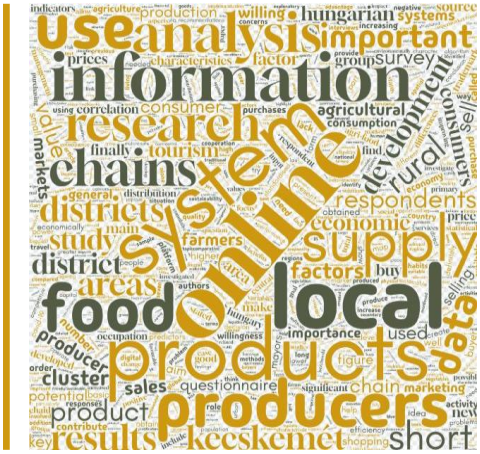
European Countryside | volume 17 | No. 1 | p. 111-136 | DOI: 10.2478/euco-2025-0006

DIGITALIZATION AND SHORT FOOD SUPPLY CHAINS IN HUNGARY





[1] Krisztián Ritter, PhD, associate professor, Department of Rural and Regional Development, Institute of Rural Development and Sustainable Economy, Hungarian University of Agriculture and Life Sciences, Gödöllö, Hungary, ORCID: 0000-0003-1206-3159, email: ritter.krisztian@uni-mate.hu

[2] Zsolt Ádám Orbán, PhD, guest lecturer,_Department of Rural and Regional Development, Institute of Rural Development and Sustainable Economy, Hungarian University of Agriculture and Life Sciences, Gödöllö, Hungary, ORCID: 0000-0002-9849-1973, email: orban.zs.adam@gmail.com

Received 10 August 2024, Evaluated 23 January 2025, Revised 10 February 2025, Accepted 27 February 2025

Abstract: The study focuses on the relationship between local producers and consumers in agri-food chains and the future potential of online sales channels in the rural economy through the example of a Hungarian micro-region. The paper categorises the Hungarian micro-regions and identifies the districts that could be considered for the introduction of such online system by multivariable secondary data analysis. It also identifies the conditions for the operation of that system from both the consumer and producer perspectives and determines the main users of it and its potential rural development impacts. The results emphasise the increasing role of short food supply chains and online solutions in rural development strategies. Our main proposal is to develop and test an online system that could support the development of the local economies and the competitiveness of rural areas.

Keywords: agriculture, local product, online sales, rural development, short food supply chain, Hungary

Absztrakt: A tanulmány a helyi termelők és fogyasztók közötti kapcsolatot, illetve az online értékesítési csatornák jövőbeli potenciálját tárgyalja egy magyar járás példáján keresztül. Többváltozós szekunder elemzés segítségével kategorizálja a magyarországi kistérségeket, illetve kijelöli azokat a járásokat, melyek a vizsgált online rendszer bevezethetősége szempontjából később szóba jöhetnek. Primer kutatás keretében a rendszer működtetésének feltételeit azonosítja mind fogyasztói, mind termelői oldalról, továbbá beazonosítja a rendszert leginkább használók körét, illetve szélesebb, vidékfejlesztési hatásait. Eredményeink hangsúlyozzák a rövid élelmiszer-ellátási láncok és az online megoldások növekvő szerepét a vidékfejlesztési stratégiákban. Legfontosabb javaslatunk egy online rendszer kialakítása/tesztelése, amely támogathatja a helyi gazdaság fejlődését, a vidéki területek versenyképességét.

Kulcsszavak: rövid élelmiszer-ellátási lánc, helyi termék, mezőgazdaság, online értékesítés, vidékfejlesztés, Magyarország

Highlights

- Importance of short food supply chains (SFSCs) and their role in rural economy
- The factors influencing disparities in Hungary and the type of territorial clusters
- Consumer perception of the online system under study
- Producer perception of the online system under study
- Rural development aspects and areas relevant to the online system under study

1. Introduction

There is a need for disruptive[3] solutions in agribusiness (Christensen et al. 2018). Disruptive innovation can lead to outcomes such as the exploitation of domestic products, the emergence of new venture capitalists and startups, and innovative technologies that can revitalize the food market (see e.g., Rowan and Galanakis 2020; Thulasiraman et al. 2021; Lakner 2022; Bujdosó and Gyurkó, 2018).

After the outbreak of the pandemic COVID-19 and the Russian-Ukrainian conflict, the world had to wake up to the fact that serious food security and food supply issues have emerged, highlighting the need for technological and social reforms in food supply, as well as innovations in the agri-food sector that require a high degree of flexibility in supply chains (Sid et al. 2020; Stanley 2020; Kamble and Mor 2021).

[3] Disruptive technology usually refers to an innovation that creates a new market and value network that eventually disrupts the existing market, replacing well-established technologies and products (Kamble and Mor 2021).

The literature proposes some solutions for the future. According to Singh et al. (2021), product storage and distribution networks need to be reassessed to manage changing demand patterns and minimise disruption. Based on Reardon et al. (2020) and Sharma et al. (2020), to take advantage of digital technology to extend supply chain flexibility, the technological resources and information processing capabilities available in agri-food supply chains need to be harnessed. Sharma et al. (2020) also advice that the advantages of artificial intelligence – including big data analytics – should be exploited to increase transparency and operational efficiency in supply chains. Flexible production systems and real-time traceability could also improve the food supply chain (see Ivanov and Dolgui 2020 or Kamble and Mor 2021).

The key word of the century is, without exaggeration, digitalisation, which is present in all areas of human activity (see Maslaric et al. 2016). In the case of logistics activities, digitalisation means the virtualisation of supply chains (Verdouw et al. 2016), and the use of IoT (Internet of Things), which imply greater flexibility, productivity, cost-effectiveness and, in essence, greater efficiency in logistics activities. Digital technologies can create entirely new capabilities to better plan, design, implement and control the flow of goods, information and value in the food supply chain. In essence, a "new" form of food supply chain is needed. This may be particularly important for the younger generation, which in many respects already approaches and values the role of the whole agribusiness in a different way (Lakner et al. 2020). According to Verdouw and colleagues (2016), the widespread adoption of future internet applications is expected to change the way food supply chains operate in unprecedented ways. The internet will help to reintroduce old services (Chen et al. 2014), could be very useful in improving local food supply chains by increasing access to local products and enabling faster shopping in traditional markets. However, internet-based services not only affect the way shoppers order and purchase food, but also have a significant impact on business models and the structure of the physical distribution network, which can have a significant capital pull effect (see Vermesan et al. 2022; Todorovic et al. 2018; Bujdosó et al. 2016; Gerencsér and Áldorfai, 2017)

Based on the above, the central question of this article is whether people would be willing to use an online system where producers and consumers can interact, exchange information and even make purchases. Our research along this question aims to produce concrete and practical results that can provide effective solutions to real problems.

