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Factors affecting the regional distribution of organic farming

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ABSTRACT

Organic farming is recognised as a potential approach to achieve a more sustainable food system and promote rural development. Thus, many countries have set targets to increase the share of organic cultivated land. In Finland, the target was to increase the share of organic farming to 20% of the total area under cultivation by 2020. Although the share of organic agricultural land has gradually increased, there are still significant regional differences. The aim of our study is to identify the factors that affect these differences. Previous research has generally excluded factors such as subsidies from the analysis; therefore, this study explores the relevance of subsidies, as well as other key factors, within the context of the uneven regional distribution of organic farming in Finland. The data sources include research from the literature, official statistics, and a large survey of organic farmers. Using qualitative comparative analysis (QCA), we identify three different pathways that have led to higher organic shares of agricultural land in certain Finnish regions. The three regions with the highest organic shares utilise the first pathway, which includes a long organic heritage, a focus on dairy farming, and an important reliance on subsidies. We conclude that the regional variation in organic farming in Finland is due to a combination of different factors, rather than any single factor. Moreover, subsidies are a key factor that should be considered when reviewing the reasons for regional variations in organic farming.

1. Introduction

There is a broad understanding of the need to develop rural areas (European Commission, 2021) and sustainable food systems that preserve the environment and ensure food security for future generations (FAO and INRAE, 2020). Organic production is seen as an approach that can promote both of these goals. Due to lower environmental impact organic farming has potential to support transformation towards more sustainable agricultural systems (Adamtey et al., 2016; Seufert and Ramankutty, 2017; Reganold and Wachter, 2016; Gomiero et al., 2011; He et al., 2016). More specifically, increasing organic farming has been identified as a means to reduce greenhouse gas emissions (Squalli and Adamkiewicz, 2018). In addition, organic farming potentially plays an important role in reducing exposure to pesticides (Möhring et al., 2020; Muller et al., 2017), supporting beneficial insects (Adhikari and Medalled, 2020) and decreasing soil erosion (Seitz et al., 2019). From the rural development perspective, organic agriculture may also promote employment in rural areas (Finley et al., 2018). Darnhofer (2005) concluded that the beneficial impacts of organic farming on rural regions can be more diverse than the general focus on food chains, landscapes, and environmental considerations.

However, the benefits of organic farming have also been contested. Smith et al. (2019) and Squalli and Adamkiewicz (2018) published opposing results about the possible benefits associated with reducing greenhouse gas emissions. Reganold and Wachter (2016) underlined the need for other innovative approaches in addition to organic farming. Meta-analyses by Tuomisto et al. (2012) and Mondelaers et al. (2009) have demonstrated that while organic farming generally has lower environmental impacts per unit of area, the results can differ when examining the impacts per product unit. Furthermore, Meemken and Qaim (2018) noted that there are several disadvantages associated with a widespread increase in organic agriculture, for example, a rise in food prices. The impact on rural development is also controversial. Lobley et al. (2009) noted that there are factors other than farming methods that may have a greater influence on rural or regional development. Despite these contested views, the benefits of organic farming have been widely accepted, and it is generally promoted as a desirable agricultural system.

The growth of organic farming involves shifts in human values and therefore relates to societal change as well as agricultural change (Michelsen, 2001; Lähdesmäki et al., 2019). Consequently, previous literature has emphasised the role of governments in increasing organic

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farming. Argiles and Brown (2010) stated that government decisions are key factors that affect the future of organic farming. Lesjak (2008) also revealed correlations between policy decisions and the development of organic farming. Hence, many European countries have set targets to increase the share of organic farmland. In addition, the EU's Farm to Fork strategy (European Commission, 2020) included a target to have 25% of agricultural land under organic farming by 2030. The targets have been set, for example, in order to enhance sustainability and to meet the growing demand for organic products (e.g. Ministry of Agriculture and Forestry, 2013). Increases in direct subsidies further strengthen these types of policy decisions, as they have been shown to exert a positive impact on the conversion to organic farming (Pietola and Lansik, 2001; Kaufmann et al., 2011).

Despite an encouraging political and economic climate, the development of organic farming can vary greatly between the different regions of a country (e.g. Schmidtner et al., 2012). To better understand the complexity of the longitudinal development of organic farming, Ilbery et al. (2016) highlighted the need for more studies with a regional focus. To date, however, the research has not adequately addressed the possible connection between subsidies and the regional distribution of organic farming, despite indications that subsidies may have a range of influences across different yield-level land areas (Pietola and Lansik, 2001). We address this research gap in our study. Accordingly, to achieve organic farming targets, it is important to understand the reasons for the regional differences and the factors that lead to higher shares of organic agricultural land.

The aim of this study is to identify the conditions or combinations of factors that have led to the regional differences in the share of organic cultivated land in Finland. Finland serves as an interesting case study because of its clear regional differences, both in terms of organic farming and other characteristics. We test the empirical validity of the categorisation developed by Ilbery et al. (2016), with the addition of one economic factor. Ilbery et al. (2016) suggested that three groups of factors – physical, structural, and socio-cultural – affect the regional concentration of organic farming. Therefore, we consider a variety of potential factors that affect the regional distribution of organic farming, such as a long organic heritage, agricultural sectors, and market diversity. The importance of subsidies is also included as one of the studied factors, as economic incentives may impact conversion decisions (Kaufmann et al., 2011; Pietola and Lansik, 2001) and food systems in general (Helenius et al., 2007). Qualitative comparative analysis (QCA) is utilised as the research method because it allows to consider the unique features of each reviewed case and enables the assessment of multiple complex causalities as well as different combinations of factors that affect an outcome (Cairns et al., 2017; Ragin, 1987; Rihoux, 2006; Verweij and Trell, 2019). Furthermore, Cairns et al. (2017) and Verweij and Trell (2019) have shown the potential of QCA for spatial research, which supports its use as a method to examine regional differences in organic farming.

