel we find that also network over longer distances can work utilising skype and other electronic channels to keep in touch regularly. Al Shamsi *et al.* (2018) also comment on networks as an important premise for sustainable production. One challenge in this dimension is to get seasonal workers locally. The farmers using foreign workers are satisfied with their work capacity. However, it can be vulnerable for local communities to be so dependent on outside workforce to maintain production, possible also leading to less connectivity to the local society.

In relation to the 'environmental integrity' dimension, one main feature is that much of the agricultural practices and possibilities for land use are regulated by law, and it is mentioned by farmers that, when complying with these regulations, the effect on the soil, water and atmosphere from production will be positive. However, one of the biggest challenge for good environmental production is found to be the dependency of rented land. Farmers say that land-exchange is usual in many areas, and this can be a solution for some to get access to more land suitable for horticultural production as well as decreasing the driving distances between the different fields. A lack of land is also a reason for less than recommended crop rotation, which can lead to an increased need for pesticides and increased fertilisation levels. In active agricultural areas this is a challenge**.** Ssebunya *et al.* (2019) found in their studies several trade-offs between the environmental dimension and other dimension. This can also be found in our study exemplified with the less than optimal crop rotation, since not utilising suitable land for yearly production will reduce yield and consequently reduce income, i.e. a trade-off between the 'environmental' and the 'economical' dimension. Waste is another issue. The use of plastic covers in production increases yield and therefore income, but at the same time increases the amount of plastic waste. Using waste streams for bioenergy can also be possible, but probably this must be done in collaboration with other industry locally to get the volume of waste necessary to reach economic viability. Transportation mileage in the value chain is high, both due to the geography, few farmers and little infrastructure. Theurl *et al.* (2017) found that, contrary to common belief, local food distribution does not involve less transportation, especially when individual shopping trips are considered.

Since in Arctic Norway only 0.83% of the land area is utilised for agricultural production, and the farms and fields are small, it is mentioned by the farmers, that their horticultural production effects the natural environment to a small degree. Due to new research and development there is continuous improvement in for example use of pesticides and fertilisation practices that can further improve biodiversity. Findings from Migliorini *et al.* (2018) show that a high level of sustainability stemmed from a high focus on land-use and biodiversity. Even though the overall environmental sustainability is considered good in Norway, many farmers mentioned the need to implement technical improvements on tractors, equipment, and precision agriculture. In a high-cost country with small field sizes the farmers must rely on quality yield rather than quantity, and then such technical innovations will be crucial.

5.3 Further considerations for sustainability in horticultural production in Arctic Norway

The findings suggest that dividing the sustainability concept in four dimensions provides a good a useful conceptual tool for studying the sustainability of horticulture producers in Arctic Norway. However, our analysis suggests a more elaborate and a somewhat different structure to the sustainability themes, than the one this study has initially chosen (Table 1). In particular, there are two themes important for the sustainability of horticultural production in Arctic Norway that were not included initially: the importance of technical improvements and innovation in both production methods and in product development, as well as the importance of competence level to be able to implement sustainable practices. New innovations can give new opportunities to a high-cost and climatically challenged area for plant production. In general, the competence level is considered high among the farmers, however, the technological development in the horticultural sector is rapid, and new competence must follow this development simultaneously. In Kiełbasa *et al.* (2018), similar findings are presented, with the farmers' level of knowledge of environmental issues having an impact on the natural world.

Another theme that has emerged as particularly important in the context we have investigated is the concern about and importance of land rental on the performance in the environmental dimension, as well as the important implications climate and climate change has on this dimension. Although climate change is not broadly mentioned by the farmers this is a feature from the context that is, and in the future will be even more, important for production. We therefore suggest 'land rental' and 'climate' as additional themes to be studied in this specific context.

As discussed, the study show that 'participation and network' is a key factor for improved and increased horticultural production. This theme was initially categorised among the factors of the 'social' dimension. Considering the effect 'participation and network' have on all the dimensions, we suggest that this theme might be better placed in the more overarching 'good governance' dimension, as it initially was also in SAFA (Figure 1). In addition, as described above the high rule of law requirements, pertaining to topics in all dimensions leads us to, as it is in SAFA (Figure 1), to include it as a separate theme in the 'governance' dimension. Table 5 shows the suggestions our analysis reveals for themes relevant for studying the horticultural production in Arctic Norway.