2. Literature review

2.1 Short food supply chain

Following the industrial revolution, the agricultural sector has moved towards a supply chain model that maximises efficiency to reduce prices for consumers. This has led to the emergence of a globalised agri-food system over the last twenty to forty years (Gereffi 1994). The main advantages of this global food supply system are lower food costs and a much greater variety of food (Welch and Graham 1999). This is achieved through large-scale production and a well-developed logistics system. The costs of large-scale farming are generally lower, especially compared to organic farming. This is mainly due to the use of fertilizers, large-scale cropping and intensive farming (Wang et al. 2022).

Concerns about agricultural sustainability and food security are leading to a growing number of alternative food production systems to address the sustainability problems of global supermarket-based agriculture (Renting et al. 2003). These innovative food supply systems do not have the main characteristics of traditional global supermarket-based food chains (Higgins et al. 2008) and have been prompted by the need for spatial, economic and social re-localisation (Goodman and Goodman 2008).

In order to mitigate sustainability-security concerns and improve farmers' livelihoods, interest in these new forms of food supply chains has increased in academic and policy-making circles over the past two decades (Owen 2014). Among these innovative forms of food supply systems, short food supply chains (SFSCs) are considered a prominent and sustainable practice (see Kumar et al. 2019; Wang et al. 2018; Marsden et al. 2002, Wang et al. 2022).

Recent studies have highlighted how digital transformation can enhance the effectiveness of short supply chains. Wang et al. (2024) emphasize that digital technologies can fundamentally improve operational efficiency and market connectivity in food supply chains, while Suali et al. (2024) demonstrated how e- commerce platforms contribute to supply chain resilience under exogenous disruptions. Additionally, Belhadi et al. (2024) showed that digital capabilities enable better risk management and more efficient response mechanisms in agri-food supply chains, particularly during periods of uncertainty. Bertalan et al. (2023) underlined that blockchain technology offers the potential for reliable data management and simplified administration and is, therefore, definitely a tool to consider if the aim is to enhance effectiveness and sustainability in food chains.

Besides the digital transformation, human activity has a negative impact on the planet. These negative impacts have been so strong that an epochal shift known as the Anthropocene[4] has occurred (Waters et al. 2016). Agriculture has contributed significantly to these changes (Kavanagh et al. 2018) through a globalised and industrialised agri-food system that has affected human nutrition and health in addition to environmental problems (Corsi et al 2018). As a consequence of this situation, a significant proportion of society has a negative perception of the global supermarket-based agri-food system and is interested in creating a more socially, economically and environmentally just system (see Watts et al. 2018).

These opinions have been reinforced in recent decades. An increasing number of people are concerned about the impact of their individual consumption and actions on the environment (Brochado et al. 2017). Thus, the ethical values of some consumer groups are characterised by a concern about their consumption (Cembalo et al. 2015) and a constant search for green and healthy products with specific quality and authenticity characteristics (Olsen and Bánáti 2014; Jarzębowski et al. 2020). It is along these considerations and concerns that SFSCs have emerged (Chiffoleau et al. 2019; Escobar-López et al. 2021). The concept of SFSC is defined by an EU regulation as "a *supply chain made up of a limited number of economic operators committed to cooperation, local economic development and close geographical and social links between producers, processors and consumers"* (Article 2(m) of Regulation (EU) No 1305/2013).

The Hungarian regulation gives the following definition: *'[a] short supply chain is a cooperation in which farmers work together to develop and operate a new or improved form of sales involving up to 1 intermediary, which becomes a regular form of sales for its members'* (Reszkető 2015: p. 78). In the Rural Development Programme 2014–2020, the focus has already shifted to addressing the problems of short supply chains: *'Short supply chain producers are typically the smallest (individual or micro-enterprises), and thus have weak advocacy skills and are not familiar with complex cooperation systems, and it is important to have a thematic sub-programme for their development with a separate framework, a clear, problem-focused thematic sub-programme for their development'* (Rural Development Programme 2014–2020: p. 98).

The short supply chain is one of the key themes of the research, as it brings together all the factors that can make rural quality of life initiatives successful. However, these initiatives will not only benefit people living in rural areas, but also the urban population, who will be able to buy healthier and more reliable products at a lower price, while local infrastructure will be improved through new investments, increased tax revenues for the government, and other indirect effects.

2.2 The importance of short supply chains and their role in the rural economy

While classical long chains, especially international chains, exploit their competitive advantage and economies of scale, contribute to the development of industrial technology, meet growing demand, improve information availability, and have ample risk capital (Mentzer et al. 2007; Bovet and Sheffi 1998; Bański 2024), short supply chains can help long chains diversify sources of food supply (Galli and Brunori

[4] With the drastic increase in human population and the need to feed endless economic needs, humanity has entered a new era, which geologists have dubbed the Anthropocene Epoch (Crutzen, 2002; Steffen et al., 2011). In this era, the effects of economic development are affecting and destabilizing the climatic properties of our land and destroying our natural areas (Brown 2015, Ims et al. 2019).

2013). This direct link between producers and consumers provides additional information about knowledge, value, product meaning, and the producers and consumers themselves, rather than simply selling the product (Marsden et al. 2002).

Some researchers have shown a change in behaviour among participants in the community-supported agriculture model, implying a change in cooking and eating habits, mainly related to the consumption of local, seasonal and healthier foods (Hayden and Buck 2012). In addition, a positive correlation has been found between the density of local markets and the body mass index of Italian adults, suggesting that local markets provide better quality food (Bimbo et al. 2015), thus promoting healthy diets (Jarzębowski et al. 2020; Šťastná and Vaishar 2022).

In recent years, research on short supply chains has shown that they contribute to the sustainable development of the economy, society and the environment (see e.g., Canfora 2016; Tanasă et al. 2015; Šťastná and Vaishar 2022). Other evidence suggests that short supply chains generate cyclical benefits for farmers, consumers and local communities, create jobs, contribute to increased incomes for people living in rural areas, increase job satisfaction, increase consumer confidence in the agricultural system, minimise waste and reduce migration from rural areas to urban centres (Roep and Wiskerke 2006; Bui et al. 2021).

From a financial point of view, Falguieres et al (2015) argued that short supply chains are important for producers because they allow them to operate more freely, unconstrained by contracts and buyer demands and obligations. Furthermore, according to Sgroi (2015), by not being dependent on the buyer and selling their commodities directly to buyers, producers achieve higher profit margins due to short supply chains. According to Levidow and Psarikidou (2011), producers' revenue per product is also much higher at nearly the same cost ratio due to the exclusion of intermediaries from the chain.

According to Blanquart et al. (2010), the income of buyers can be as high as 60% of the total income per product. According to Fehér (2012), when a buyer is involved in the product supply chain between the producer of the product sold and the final consumer (buyer), the producer usually receives only 20% of the selling price of the product sold as the purchase price (cited in Kiss 2020).

According to Aguiar et al (2018), short supply chains allow producers to expand their product portfolio and thus sell their products at a higher profit margin. Schmid et al. (2014) find large differences in operational efficiency across short supply chain collaborations. Sellitto et al. (2018) concluded that short selling distances in kilometres are not a sustainable financial advantage for short supply chains in the long run.