2. Organic farming in Finland

The organic farming conversion aid scheme began in Finland in 1990, and after 1995 when Finland joined the EU, the share of organic farming began to grow significantly (Mononen, 2008). In 1990, only about 0.5% of Finnish farms were organic; however, within 10 years that share had grown to around 6%. According to Lampkin et al. (1999), the conversion rates in the 1990s can be partially linked to the subsidy levels in Europe. Countries with high payment levels, such as Austria and Finland, experienced notable growth in organic farming. Lehtimäki and Virtanen (2020) stated that the institutionalisation of organic agriculture in Finland was mainly due to economisation. The Finnish Government set a goal in 2013 to increase the share of organic farming to 20% of the total area under cultivation by 2020 (Ministry of Agriculture and Forestry, 2013). However, this target was not achieved despite the share of organic agricultural land increasing rather steadily over the past 12 years (Fig. 1). In 2019, organic agricultural land accounted for 13.5% of the total cultivated land in Finland (Finnish Food Authority, 2020a). Globally, Finland was ranked 13th in terms of its share of organic agricultural land in 2018 (FiBL and IFOAM, 2020).

The number of organic farms has increased at a slower pace than the share of organic cultivated land, with the number of organic farms even decreasing in some years (Finnish Food Authority, 2020a). The expansion of farms explains this development: the average size of an organic farm was approximately 34 ha in 2005 and approximately 61 ha in 2019. However, average farm sizes vary by region (Table 1). In the Eurostat regional breakdown, these regions correspond to the NUTS3 regions (Southeast Finland, Häme, and Ostrobothnia comprise two NUTS3 regions).

Although the target for organic farming in Finland was set as a nationwide goal, there are clear regional differences in organic land area as a proportion of the total agricultural area (Fig. 2 and Table 1). In 2019, regional shares of organic land varied between 7.2% and 28.8% (Finnish Food Authority, 2020a). Hence, some regions have already exceeded the government's target, while others remain far behind. The largest average organic farm size is in North Ostrobothnia in Northern Finland. However, the highest organic shares are in Eastern Finland, where population density is rather low and grain yields are smaller than the average for Finnish farms. The population density also indicates if the region is rural or urban, although almost all Finnish regions are predominantly rural. The prime agricultural production sectors in each region also vary. For this analysis, the prime sector designates the production sector that covers the largest share of the utilised agricultural area. In this study, we also focus on mainland Finland. The Åland Islands, a small group of islands between Finland and Sweden, have unique characteristics that are distinct from the mainland, and thus the region is excluded from the analysis.

Overall, about half of the organic agricultural land in Finland is grasslands, about one-fifth is in crops production and the majority of the organic animal farms are beef or dairy farms (Finnish Food Authority, 2020a). Approximately 3% of beef and milk is produced organically, while the corresponding share of organic eggs is almost 7% (Natural Resources Institute Finland, 2021). Oats are the most common organically cultivated cereal in Finland, representing about 6.5% of the total oats production (Natural Resources Institute Finland, 2021). Organic farms also produce, for example, potatoes, carrots, and berries (Finnish Food Authority, 2020a). In Finland, the retail sales of organic products more than doubled between 2011 and 2019, increasing from 163 to 368 million euros and accounting for about 2.6% of the Finnish grocery trade (Pro Luomu, 2020).

In addition to the regional differences shown in Table 1, regional variation is also evident in the history of organic farming. Development and educational work related to organic farming started most notably in Finland before 1990, but only in a few regions. Prior to 1990, there were several key milestones that occurred primarily in South Savo, Kainuu, and North Karelia, but also in Uusimaa and South Ostrobothnia (Mononen, 2008; Nykänen and Järvenpää, 2006; Yli-Viikari, 2016; Laukkanen, 2017). In South Savo in the 1980s, the key factors in the development of organic farming were the establishment of active organic advisors, the Mikkeli eco-county, and the Partala Centre for Rural Development for research on organic farming (Mononen, 2008; Nykänen and Järvenpää, 2006). In Kainuu, an organic farming advisor and the eco-municipality experiment in Suomussalmi created a network of organic farmers who developed organic agriculture in the region (Mononen, 2008; Yli-Viikari, 2016). The first university-level organic farming programme began at the University of Joensuu in North Karelia in the mid-1980s (Laukkanen, 2017). In addition, organic farming was promoted by industry-related associations and education programmes in Uusimaa during the 1970s and 1980s (Mononen, 2008). Before 1990, South Ostrobothnia had established one organic farming association and employed an active advisor (Laukkanen, 2017).

Studies of organic farming should acknowledge the differences

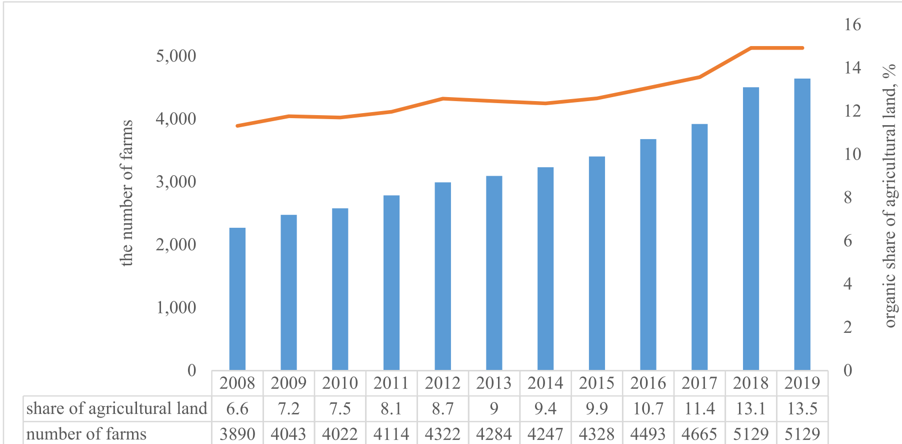

Fig. 1. Development of the number of organic farms and the share of organic agricultural land in Finland.
Source: Finnish Food Authority, 2020a.

Table 1
Descriptive statistics of Finnish regions in 2019.