Another finding from our analysis is the numerous interrelations among the various dimensions and themes. The 'governance' dimension overlaps with the 'environmental' dimension, especially for the themes 'future prospect' and 'holistic management', as well as with the theme 'holistic management' and the 'social' dimension theme 'local society'. Between the 'environmental' and the 'economical' dimension, we find overlap in most themes. The 'social' dimension overlaps with the 'environmental' dimension in the theme 'local society', and with all the themes in the 'economical' dimension. It is important to recognise these overlaps to understand the complexity of sustainability assessments as well as their limitations in depicting real-world-issues in neat tables. Overlapping issues can also lead to trade-offs when working on improving a value chain since actions taken in one theme can negatively affect another theme.

Table 5. Sustainability dimensions with relevant themes for the horticultural value chain in Arctic Norway.

Good governance	Economic resilience	Social well-being	Environmental integrity
holistic management	profit and economic security	local society	energy
future prospects	economic vulnerability	local economy	waste and recycling
participation and network	long-term profitability	local food	land use and biodiversity
innovation and competence	product quality	labour condition	land rental
rule of law		health and safety	climate

5.4 The contribution from qualitative methods on sustainability

This study uses a qualitative method to identify the farmers' perspectives. We find that a qualitative method gives a rich material to analyse and that it is especially useful for discovering possibilities and challenges for a more sustainable production and to uncover new concerns in relation to sustainable production. A concern raised in Jawtusch *et al.* (2013) is that the comprehensiveness of the SAFA objectives may require much time and resources to obtain good data, and that the quality of the assessment depend on the expertise of the person performing the assessment. This address both the challenge and strengths of such a qualitative approach, where we found that a good contextual understanding is paramount for understanding farmers' perspectives and the strategies available for improving sustainable agriculture in a given context. In-depth interviews provide thick descriptions and give the possibility to identify a broad set of interacting factors that influence on the farmers perspectives that further connects and diversifies the context and the findings.

In relation to this, Migliorini *et al.* (2018) reflect on the concern that the complexities of food production challenges the possibilities to reduce sustainability issues into indicators for quantitative calculations. Qualitative methods might not be as suited for generalisation of sustainability nor for comparing sustainability levels between various production methods. Using only farmers' perspective as the only measurement will not be suited for the sole assessment of the state of the sustainability of the horticultural production in Arctic Norway. The findings unravel the perspectives of key stakeholders in the value chain. The farmers, with their combined practical and theoretical knowledge about critical factors for a successful horticultural farm provide valuable insight to challenges and conditions for improved sustainability that can inform policy. Our view on this choice of method much conclude in the same way as Galli *et al.* (2015) saying that qualitative methods: 'can help identify issues to deal with and critical gaps, thus representing a starting point for further empirical research'. However, in addition to this, we find that qualitative methods utilised to uncover the farmer's perspective on sustainability can be of paramount importance since the farmers are the main stakeholders to ensure possible changes towards sustainability. And, as such this qualitative study very much emerge as a complete work on its own.

6. Conclusions

In this study, we use a qualitative method to explore the perspective on sustainability of horticultural farmers in Arctic Norway. We find that many of the premises for fulfilling the UN SDG 2 are present in Arctic Norway horticultural production. Horticulture provides healthy food and the farmers interviewed generate decent income and are positive contributors to their local communities. The main challenge in Arctic Norway is probably to be able to produce more food. The production today is small in relation to the consumption. However, the government has a special focus on increasing the horticultural production and consumption. To achieve a higher production level of sustainable produced horticultural products in Arctic Norway, there should be more horticultural farmers and more available land suited for this production, as well as increased infrastructure that today lacks due to that it is only one remaining wholesaler in Arctic Norway. The producer's network is identified as a critical factor for development. A paradox is that the producers themselves say that there is good money to be earned from horticultural production, but still the production is low. Reducing the vulnerability due to fluctuating yields and income, as well as innovation that makes this traditionally physically hard laborious production more production efficient and technical, can help increase production.

A concern in R&D is to go from assessments to an actual transformation towards sustainability. Our findings suggest that one limitation to such transformation can be that the knowledge of what, holistically, sustainable food production includes is unclear. Farmers, as key stakeholders in the agricultural food value chain, need to play an active role in assessments for change to occur. Contextualisation of what is important to assess to consider sustainability for the specific value chain is shown to be important, and is a prerequisite for a good assessment and for the assessment to fit the real-world.

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