Short-supply chain economies produce higher value-added products, contribute to a favourable rural economy (DuPuis and Goodman 2005), create new economic space and halt or mitigate the decline of rural services and agricultural production infrastructure (Renting et al., 2003; Marsden et al 2002, Farms with larger labour volumes (see Kneafsey et al. 2013) linked to short supply chains achieve higher income per asset and per hour – although these values vary widely across farms (for more details see Malak-Rawlikowska et al. 2019) – and also partly address economic concerns about long chains (Bui et al. 2021).

The Strength2Food project, part of Horizon 2020, examined the pathways of six food products in one hundred and eighty-six economies in seven countries, comparing six short and four long supply chains. Although assuming a small sample with low representativeness, the results showed better prices and higher value added for short supply chains compared to long chains; sales in farmers' markets, pick-your-own farms and farmers' shops represented the largest market share (Malak-Rawlikowska et al. 2019; Cesaro et al. 2020).

Short supply chains have also helped the development of the local tourism industry (especially in terms of local brands and specialities) and other service industries, thus contributing to the improved performance of the local economy (Pearson et al. 2011). Directly, the production and marketing activities such as planting, picking, packing, selling, etc., or indirectly, the transport service from material suppliers to retail outlets, create new jobs (Bui et al. 2021).

Some researchers have argued that short supply chains contribute to increasing producers' incomes by allowing them to sell at higher prices, gain a larger share of profits by eliminating middlemen, diversify,

and increase the value of their products (Pearson et al. 2011; Alonso 2011). Others have concluded that SFSCs thrive on marketing and on-farm sales, and that they reduce marketing costs due to brand loyalty, good product quality and availability (Broderick et al. 2011).

Other studies argue that effective management of the supply chain contributes to increasing the sustainable competitive advantage of organisations. Short supply chain management helps to increase the efficiency of the actors in the chain through the efficient use of resources and the development of internal and external linkages to create coherent coordination and thereby increase competition among producers in the chain (see Christopher 1996; Ketchen and Hult 2007).

Effective relationships built in short supply chains contribute to improved performance of firms and actors in the chain (Kalwani and Narayandas 1995; Boyer et al. 2005) and can provide a sustainable competitive advantage (Malak-Rawlikowska et al. 2019; Rungtusanatham et al. 2003).

The importance and benefits of short supply chains have been demonstrated in a number of research studies showing the production of higher value-added products, the creation of new economic space, and the development of rural services and agricultural infrastructure (e.g., DuPuis and Goodman 2005; Renting et al. 2003; Marsden et al. 2002). However, while SFSCs offer numerous benefits, research has identified specific limitations to their widespread adoption. Benedek et al. (2020) demonstrated that short supply chains face documented logistical inefficiencies and higher per-unit transportation costs compared to conventional supply chains, while empirical research by Vittersø et al. (2019) found that higher prices and limited product availability constitute measurable barriers to regular participation. In the Hungarian context, Kacz (2019) conducted a systematic analysis showing that while both traditional and neo-traditional forms have been shown to be viable, traditional SFSC types, particularly local farmers' markets, maintain a documented predominant role – a pattern consistent with other Central and Eastern European countries. The research found that farmers' markets operate in most regions of the country, while community supported agriculture exists predominantly in urban areas, with quantifiable lower presence in economically disadvantaged regions, demonstrating the role of state support mechanisms.

There have already been several domestic studies on short supply chains in Hungary (e.g., Juhász et al., 2019; Kacz, 2019; Kiss et al., 2020; Szabó et al., 2017; Troján et al., 2023), but the link with online systems has not been investigated yet. The aim of our research building on the literature findings is to investigate the efficiency and sustainability of SFSC sales-based economic forms, with a particular focus on the Kecskemét district, Hungary. The research mainly covers the role of online systems that can facilitate the market access of local products and strengthen direct producer-consumer links, thus contributing to the development of the local economy and the competitiveness of rural areas.

3. Material and method

In our own research we investigated what the attitudes of the different rural actors would be if there were an online system to get information about local products and producers and even to make purchases. The research focused on the Kecskemét LAU1 level district in Hungary (Figure 1) for several reasons.

The first and most important reason is that one of the authors and his family are farmers in this district. Another reason is that the selected district is one of the most typical rural areas with agricultural character, but where the state of the economy should also allow the emergence of a consumer niche opened to smart SFSC innovations. The district of Kecskemét (Kecskemét city as the district capital and 16 other rural municipalities) has a population of 155 686 inhabitants, an area of 1212 km^2.

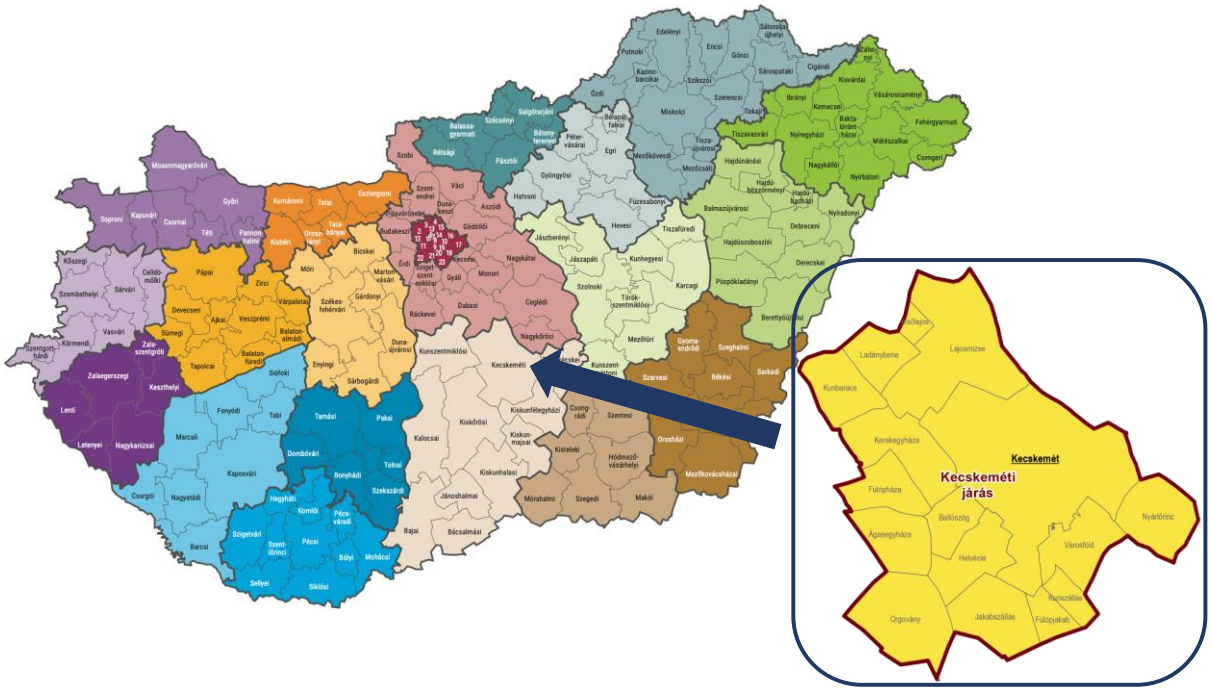


Fig 1. Location of the study area (Kecskemét LAU1 level district) in Hungary. Source: CSO (Central Statistical Office)

In order to get a more accurate picture of the perception of the key actors involved, the following research methods were used:

- Multivariate comparative analysis of Hungarian LAU1 level areas (districts);
- Primer questionnaire survey in the consumer segment in the Kecskemét district;
- Examining the correlation between the results of consumer survey using statistical methods;
- Primer questionnaire survey among agricultural producers in the study area;
- Structured interviews with mayors of the settlements in the study area.