Region	Organic share of total agricultural land (%)	Average organic farm size (ha)	Average grain yields[a] (M kg/1000 ha)	The prime agricultural production sector (ha)	Population density (people/km^2)
North Karelia (NK)	28.8	62.3	3.2	Dairy farming	9.1
Kainuu (K)	24.5	54.8	2.1	Dairy farming	3.6
South Savo (SS)	18.0	46.9	3.2	Dairy/other plant	10.0
Pirkanmaa (P)	16.4	54.0	3.5	Cereals prod.	41.1
North Ostrobothnia (NO)	16.2	76.7	3.2	Dairy farming	11.2
Southeast Finland (SEF)	15.3	71.9	3.4	Cereals prod.	28.5
Uusimaa (U)	15.1	68.1	3.7	Cereals prod.	185.7
North Savo (NS)	13.0	53.3	3.1	Dairy farming	14.6
Ostrobothnia (O)	12.9	49.8	3.9	Cereals prod.	19.5
South Ostrobothnia (SO)	12.1	65.8	3.8	Cereals prod.	14.0
Southwest Finland (SF)	10.6	65.9	4.0	Cereals prod.	44.9
Central Finland (CF)	10.2	49.2	3.1	Other plant	16.5
Häme (H)	8.3	45.9	3.9	Cereals prod.	35.9
Satakunta (S)	7.8	60.4	4.1	Cereals prod.	27.7
Lapland (L)	7.2	70.1	2.1	Dairy farming	1.9
FINLAND	13.5	60.9	3.7	Cereals prod.	18.2

[a] The yield data represent the average yields of the two most cultivated grains in Finland (barley and oats) in conventional farms between the 2015 and 2019.
Sources: Finnish Food Authority, 2020a; Official Statistics of Finland, 2020; Natural Resource Institute Finland, 2021.

between organic and conventional farming, as they may have a clear influence on conversion decisions. In Finland, the notable economic differences between organic and conventional farming include cost structure, crop yields, profitability, and subsidy levels (Natural Resource Institute Finland, 2019, 2021). Statistics (Natural Resource Institute Finland, 2021) demonstrate the differences in grain crop levels between organic and conventional farming: conventional cereal production is more efficient in terms of land use. This is also the case in many other countries (Tuomisto et al., 2012; de Ponti et al., 2012; Seufert et al., 2012). In Finland, the yield of organic oats, for example, was about 2300 kg per hectare in 2020, and the corresponding number for conventional oats was about 3900 kg per hectare (Natural Resource Institute Finland, 2021). However, the organic farms in Finland appear to perform better in terms of profitability (Natural Resource Institute Finland, 2019), an observation that has also been made in other countries (e.g. Crowder and Reganold, 2015).

3. Material and methods

Qualitative comparative analysis (QCA) is used in this study to identify the pathways that are connected to the varying organic shares of agricultural land in certain regions of Finland. The data are drawn from the literature, official statistics, and a large survey of organic farmers.

3.1. Qualitative comparative analysis

The factors or conditions affecting regional differences in the share of organic farming are analysed using QCA. QCA can accommodate a variety of techniques, and it has been increasingly utilised in such fields as political science, sociology, economics, geography, and applied sciences (Rihoux et al., 2013; Verweij and Trell, 2019). Moreover, it has also been employed in several studies to examine sustainability issues (e.g. Marks et al., 2018) and agricultural change/development (e.g. Qin and Liao, 2016; Florea et al., 2019). In particular, QCA has been used in recent organic related research. For example, Rabadán et al. (2020) identified the main reasons why consumers would choose not to buy organic lamb meat, and Bernal Jurado et al. (2017) determined the factors for economic efficiency in the organic olive oil sector. QCA can also be useful in formulating geographical questions that can reveal the complex processes that lead to spatial variations (Cairns et al., 2017; Verweij and Trell, 2019). In addition, QCA has been used in several regional analyses (e.g. Pagliarin et al., 2019; Cui et al., 2020).

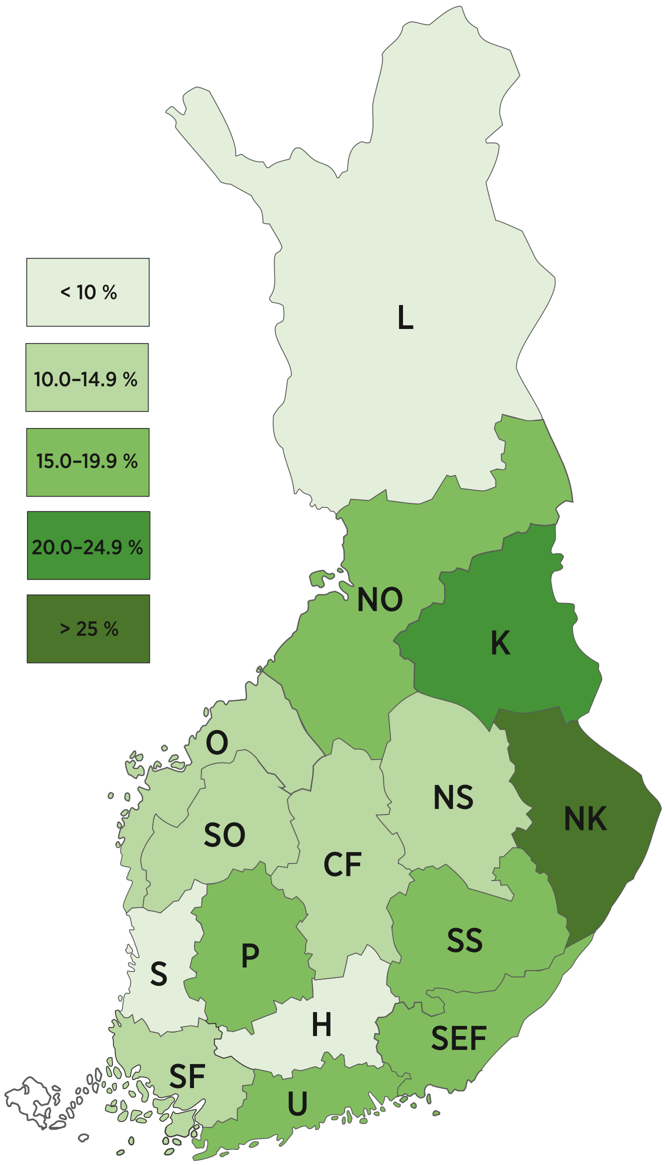

Fig. 2. Organic land as a proportion of the total agricultural area in mainland Finnish regions in 2019.
Source of data: Finnish Food Authority, 2020a.