The research took place in 2021–2022. Thus, it is important to note that the COVID-19 pandemic made primary research very difficult and mainly online solutions were used. This was compounded by the fact that the willingness to complete the producer questionnaire survey was much lower, so the data obtained there, although not representative, can be considered as a basic guide. The following is a brief description of the different methods used.

3.1 Multivariate comparative analysis of Hungarian districts

Using selected input data as a starting point, we investigated where all districts of the country (and the selected district of Kecskemét) are positioned along the factors generated from the standardised basic data and in the clusters formed with their help. Our aim was to shed light on the group of factors that define and characterise the selected and researched region. More importantly, the results could provide further information for the research: which districts in the country could be the ones where the local product sales and information online system we studied could be implemented. Multivariate methods were used for the analysis: factor and cluster analysis using the SPSS software package following standard statistical procedures (see Field, 2018). QGIS software was used to map the results.

Our research involved 85 social, economic, environmental and infrastructure indicators that are generally used in the literature for measuring territorial differences (see e.g., Annoni and Dijkstra, 2017; Maggino, 2017; or Péter et al., 2023). The basic data collected were standardised before starting the analysis. The source of data was the National Spatial Planning and Information System (TeIR in Hungarian), operated by the national Central Statistical Office (CSO – KSH in Hungarian).

The analysis was carried out along basic indicators formed by the variables included for all districts of the country (in order to avoid bias, we also excluded the capital city from the analysis, as a common practice in regional studies). At the beginning of the analysis, to increase the explanatory power of the model, standardised basic indicators with low explanatory power were omitted. After the selection, we finally obtained 78 standardised baseline indicators. The data obtained from this reduction could finally be used for a comparative analysis of the regions, based on the statistical measures obtained in the analysis. In this article we do not focus on this analysis, we present the most important secondary results mainly to identify Hungarian territorial cluster-types and the possible locations for further research.

3.2 The consumer survey

The main objective of the primary research, which was based on a consumer questionnaire following standard survey methodology (see Hair et al., 2019 or Malhotra, 2020), was to investigate general food consumption habits, focusing on local products and the related justification for an online system where consumers can easily obtain information about local products and even buy them there.

The consumer questionnaire started with traditional questions such as the respondent's gender, age, education and occupation. Other questions included: purchasing habits, consumer preferences and price sensitivity. In the second half of the questionnaire and the survey, questions were asked about local products, their distribution and availability, as well as available food products and shopping habits. Finally, responses were collected on the use of the online system that was the subject of the research. As a consequence of the COVID-19 situation, an online questionnaire survey was conducted from January to April 2021 in the Kecskemét district. The anonymous questionnaire resulted in a total of 499 completed questionnaires, a sample size that is already suitable for scientific findings.

3.3 Secondary (correlation) analysis of consumer research results

The basis and input data for the analysis was provided by our online primary consumer data collection. Our goal was to explore the key drivers of interest in the online system and the potential users of that. We used correlation analysis and cross tabulation analysis as well.

For the correlation test, we created two decision trees with two target variables. The two target variables were:

- Which characteristics of consumers would be most likely to use the online system to *find information* about local products/producers/actions?
- Which characteristics of consumers would be most likely to use this online system to *buy* local products?

Based on Kass (1980) the CHAID learning algorithm was used to build the decision trees. CHAID algorithm is considered to be one of the most used supervised learning methods as it is adaptable to solving any kind of problem at hand, and can analyze the data very well and reliably detect significantly correlated factors (see Yang et al., 2023). For the consumer primary questionnaire linkage research, we used Microsoft Excel, and IBM SPSS Modeler software application to generate the data and results.

3.4 The producer survey

With the primary producer questionnaire survey (as a basic research methodology – see Kumar, 2019) our aim was to find out how all the stakeholders involved in the research – consumers, municipal managers and producers – perceive the marketing and production opportunities for their products in their area, and to get an answer to whether producers would use and what their perceptions would be of an online local product information and marketing system.

An online anonymous questionnaire was used for the producer survey. Overall, it can be stated that the sample included producers from all types of farming in the district. We also tried to involve local village

farmers and the National Chamber of Agriculture (NAK) in order to maximise the response to the questionnaire, but unfortunately this was not successful. As a consequence of the COVID-19 situation, the anonymous questionnaire survey, which was mainly designed on an online basis, was carried out from September 2021 until March 2022 in the Kecskemét district. A total of 36 completed items were obtained. Although the low number of items is an obstacle to present a complete producer needs survey and the results are not perfectly suitable for statistical analysis, they are suitable to form a view on the producers' opinion on the research topic. Thus, only descriptive statistic was used to evaluate the data obtained due to the low number of items.

3.5 The municipal/mayor interviews

With a structured interview for the mayors of the Kecskemét district – based on Brinkmann and Kvale, 2018 – our aim was to find out how the local government leaders see the sales and consumption opportunities of local products in their settlements and their surroundings (). In addition, we also wanted to know their justification for the online local product information and marketing system, which is the subject of this research, as well as its rural development aspects. We managed to interview 12 of the total 16 mayors of the Kecskemét district, the interviews were conducted in autumn 2022. The results are considered to be basically representative due to the 75% participation rate, although it is regrettable that the head of the district and county centre could not be interviewed, despite repeated attempts. We believe that opinions and insights/experiences would have been of fundamental importance to the topic and the region. Overall, the data is representative and suitable to form a picture on the views of local mayors on the research topic. Descriptive statistics were used to evaluate the data obtained due to the low number of items.

4. Research Results

4.1 Comparative analysis of Hungarian districts using multivariate methods

Using factor analysis, our aim focusing on spatial differences was to create clusters that can be characterized separately and to highlight where our chosen district belongs to within the clusters. In addition, this study could also provide information for another aspect: which districts in Hungary could be the ones where the local product sales and information online system under the study could be applied. The paper does not go into more details only presents the most important secondary results and identifies the possible areas for further research.

The factor analysis resulted in 78 standardised input variables. From the standardised input variables, the design of 6 factors was finally ideal, which explained 68.63% of the total data set content (Table 1).

Tab 1. Information content of the factors obtained in the study. Source: authors' own research

Factor	Initial own values			Value after factor analysis			Value after rotation		
	Proprietary	% of variance	Cumulative %	Proprietary	% of variance	Cumulative %	Proprietary	% of variance	Cumulative %
Economic status	22,545	28,903	28,903	22,545	28,903	28,903	19,275	24,712	24,712
Peripherality	10,087	12,933	41,836	10,087	12,933	41,836	8,277	10,612	35,324
General tourism	7,839	10,050	51,885	7,839	10,050	51,885	7,819	10,025	45,348
Agricultural activity	5,445	6,980	58,866	5,445	6,980	58,866	7,382	9,464	54,812
Rurality – rural tourism	4,193	5,376	64,242	4,193	5,376	64,242	6,185	7,929	62,741
Demography	3,423	4,388	68,630	3,423	4,388	68,630	4,593	5,888	68,630

Each component represents a different characteristic, and the factors are named according to these characteristics. National spatial differences can be defined along the following factors:

1. ***Economic status:*** The basic indicators in this factor reflect the economic situation (the Kecskemét district is economically well developed, but it is not among the most developed districts).
2. ***Peripherality:*** This factor is related to road accessibility factors (the district of Kecskemét is in the middle of the rank).
3. ***General tourism:*** Tis factor refers to the general situation of tourism. (the study area belongs to the districts that perform less well in general tourism).
4. ***Agricultural activity:*** A high value of the factor indicates a stronger agrarian character (Kecskemét district has a middle-level factor value).
5. ***Rurality*** – ***rural tourism:*** Positive values of the factor are associated with regions that have a rural character, a basically well-functioning tourism sector and a more favourable economic situation. The factor value of the Kecskemét district indicates that the study area is not typically rural in character or characterised by rural tourism.
6. ***Demography:*** Areas with positive factor values indicate areas with an ageing population (the study area is one of the districts with a more favourable situation in terms of demographic trends).

4.2 Results of the cluster analysis

One of our aims was to identify groups/clusters focusing on territorial differences that can be characterised separately and to highlight which group (cluster) the study area belongs to. It could also provide information for the other aim of the research, namely to identify the districts in Hungary where the analyzed online system could be applied. The cluster analysis was run for both the standardized input variables and the factors. Finally, seven clusters appeared to be the most appropriate, using hierarchical clustering (Ward's method). The characteristics of the cluster structure along the six main factors we developed are shown in Figure 2.

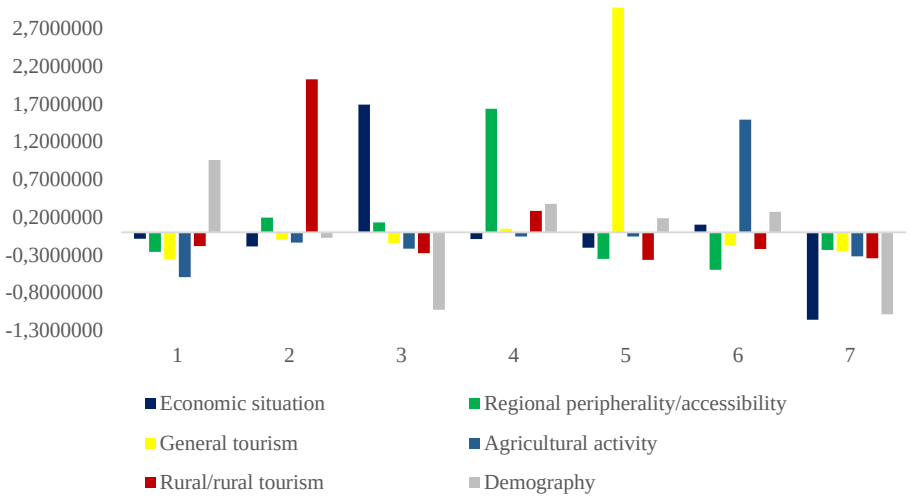


Fig 2. Characteristics of the cluster structure along the average factor values. Source: authors' own research

Figure 3 summarises the cluster groups obtained from the cluster analysis and the classification and distribution of the districts that make up the cluster groups across the country.

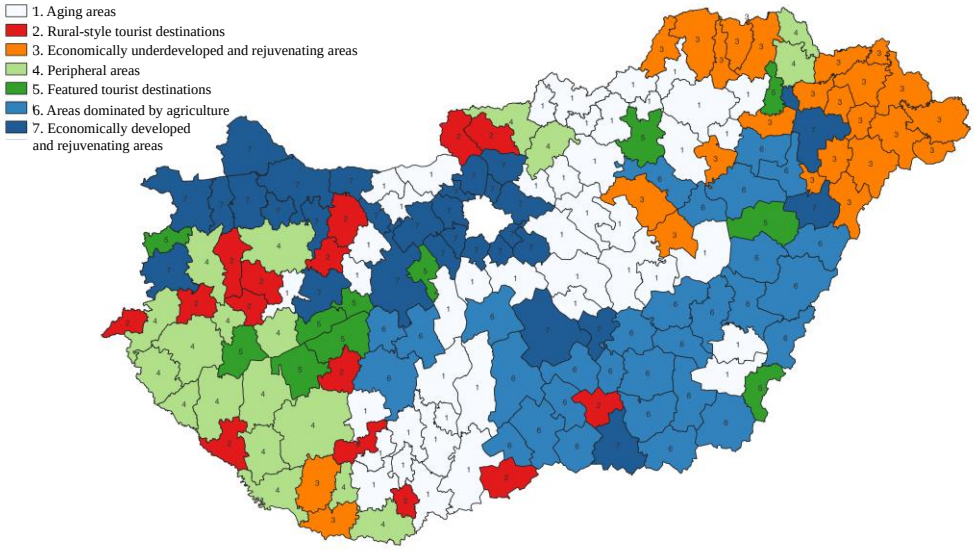


Fig 3. Distribution of cluster groups and their constituent regions in Hungary. Source: authors' own research

The first cluster is called *ageing areas* (marked white on the map). This group includes generally more developed districts with ageing population, characterized by poor tourism and low agricultural activity. The second cluster is called *rural tourism destinations* (marked red on the map) and includes districts with a strong rural character and significant rural tourism, and relatively developed economy. The third cluster is called *economically underdeveloped and rejuvenating areas* (marked orange). This group includes the poorest but demographically young districts with special governmental programs and high level of social aid. The fourth cluster is called *peripheral areas* (marked light green), and includes districts with poor accessibility, a small village structure and mainly ageing population. The fifth cluster is called *featured tourist destinations* (dark green on the map). This group includes districts with exceptionally high tourism indicators and good economic performance. The sixth cluster is called *agricultural-dominated areas* (marked light blue on the map), which includes economically less developed districts with a significant agricultural activity and an ageing social structure. The seventh cluster is called *economically developed and rejuvenating areas* (dark blue on the map). This group includes the districts with the best economic performance and good demographic indicators in the country. It is important to emphasise that the Kecskemét district, which is our priority, is a member of this cluster.

4.3 Main results of the consumer survey

The main objective of the primary consumer research was to investigate the general food consumption habits in the selected area, focusing mainly on local products, and the related justification of an online system where consumers can easily obtain information about local products and even buy them there. Detailed results on food consumption habits and local product preferences were published in a previous publication (see Orbán, 2023a), but the results on the online system were not discussed there. Several aspects of the system in question were investigated, but only the most important results are presented here.