QCA is designed for comparing a small or intermediate number of cases (Cairns et al., 2017; Ragin, 1987; Rihoux, 2006); it also incorporates both qualitative and quantitative methods. QCA emphasises the unique characteristics and the full complexity of every case (Cairns et al., 2017). It is also a comparative approach, which aids the identification of similarities and differences between cases. This process can be achieved using a truth table with a data matrix that expresses the possible combinations of causal conditions (Rihoux, 2006; Ragin, 1987). Moreover, QCA is an explanatory model that can be used to test a theory with empirical evidence and, significantly, reveal contradictions (Rihoux, 2006). In addition, QCA enables the assessment of multiple complex causalities (Cairns et al., 2017; Ragin, 1987; Rihoux, 2006). In contrast to many statistical methods, QCA is not designed to specify a single causal model that best matches the data; instead, it can be used to define the number and character of the different causal models that exist among selected cases (Ragin, 1987). According to Cairns et al. (2017), the QCA method has the potential to examine the complex spatial factors that affect area-level issues. Furthermore, multiple types of data can be used in QCA to enable comprehensive coverage of the studied topic (Verweij and Trell, 2019). These significant features support the decision to use QCA in our study.

This study employs the fuzzy-set QCA (fsQCA) method, and the analysis is performed with fsQCA 3.0 software (see Ragin and Davey, 2016). More specifically, we use a four-value fuzzy-set technique (see Ragin, 2008); therefore, in line with several previous studies, the data are calibrated into four-value categories (0, 0.33, 0.67, and 1) (e.g. Marks et al., 2018). The fuzzy-set technique was selected because of the nature of our data: both the outcome and the conditions are mostly quantifiable. Crisp-set QCA only allows dichotomous values (1 or 0) for the factors, whereas fuzzy-set QCA allows scores at intervals between 0.0 and 1.0 (Ragin, 2006). Therefore, the fuzzy-set approach enables us to categorise both the outcome and the conditions more precisely than other QCA techniques, as the conditions are often not clearly present or absent, but something in between.

Defining the studied outcome and the selected conditions marks the starting point in QCA. Researchers then produce a raw data table, in which each case indicates a specific combination of conditions and an outcome (Rihoux, 2006). It is recommended that a necessity analysis is conducted separately before a sufficiency analysis to test if some conditions are necessary for the outcome to be present (Ragin, 2008). For the sufficiency analysis, the software produces a truth table from the raw data and displays the data as a list of configurations (a given combination of conditions and an outcome). The Boolean minimization reduces the long Boolean expression to the shortest expression that will uncover the regularities in the data (Rihoux, 2006). More specifically, the Boolean minimization eliminates all the irrelevant conditions from the set relation (if none of its values affect the outcome) (see e.g. Thiem and Duşa, 2013). The consistency measures of the results indicate the set-theoretical importance of the outcome, and the coverage measures reveal the empirical importance of the results (Ragin, 2006). Overall, the results require some interpretation, potentially in terms of causality. Therefore, the interpretation demands a case-oriented review.

The studied outcome in this research is the regional organic shares of total agricultural land (ORG), which relates to the Finnish national target for organic farming. We selected the causation factors based on the previous literature and the number of variables that would be reasonable in proportion to the studied cases (see Marx, 2006). According to Ilbery et al. (2016), structural (e.g. marketing channels), physical (e.g. farm size), and socio-cultural (e.g. organic heritage) factors lead to different concentrations of organic farming. In addition, Helenius et al. (2007) stated that food systems are affected by several factors, such as socioeconomic and biophysical aspects, and people as actors and decision-makers. Therefore, it is necessary to include several different factors in this analysis. The following five conditions were selected; they cover all the categories in the conceptual framework of Ilbery et al. (2016) as well as one additional economic factor:

1) *Organic heritage* (HER) is one of the socio-cultural factors that leads to different concentrations of organic farming (Ilbery et al., 2016). A long organic regional heritage can be connected to the early development or the educational initiatives of organic farming in a region. The period before 1990 was selected for this analysis because it preceded the introduction of the first subsidies for organic farmers (Mononen, 2008; Lampkin et al., 1999). Current training and information related to organic farming is generally not based on location. As Wollni and Andersson (2014) discovered, information availability as well as social conformity have important roles in the decision-making regarding a conversion to organic farming. In addition, a long organic heritage in a region can be linked to an early social acceptance of organic farming and therefore also to the neighbourhood effects.
2) *Size of organic farms in hectares* (SIZ) is one of the physical factors connected to the concentration of organic farming according to the categorisation by Ilbery et al. (2016). In addition, the findings of

Pietola and Lansik (2001) indicated that farms with large land areas are more likely to convert to organic farming. In Finland, the statistics indicate a similar direction, as organic farms have been notably larger than conventional farms. In 2019, organic farms were about 70 ha on average, whereas the average size of all farms was 49 ha (Finnish Food Authority, 2020a; Natural Resources Institute Finland, 2021). An important factor is that larger farms appear to provide better sales opportunities for organic produce.

3) *Primary agricultural sector* (SEC) describes the regional agricultural differences connected to sectoral concentrations as well as the differing agro-ecological conditions. Regions with lower yield potentials concentrate on dairy cattle or other animal production, and regions with higher yield potentials focus on cereals production (see Table 1). Mixed and dairy farms have been connected to concentrations of organic farms in some countries (e.g. Gabriel et al., 2009). Ilbery et al. (2016) also referred to sectoral aspects as one of the physical factors in their categorisation. The findings of Pietola and Lansik (2001) indicated that agro-ecological conditions directly affect farmers' abilities to benefit from organic agriculture. Pietola and Lansik (2001), Gabriel et al. (2009), and Kuo and Peters (2017) noted that organic farms are more likely to be located in areas with lower soil quality and lower average yield potential. Malek et al. (2019) found similar patterns in a number of other countries. Hence, a farm located in an area with a low soil quality and yield may consider organic farming as a means to increase their profits (Kuo and Peters, 2017).
4) *Markets (MAR)* for organic products are one important factor affecting production. For instance, population density, which is one of the physical factors included in the categorisation by Ilbery et al. (2016), can influence demand for organic food. According to Malek et al. (2019), a large consumer base close to producers can affect the location of organic farms. On the other hand, research on market concentration/diversity has shown that the availability of markets for organic products influences the conversion decision (Ilbery et al., 2016; Kauffman et al., 2011; Schmidtner et al., 2012). Together, population density and market concentration describe the broad market situation in the regions.
5) *The importance of subsidies* (SUB) relates to the assumption that subsidies and other economic factors are among the most important drivers for conversion to organic agriculture (Kaufmann et al., 2011; Pietola and Lansik, 2001). In addition, subsidies seem to play different roles in different yield level areas (Pietola and Lansik, 2001), even though subsidies for organic farming in Finland are calculated according to land area (per hectare) and the number of animals, meaning that subsidy levels are the same for each region (Finnish Food Authority, 2020b). This may be affected, in part, by the profitability of agriculture in different areas of Finland. Although the subsidy levels are the same for all Finnish farms, the relative importance of the subsidies seems to vary in each region. The results of Läpple and Kelley (2015) also indicated that the impact of economic incentives on the adoption of organic farming varies.

The selected factors can be structured according to Fig. 3 (see Ilbery et al., 2016).

After selecting the studied outcome and the conditions, the recommended necessity analysis was performed prior to the sufficiency analysis. The sufficiency analysis was then performed with the recommended 0.8 consistency threshold (Ragin, 2008). The frequency cut-off was set to 1. Based on previous studies, the conditions were assumed to be present (values over 0.5). The reported outcome in this study was based on an intermediate solution.

3.2. Data collection

The complexity of the topic and the variety of the conditions required different kinds of data and methods. Thus, we gathered data on the

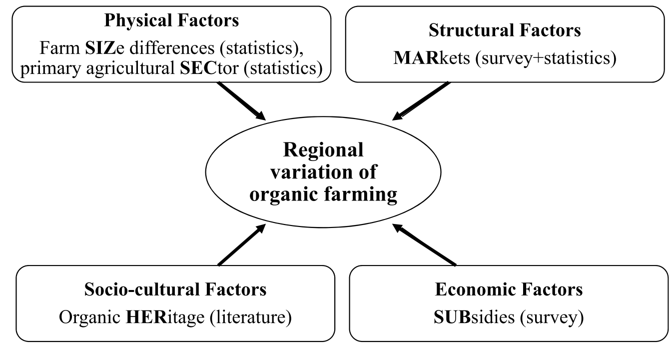

Fig. 3. The selected factors for the qualitative comparative analysis (and the data sources).

Finnish regions and organic farming from official statistics and key literature, and we also conducted an extensive survey.

3.2.1. Statistics and the literature

Official statistics were used to gather the data on organic farming (ORG and SIZ), primary agricultural sectors with average crop yields (SEC), and population density (part of MAR) (see Table 1) (Finnish Food Authority, 2020a; Natural Resource Institute Finland, 2021; Official Statistics of Finland, 2020).

We collected the organic heritage information (HER) from the existing literature. A wide range of literature was used to gather information on essential organic farming-related education and other development work, such as the presence of active organic advisors in different regions prior to 1990 (e.g. Mononen, 2008; Nykänen and Järvenpää, 2006; Yli-Viikari, 2016; Laukkanen, 2017). To ensure that all relevant material was considered, we consulted an experienced organic farming advisor.

3.2.2. Survey and Herfindahl–Hirschman index

The data on subsidies (SUB) and market diversity (part of MAR) were obtained by conducting a survey. The survey was sent to all Finnish organic producers who had given permission to use their contact information. The survey, which was conducted as an electronic survey in 2015, was complemented by postal surveys and telephone interviews. According to the Finnish Food Authority (2020a), there were 4247 organic farms in Finland in 2015. A total of 840 (20%) organic farmers answered the survey. By region, 16–23% of organic farms were covered.

The organic farmers who answered the survey represented farms of different sizes and types. Approximately 600 farms produced field crops, 205 meat, 95 horticultural products, 41 milk, 24 eggs, and 23 other produce, such as honey. Some of the farms produced several products. Thus, the survey respondents represent comprehensively different type of organic farms in Finland, roughly in proportion to organic agricultural land. The average farm size in our survey was approximately 57 ha; according to the Finnish Food Authority (2020a), this was about 5 ha larger than the average for organic Finnish farms in 2015. The respondents had begun organic farming between 1966 and 2014; therefore, answers were obtained from farmers with a wide range of experience. Overall, the survey provided a representative sample of organic Finnish farms.

The survey included several questions about the background information of the farm (e.g. region, year of organic conversion, and farm size). The research questions, that were mostly structured, concerned the conversion, sales, economics, and estimates of the organic farming development. The most important questions for this study addressed the reasons why the farms were converted to organic and how the sales of their produce were distributed across the different market channels and regions. The respondents were asked to select the two most important reasons for the conversion from a predefined list of 13 options (e.g. better price for the products, environmental aspects/sustainability, subsidies, animal welfare, and demand for organic products); one option also enabled an open response. The reasons listed in the question were obtained from previous studies and surveys. The marketing channels question addressed how their organic produce sales were divided into seven categories of channels (in percentages): direct marketing, sales to primary production, sales to the processing sector, sales to the retail and wholesale trade, sales to private kitchens, sales to the public sector, and other channels. In addition, they were asked to provide their sales distribution divided as shares (%) in their own region (NUTS3), the rest of Finland, and abroad.

The survey data on markets was finally formed into regional market concentration indexes based on the Herfindahl–Hirschman index (HHI). This index is commonly used to measure market concentration and has also been employed in cases related to farming (e.g. Ilbery et al., 2016). The indexes were calculated to reveal the concentration of regional organic sales, not the concentration of individual farms. The formula for the HHI is:

$$HHI = s_1^2 + s_2^2 + s_3^2 \ldots s_n^2$$

where: s_n = the market share percentage in a market channel (n).

All in all, the survey reveals important experience-based information regarding the organic market and the reasons for a conversion to organic farming. Therefore, the views of current organic farmers can help identify the reasons for regional differences in the scope of organic farming.

4. Results

4.1. Results of the survey

The results of the survey highlighted economic and environmental factors as significant drivers for converting from conventional to organic farming. The most important reason given by the farmers was smaller production costs leading to better viability, with 36% selecting this as their first option. The second most popular reason was ecology or sustainability, with 19% of farmers selecting this as their primary motivation. These two options were highlighted as significant in every region. Other reasons that were also frequently mentioned were healthiness and cleanness, a better price for their produce, subsidies, and the farm's production already approximating organic farming practices. In addition, the survey revealed a wide variety of other reasons, from principles and ideology to specialisation and an interest in organic production.