Among other things, we surveyed attitudes towards the use of an online system that could help people to get reliable information about local food products, make shopping easier, check and track local products, etc. Our results (Figure 4) show that 27% of respondents think it is a very good idea and would definitely use it. For 37% of the sample, it sounds interesting, and they would be very likely to try it (it can therefore be stated that 64% of the respondents would be very likely to use this online system to get information about producers and products). 30% of the respondents would possibly try it and only 6% would absolutely not use it.

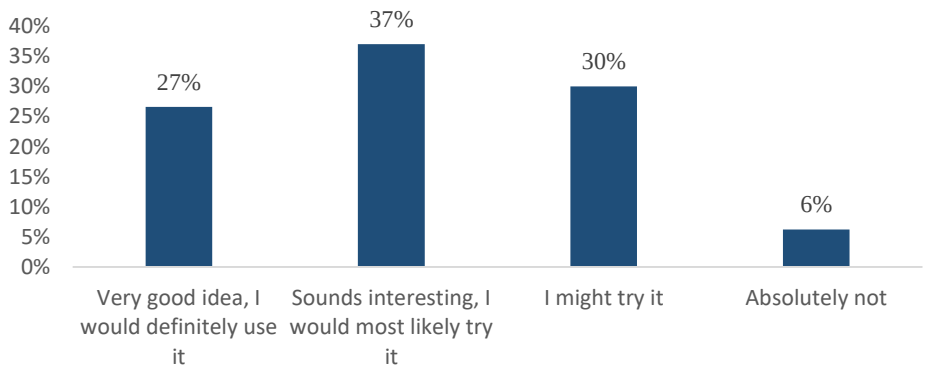


Fig 4. Distribution of respondents by propensity to obtain information on online systems (%). Source: authors' own research

We also wondered whether respondents would be willing to buy specifically from local producers through such an online system. As shown in Figure 5, 24% of respondents would most definitely use this online system to buy local products.

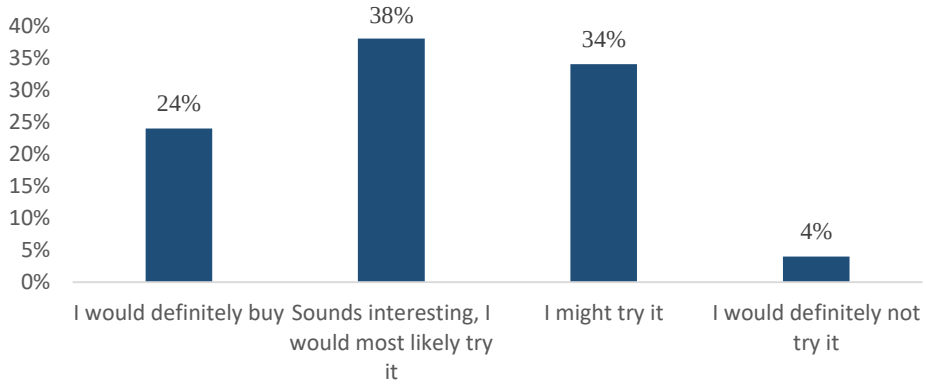


Fig 5. Distribution of respondents by willingness to buy online (%). Source: authors' own research

38% of respondents found it interesting and would be very likely to try it (i.e., 62% of respondents would be very likely to use this online system to buy local products). 34% of respondents would possibly try this online system. Finally, 4% of respondents are sure that they would not use this system.

4.4 Correlation analysis of the consumer survey's results – key findings

Because of the limitation of this paper, we do not present the detailed results of the whole consumer survey (see Orbán, 2023a for them). Here, we focus only on the correlations between the consumer characteristics and the studied online system. The primary aim of the correlation analysis was to find out what basic correlations could be identified on the basis of the sample and what factors could help or influence consumers' consumption of local food and their use of the online system under study. The most relevant research findings are presented below.

One of our main research questions was who would be the potential user of the online system to get information about local products/producers/actions and to make purchases. In other words, to investigate what factors influence consumers' willingness to engage in such a system. Figure 6 shows the importance of the main predictors (identified by the help of the CHAID learning algorithm), i.e., the characteristics that would make consumers most likely to use this online system to ***obtain information***. The first and strongest predictor is the *distance of travel for local food*. The next predictor, above 0.2 importance level, is the *average monthly household expenditure on food*. This is followed, with a lower importance value, by the *gender of the respondent* and the *importance of the local trademark on food*. There is a lower explanatory power, but still a further correlation, if the respondent knows that dairy

products are produced nearby (0/1 or false/true "flag") or if his/her decision is generally influenced by the promotion/discounting. The other correlations are of very low value. The present analysis has an AUC[5] of 0.75, which means that there is a 75% chance that the model will be able to distinguish between the positive and negative (i.e., those who use the system and those who do not) class.

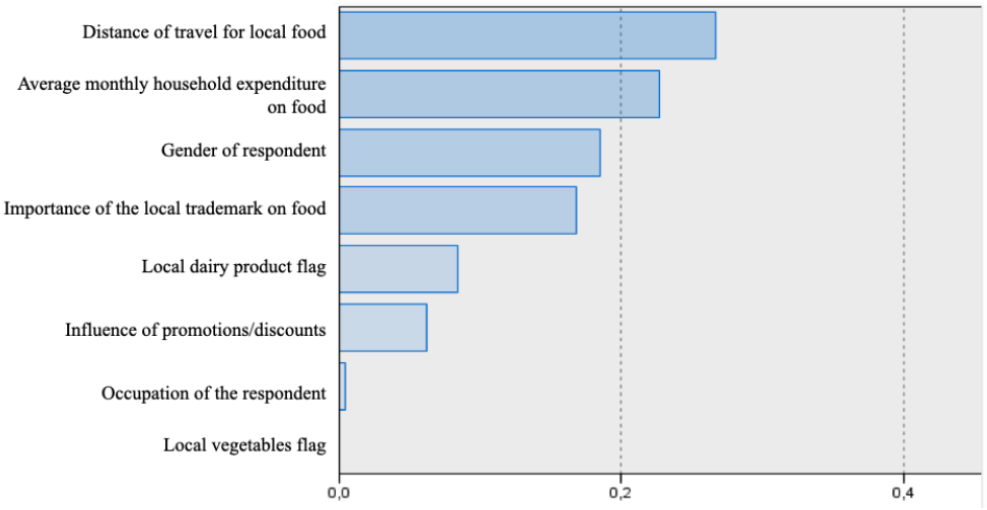


Fig 6. Key factors influencing the use of the online system (information retrieval, CHAID AUC = 0.75). Source: authors' own research

In the final, crucial part of the analysis, the decision tree generated by the CHAID learning algorithm can be used to identify the respondents who are most likely to use this online system to obtain information. Based on the data obtained, it can be stated that respondents who are willing to travel for local products (72% willingness), and within this group mainly those with an intellectual occupation (81% willingness along the decision tree), would be typically more likely to be involved. Within the group showing willingness to travel, those with other occupations, retired or physical, and those for whom a promotion or discount is not very important when shopping, are also more likely to be opened for the online system.