As anticipated, the results varied between the regions. One significant difference related to the importance of subsidies in the decision to convert from conventional to organic farming (Fig. 4). Over 40% of the organic farmers in Kainuu stated that subsidies were among the two most important reasons for their farm conversion. In contrast, none of farmers from Satakunta selected this as an important option. It is interesting to note that Kainuu had the highest organic share and Satakunta had the lowest organic share. Indeed, the four regions where subsidies were given the highest importance were among the regions with the highest organic shares.

The development or availability of markets for organic products is also an important factor affecting farmers' conversion decisions (Kauffman et al., 2011; Schmidtner et al., 2012). The use of a broad range of marketing channels in a particular region indicates diverse demand and better sales opportunities. The results of the survey showed considerable variation in the utilised marketing channels (Table 2). One of the regions (Uusimaa) used all seven categories, and in most of the regions, farmers sold their products to five or six of the marketing channels. The share of sales to the processing industry varied between 20% and 57%; primary production sales were between 25% and 57%; and direct sales varied between 0% and 20%. The proportion of sales to the retail and wholesale trade was the highest in Southwest Finland (19%) and the lowest in North Ostrobothnia (1%). Private restaurants and canteens and the public sector only accounted for a very small share of the sales (0–3%). Other smaller markets included, for example, sales to abattoirs and sales through food collectives. According to the survey, the majority of the sales took place within the producer's own region, 66% on average.

In order to reveal regional differences in market concentration, the market concentration index (HHI) was calculated for all the regions. A higher share was associated with more concentrated organic farmers' markets in a region. The results also revealed that the least concentrated markets were located in some southern regions, such as Southwest Finland, Häme, and Uusimaa (see Table 2). In contrast, the highest concentrations were found in Western Finland (e.g. Satakunta and South Ostrobothnia).

4.2. QCA operationalisation and results

Table 3 shows the operationalisation of the outcome: the organic share of total agricultural land in 2019. The outcome was operationalised by dividing the regions into four different groups: those with a clearly low organic share (0), a slightly below average share (0.33), a

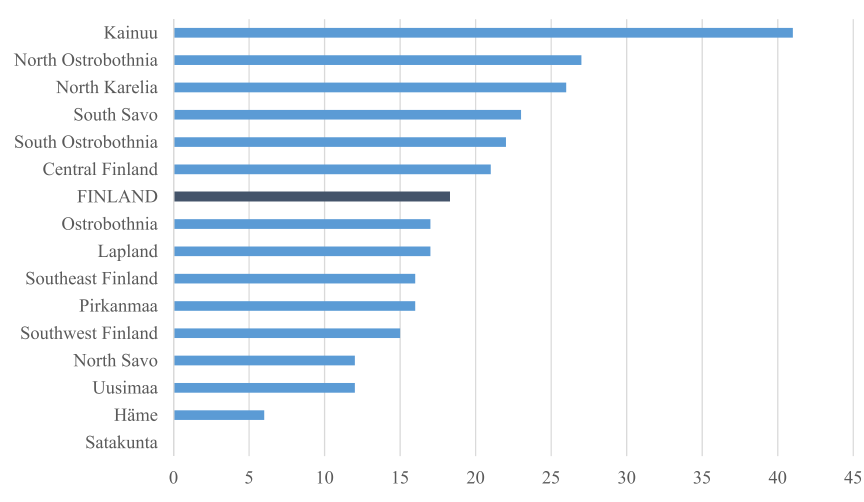

Fig. 4. The proportion of organic farmers citing subsidies as one of the two main reasons for converting from conventional to organic agriculture.

Table 2
Sales by markets (average share, %) and the market concentration index (HHI).

Region	Direct marketing	Retail and wholesale trade	Private restaurants and canteens	Public sector	Primary production	Processing industry	Other	HHI
Southwest Finland	12	19	0	0	34	34	1	0.28
Häme	20	11	2	0	25	41	1	0.29
Uusimaa	12	9	2	1	28	45	3	0.30
South Savo	11	7	2	0	41	38	1	0.33
Ostrobothnia	9	10	0	0	31	47	3	0.33
Pirkanmaa	11	4	2	0	40	41	2	0.34
FINLAND	9	6	1	0	38	43	2	0.34
Central Finland	11	5	3	0	56	22	3	0.38
North Karelia	9	2	1	0	36	49	3	0.38
Kainuu	10	2	2	1	35	50	0	0.39
Lappland	13	8	2	0	57	20	0	0.39
North Ostrobothnia	9	2	0	0	44	44	1	0.39
Southeast Finland	6	8	0	2	30	54	0	0.39
North Savo	7	2	0	0	57	30	4	0.42
South Ostrobothnia	4	4	0	0	33	57	2	0.43
Satakunta	0	4	0	0	45	49	2	0.45

slightly above average share (0.67) and a clearly above average share (1). Henceforth, the term high organic share region refers to regions with a score above the average (1 and 0.67).

For most of the conditions (Table 3), we used the national average level to establish the position of demarcation between 0.33 and 0.67. This was a natural cut-off point to highlight cases below and above the average, as the studied cases covered all the mainland Finnish regions. The values 0.33 and 0.67 concern equal value ranges from the average national level. These value ranges were formed statistically: values of 0.67–1 and 0–0.33 were divided so that averages above or below 0.5 served as devisors. A value of 1 indicates that it is closest to the theory explaining the regional differences in organic farming.

Fuzzy-set scores were set to the outcome and to all of the selected conditions in every case (Table 4). The data indicated that a total of three regions have a clearly high organic share (1), while four are slightly above the average (0.67), four are slightly below the average (0.33), and the remaining four are clearly below the average (0).

The necessity analysis revealed that none of these conditions are necessary for a high organic share of total cultivated land when using a score of 0.90 as a consistency threshold for a necessary condition, a method similar to Marks et al. (2018). Overall, the necessity analysis scores for consistency varied from 0.55 to 0.80 (see Table 4), with the highest scores associated with sectors as well as subsidies and the smallest markets. Our conceptual approach implies that different factors impact different regions; therefore, even the lowest score conditions were included in the sufficiency analysis.