Of those who would only buy local products in their own town or did not give a meaningful answer, 54% are willing to use this online system to get information about farm products. Within this group, 70% of those who would only buy a local product in their own municipality or did not give a meaningful answer, and for whom it is very important that the product is labelled, would be willing to use this online system. Therefore, it is important that the producer products have a trademark (even a local trademark).

The following are the characteristics that would make shoppers most likely to use this online system for ***shopping***. In this case, the strongest predictor (see Figure 7) of propensity to buy, with a significance value of more than 0.2 alone, is *the occupation of the respondent*. Subsequently, it is observed that the current predictors have weaker explanatory power compared to the previous ones (relating to obtaining information), but also a much less hectic movement.

Stronger predictors also include the *importance of environmentally friendly/sustainable production* and the *price of the product*. It is also found that there is a small but significant relationship between whether the respondent would use this online system to buy local products and a) *knowing that dairy products are produced nearby*, b) the *average monthly household expenditure on food*, and c) the *importance of the local trademark on food*. The least strong predictors include *local pickle flag* (the respondent knows that pickles are produced nearby*)*, the *gender* of the respondent (female preference), and finally the *local vegetables flag* (respondent knows that vegetables are produced nearby).

[5] The AUC value shows how well the model can distinguish between classes. The AUC value ranges from 1 to 0, where 1 has excellent results and a good measure of separability, and 0 has the worst measure of separability, essentially a reciprocal result. If the AUC is 0.5 then it has no ability to separate classes at all (Narkhede, 2018).

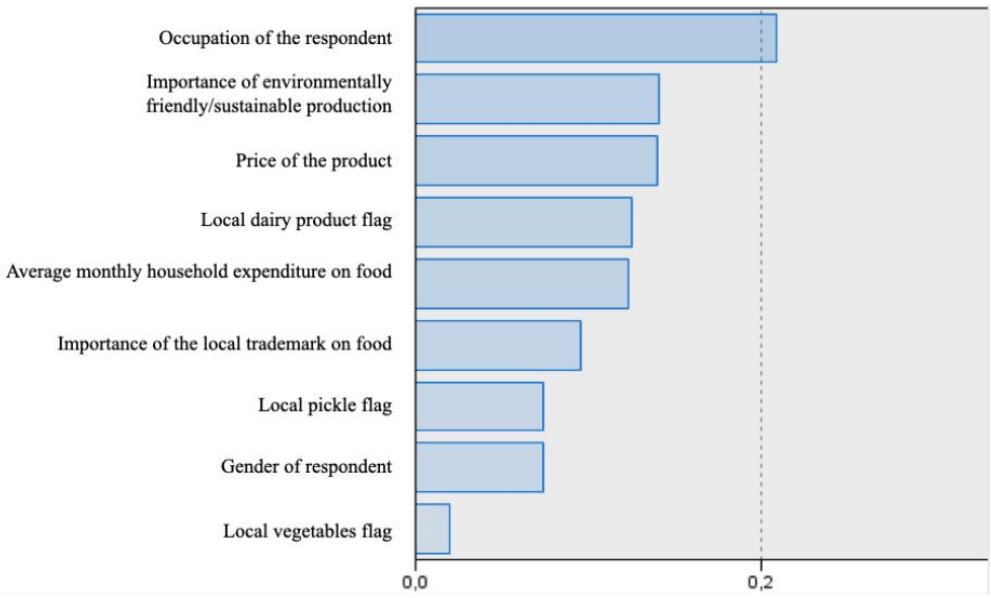


Fig 7. Key factors influencing the use of the online system (shopping, CHAID AUC = 0.72). Source: authors' own research

The present analysis has an AUC value of 0.72, which means that there is a 72% chance that the model will be able to distinguish between the positive and negative class (i.e., those who use the system and those who do not). Compared to the previous AUC value, the current one shows a slightly lower value, but it is also observed that the input variables explain the target variable in a much more stable way. This is fully acceptable for the analysis. It can be observed that there are significant differences between Figure 6 and Figure 7, as in Figure 6 the most important characteristic is whether the consumer would be willing to travel for a local product, but in Figure 7, this characteristic is no longer found among the predictors.

In this phase of the analysis, a decision tree was also created using the CHAID learning algorithm to identify the respondents who would be most likely to use this online system to buy local products. The data obtained shows that respondents who are most likely to use this online system to buy produce are those for whom price is not the most important characteristic (64%). Within this, respondents with intellectual occupation show a 71% propensity to use this online system. Those for whom the price of the product is not very important, but who are in a physical occupation or retired, would use this system only with 49% certainty. Among those who consider it very important for their purchasing habits that the product be labelled, 73% would be willing to use this system for purchases, but the number of items is low (26). On the other side of the decision tree are those for whom the price of the product is very important – in this case only 46% of respondents would use this system for purchases. Within this group, 64% of those who know a specific place nearby where vegetables are produced would be willing to use the system, influenced by their occupation.

4.5 Main results of the producer survey

With the primary producer questionnaire survey, our aim was to find out how producers perceive the marketing and production potential of their products in their area, and to get an answer to the question whether producers would use and what their perceptions are of an online system for local product information and marketing. Here, we present just the most relevant results of the survey.

We asked where the producers sell their products. The results show that 50% of producers sell their products through a trader or a buyer. The other 50% of respondents, the majority, are described as selling at wholesale markets, farmers' markets, online, or door-to-door.

We investigated whether producers have any local cooperation with other producers/producer groups or other companies/regional actors. 50% of respondents have some form of cooperation, the other half do not. We also asked how to encourage cooperation. The biggest problem (90% of the answers) is the fact

that purchase prices are too low. However, many also note that human nature is a barrier to this issue, as everyone wants to sell their goods at the best price alone.

58% of respondents have never used any advertising platform, 31% have advertised their products through Facebook and 11% through other means (municipal website, YouTube, Google, influencer, etc.). We looked at how producers currently sell (not just advertise) online. 33% of the producers concerned deliver their goods themselves after online shopping, 3% through a shopping community, 3% through farmers' shops and 11% by “from door” selling (the customer comes to the producer).

We asked what producers would say about an online system that would make it easier for consumers *to find information* about local products/producers/actions. 47% of the asked producers would definitely use an app, 39% of those who might join and finally 14% of those who would not be interested. We also investigated how they would feel if they could even make purchases from this online system, where they could *sell their own products*. The distribution of respondents who would use this online system to sell their products is as follows: 17% would definitely use it because they think it is a very good idea, 28% think it sounds interesting, 28% would be very likely to be interested, 39% would possibly try it and 17% of respondents would not be interested.

We asked the farmers what positives they could imagine for themselves and their farms from such an online system. 80% of the respondents would expect more stable sales and better prices from this online system. In addition, respondents also mentioned the following potential impacts: promptness; buyers would get to know the products better; thus mutual trust could be more easily established; fast and targeted sales; no need to go to the market; better prices by eliminating the purchaser; easier to bring producers together; and finally easier logistical organisation. We looked at the concerns about this online system. 60% of the respondents said that it is time consuming to keep up to date; furthermore, in many cases personal contact is very important for selling local products (this system does not hinder this: it is possible to use it for information sharing only); the older generation does not use the internet, it cannot reach enough customers; there are producers with previous negative experience of online sales; and finally, people are not yet prepared for this in the rural areas.