Table 5 presents the pathway results of the sufficiency analysis. The results showed three different pathways and covered five of the seven regions with a high organic share. None of the conditions are present in every pathway leading to a high organic share, which confirms that none of the conditions are necessary for a high organic share. The most common pathway (1) to a high proportion of organic farming includes a long organic heritage, a concentration on dairy farming, and a region that places a high importance on subsidies. Pathway 1 represents the three highest organic shares in Finland (Kainuu, North Karelia, and South Savo). Pathway 2 differs from the first pathway in only one factor. Instead of a long heritage, it includes a larger farm size. Pathway 2 covers two regions, North Ostrobothnia and North Karelia. Pathway 3 is represented by one region (Uusimaa). In pathway 3, a long organic heritage and larger farms and markets enable the high organic share. These pathways do not apply to two Finnish regions with higher organic shares, Pirkanmaa and Southeast Finland.

In our results, consistency scores for all pathways are over the recommended 0.8. In two of the pathways, the consistency score is 1.00. The coverage scores are highest in pathways 1 and 2 (0.45). In the third pathway, the coverage score is 0.15. The solution score of 0.89 for solution consistency is over the threshold score of 0.75. Thus, the results can be considered sufficient to establish a set-theoretical relation. The solution score for coverage is 0.80, indicating that the three pathways apply to 80% of Finnish regions with an above-average organic share.

The analyses for the low share organic farming regions confirmed the logic of the results for regions with a high organic share. One of the most common pathways to a low organic share (coverage 0.52, consistency 0.86) was the mirror image of pathway 1: a lack of an organic heritage, a concentration on cereals production, and a low value placed on subsidies. Overall, the analysis for the low organic regions revealed three different pathways with a solution coverage of 0.88 and a solution consistency of 0.88. These solutions cover all low organic regions as well as some high organic share regions. Thus, the absence of the selected conditions clearly reveals why some regions have a low proportion of organic land.

5. Discussion

This study reveals new knowledge about the regional differences in the share of organic cultivated land in mainland Finland. This kind of knowledge is needed to achieve the targets to increase organic farming and further promote rural development and a sustainability transition (e.g. Finley et al., 2018; Adamtey et al., 2016; Seufert and Ramankutty, 2017). In addition, our results are similar to those of Cairns et al. (2017), as we show that QCA can be a valuable method for theory-testing regional studies that focus on complex entities.

Our findings confirm the assertion of Ilbery et al. (2016) that the regional concentration of organic farming is explained by a combination of different factors rather than a single factor. However, our results suggest that the categorisation by Ilbery et al. (2016) should be supplemented with clear economic factors, such as the importance of subsidies, to improve coverage of the possible causes of regional concentrations in organic farming. The importance of subsidies has been highlighted in earlier studies (e.g. Kaufmann et al., 2011; Pietola and Lansik, 2001); however, previous research focused on farmers' general decision-making rather than addressing the connection with regional differences. The location of farms in different Finnish regions affects their economic opportunities, and therefore the role of economic aid can vary. Our findings highlight the importance of economic aspects and align with the results of Lehtimäki and Virtanen (2020) on the economisation of organic agriculture in Finland, at least to some extent.

A close review of the data reveals that different types of regions utilise different pathways to achieve a high share of organic cultivated land. There are significant regional differences in cultivation conditions

Table 3
Definitions and operationalisation of the outcome and conditions.

Definition	Operationalisation (detailed value range)
Outcome:	
ORG The organic share of total agricultural land (%)	0 = significantly below the average national level (<11%) 0.33 = slightly below the average national level (11–14%) 0.67 = slightly above the average national level (14–17%) 1 = significantly above the average national level (>17%)
Conditions:	
HER Organic heritage in the region	0 = no essential development or education work in the region before 1990 1 = essential development or education work in the region before 1990
SIZ Average size of organic farms (hectares)	0 = significantly smaller than the average national level (<52ha) 0.33 = slightly smaller than the average national level (52–60ha) 0.67 = slightly larger than the average national level (61–69ha) 1 = significantly larger than the average national level (>69ha)
SEC Primary agricultural sector (in hectares together with cereals production yield levels)	0 = cereals production as the primary agricultural sector with cereals production yields above the national average 0.33 = cereals production as the primary agricultural sector with yields slightly below the national average 0.67 = other plant production as the primary agricultural sector and dairy farming secondary 1 = dairy farming as the primary agricultural sector (+cereals production yields below the national average)
MAR Markets (population density, people/km^2 and market concentration, HHI)	0 = the lowest population densities (<10) with the market concentrated index above the national average (>0.34) 0.33 = population density below average (<18) with the market concentration index above or near the national average (≥0.33) (excluding the combination in value 0) 0.67 = population density above average (>18) with the market concentration index at ≥0.31 1 = the highest population densities (>26) with the most diverse markets (<0.31)
SUB Subsidies (% of organic farmers who viewed subsidies as one of the key factors in their conversion decisions)	0 = significantly below the average national level (<12%) 0.33 = slightly below the average national level (12–17%) 0.67 = slightly above the average national level (18–23%) 1 = significantly above the average national level (>23%)

in Finland; therefore it is logical that the key factors involved in a high organic land share vary. Pathway 1 applies to the regions in Eastern Finland with the three highest shares of organic farming (North Karelia, Kainuu, and South Savo). This pathway confirms the results of Pietola and Lansik (2001) concerning low yields and subsidies, although the authors did not consider relevant educational or development programmes in the earlier decades of organic farming. Our findings suggest that a long organic heritage is one of the key factors affecting regional concentrations of organic farming, a result also noted by Ilbery et al. (2016). In comparison to other regions, a long regional organic heritage can represent an early social acceptance and learning from regional organic education actors or neighbours. As Lähdesmäki et al. (2019) concluded, social acceptance is a key factor in achieving sustainability goals. In addition, increased knowledge helps to make the decision about the conversion (Mononen, 2008). The absence of markets in this path may be due to the focus on dairy farming in these regions; dairy farming markets are often national rather than regional and rather concentrated. Although markets can still be important in these regions, they are not particularly versatile and may not be located locally.

Table 4
Fuzzy-set data for outcome and conditions.

Case	ORG	HER	SIZ	SEC	MAR	SUB
North Karelia	1	1	0.67	1	0	1
Kainuu	1	1	0.33	1	0	1
South Savo	1	1	0	1	0.33	0.67
Pirkanmaa	0.67	0	0.33	0.33	0.67	0.33
North Ostrobothnia	0.67	0	1	1	0.33	1
Southeast Finland	0.67	0	1	0.33	0.67	0.33
Uusimaa	0.67	1	0.67	0	1	0.33
North Savo	0.33	0	0.33	1	0.33	0.33
Ostrobothnia	0.33	0	0	0.33	0.67	0.33
South Ostrobothnia	0.33	1	0.67	0.33	0.33	0.67
Southwest Finland	0	0	0.67	0	1	0.33
Central Finland	0	0	0	0.67	0.33	0.67
Häme	0	0	0	0	1	0
Satakunta	0	0	0.33	0	0.67	0
Lapland	0	0	1	1	0	0.33
Necessity analysis						
Consistency		0.60	0.60	0.80	0.55	0.80
Coverage		0.80	0.57	0.67	0.50	0.73

Table 5
Three different pathways to a higher organic share.

	HER*SEC*SUB (Pathway 1)	SIZ*SEC*SUB (Pathway 2)	HER*SIZ*MAR (Pathway 3)
Consistency	1.00	0.82	1.00
Coverage	0.45	0.45	0.15
Regions covered	North Karelia, Kainuu, South Savo	North Ostrobothnia, North Karelia	Uusimaa
Solution consistency 0.89			
Solution coverage 0.80			

Overall, pathway 1 covers all the subsystems described in the food system conceptualization by Helenius et al. (2007): socioeconomic subsystems (subsidies), people as actors/decision-makers (heritage), and biophysical subsystems (yields/sectors). Despite initially relating to the food system more generally, these three subsystems or categories seem to offer an apt categorisation of the different factors that are connected to the variation in regional organic farming.

Pathway 2 describes the relevant factors in Northern Finland (North Ostrobothnia) and also in one eastern Finnish region (North Karelia). The fact that both the first and second pathways apply to North Karelia reinforces its position as the region with the highest share of organic farming in Finland. In turn, pathway 3 illustrates the situation in Southern Finland (Uusimaa), where markets seem to play an important, albeit not singular, role in the development of a high organic share. Our finding that markets are a significant factor aligns with the conclusions of several previous studies (Ilbery et al., 2016; Kauffman et al., 2011; Malek et al., 2019; Schmidtner et al., 2012).

The present study confirms several previous findings regarding the conditions in the regions with a high proportion of organic land. For example, as in other countries (e.g. Gabriel et al., 2009; Kuo and Peters, 2017), lower agro-ecological conditions seem to play an important role in characterising the regions with the highest organic shares in Finland.

However, agro-ecological conditions alone are insufficient to explain the high shares in these regions; instead, it appears to be the result of a combination of several conditions, as noted by Ilbery et al. (2016). In addition, while markets seem to be important, market diversity and close proximity seem to be more relevant in regions that focus on cereals production. Moreover, the absence of these conditions seems to illustrate why some regions have a low share of organic land. Even though the unique characteristics of different countries and regions suggest that the pathways for Finland are not necessarily universally applicable, it is likely that similar factors and especially a combination of several conditions also affect regional differences and the share of organic land in areas outside Finland, particularly in middle-income and high-income countries. For example, it seems that also in other countries, especially in combination with other factors, markets play a vital role particularly in some regions, dairy farming is connected to some organic concentrations, and subsidies can effectively increase organic farming in certain areas. Therefore, same political approach to increase organic farming does not necessarily work for every region.

Our research contains several limitations that should be addressed in future research. The first limitation was that we were unable to analyse all of the possible factors that may affect the share of organic cultivated land. The literature suggests that the concentration of organic farming is affected by more factors than the five included in our analysis (e.g. Ilbery et al., 2016). In addition, the data from Pirkanmaa and Southeast Finland indicate that there may be other relevant factors outside the selected conditions. Therefore, the results cannot be regarded as completely comprehensive in terms of explaining the regional differences in the proportion of organic farming. One additional condition could be the role of wholesalers. However, according to our survey, wholesale (together with retail) seems to have a fairly small role in the Finnish organic market, at least from a farming point of view. Data limitations and the appropriate number of conditions for a QCA method (see Marx, 2006) influenced the number of selected conditions in this study. The conditions were also carefully selected based on previous studies and the authors' knowledge of regional features. The second limitation relates to the changing situation in the spatial share of organic farming, whereby the selected reference year may influence the results. However, changes in the share of organic farming occur relatively slowly, and regions with the highest organic shares have held that status for some time. Only regions with close to average values have witnessed more notable changes in recent years. In addition, the conditions were formed to include data that related to different periods: the period preceding 1990 (HER), a wide range of years during which farmers converted to organic farming (SUB), and the most recent period (e.g. SIZ).

6. Conclusions

Our study contributes to the discussion on the reasons for regional differences in the share of organic cultivated land. To understand the causes for the uneven regional distribution of organic farming, it is essential to consider a number of different factors and their combinations. Previous studies have approached the issue from different perspectives, but our research is the first to combine socioeconomic, biophysical, and person-centred aspects in a single study. Our utilisation of QCA allowed us to fully examine the complexity of the issue. According to our results, three different combinations of conditions have led to a higher share of organic farming in certain regions of Finland. The importance of subsidies is one of the key factors that is connected to these regional differences. Thus, we suggest that it is essential to include economic factors in any examination of regional differences in the share of organic farming. Moreover, subsidies seem to be a rather efficient approach to promote organic farming in some regions.

This study reveals new information on the different factors or conditions that have led to a higher organic share of total agricultural land in particular regions of Finland; therefore, our results can be applied to organic farming development work. The results indicate that high organic farming shares are either sector/yield and subsidy-driven, with one additional factor, or more market-driven. Therefore, policies combining subsidy-led and market-led approaches could be the most successful strategy to affect different type of regions. In addition, active work addressing development or education in the regions produces positive results, at least in the longer term. Future research should also study the factors at a local level, as additional information on local-level differences could improve the knowledge on the regional variation of organic farming.

Author statement

Susanna Kujala: formal analysis, investigation, writing – original draft and conceptualization. Outi Hakala: writing – review and editing as well as conceptualization. Leena Viitaharju: investigation, writing – review and editing as well as conceptualization.

Declaration of competing interest

None.

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