4.6 Main results of the municipal/mayor research

With structured interviews for the mayors of the Kecskemét district’s settlements, our aim was to find out how the local government leaders see the sales and consumption opportunities of local products in their localities and surroundings, and how would they evaluate the idea of an online product information and sales system. From the interviews, we would like to highlight just some of the most important statements.

Although during the coronavirus pandemic, local products have become more valuable and good quality products are being produced, but customers want or can pay very low prices because there is little purchasing power. Farmers could produce much more in terms of capacity if there was a market of sufficient size, or if customers would buy more local products. The key problem is that it doesn't get through to the buyer what product is around, the buyer doesn't get information.

We searched for the biggest problems in the production and marketing of local products in the study area. Based on the responses, it can be stated that the biggest problems are: poor and hectic purchase prices; lack of coordination; lack of motivation; animal diseases; lack of irrigation systems; increasing lack of available labour force; climate change challenges; tax and accounting regulations; low demand; lack of entrepreneurial motivation and finally few conscious consumers. Based on the interviewees' responses, it can be said that a completely new approach is needed, both on the part of consumers and producers.

We also investigated how the settlement leaders see the marketing opportunities for local products general in national context. The responses indicate that purchase prices are not good in general, however the central wholesale market in Budapest is the best place to sell products. It is also a conclusion that an integrated selling system would be better where it would be more beneficial if farmers could sell their products locally, but recently it is very difficult to do so. Local products should also be placed in local shopping centers.

Finally, we asked what the mayors think about a possible online system that would make it easier for consumers to find information about local products/producers/actions. The responses indicate that almost all the persons interviewed consider it a very good idea and some have already taken such an initiative. It can be stated that more organizations and efforts of farmers are needed for that. We also asked what the mayors would think if this online system could also be used to make purchases, where the local farmers could sell their products. The answers here, as in case of the previous question, were very common, i.e., supportive. As a main conclusion of the interviews, it can be stated that if this system were properly developed, it could be viable, the only question is how it would be supported by marketing activities. It was also noted that this system could work best for larger producers, and not only via smartphones but also via home-internet.

4.7 Delimitation of the areas relevant to the online system under study

As a final goal of our research, we wanted to identify the potential micro regions (economically well-developed districts close to agriculturally active areas on LAU1 level) in Hungary where the conditions could be given for the introduction of the online system we studied and for its further, more detailed investigation. Based on the results of our secondary analyses described above, six districts with high economic indicators (economic potential) can be identified in the country (Figure 8), with significant agricultural activity (food producing potential) in their immediate neighborhood.

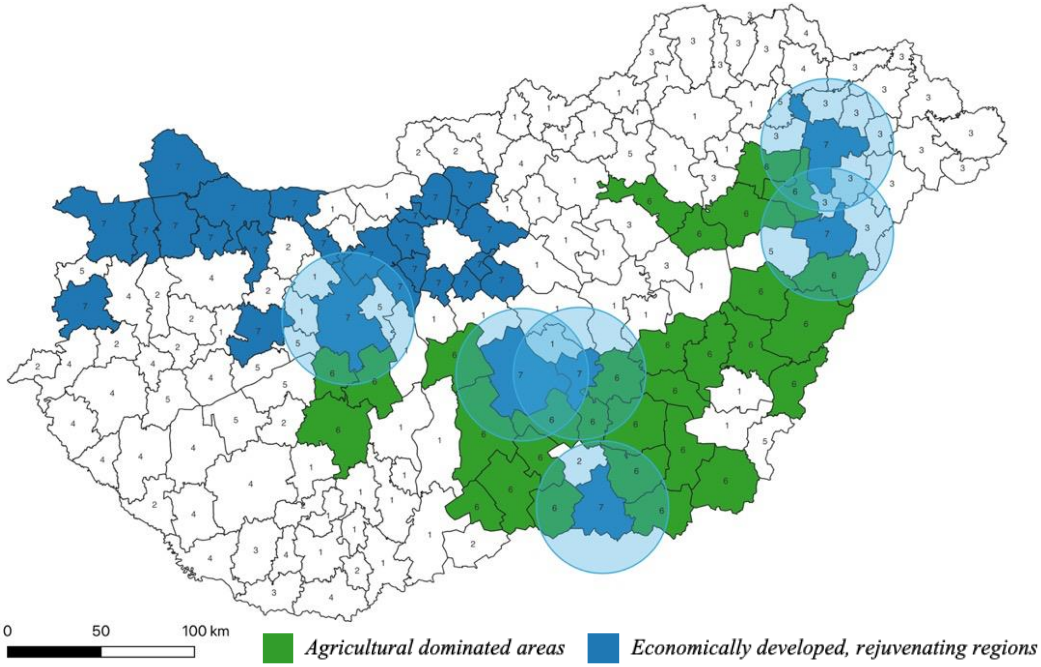


Fig 8. Possible areas for further research on the online system under study in Hungary. Source: authors' own research

According to the Hungarian 52/2010 (IV. 30.) FVM Regulation, the "local product" must be produced within the geographical region, i.e., in the own county or within a 40 km radius where the product is sold. According to this definition of local products in the regulation, all six districts can meet the 40 km criterion. Based on our results, it is verified to start further research in the chosen districts to explore the terms and potentials of the implementation of such an online system that we focused on. The designated areas for further research are the districts of Székesfehérvár, Kecskemét, Nyíregyháza, Debrecen, Tiszakécske and Szeged (the areas marked with a circle on the map). The most important finding of the study is that the Kecskemét district, which is the focus of our research, is also included in the potential group of districts.

5. Conclusion and discussion

The food chain/food supply system of Hungarian agriculture is increasingly vulnerable, first as a consequence of COVID-19, and then even more so after the outbreak of the Russian-Ukrainian conflict. One of the biggest challenges for Hungarian agriculture is to move in a direction where it can build up its core value chains and keep them within the national borders. This is particularly actual recently, but it is important anyway without crisis situations as well. On the other hand, improving the position of small producers is a continuous ongoing challenge.

As the literature makes it clear, vertical integration may be the only means for agricultural producers to achieve financial stability. However, it is far from simple. We know for a fact that such schemes already exist in our country and around the world, but they have not yet managed to penetrate the “main stream”-world. Our initial idea was that producers should have an alternative sales channel for their products, where they could achieve better selling prices with little energy investment, and also have the opportunity to diversify their portfolio if they wanted to. The benefits could include a unified platform, where the risk, labour and capital invested would be less than if they had to create a completely new stand-alone platform. We do not believe that this idea alone would solve the problem of selling rural products, but the lack of similar solutions will lead to a further shrinking of the pool of small and medium sized Hungarian farmers.

The lack of systems based on local products to serve the needs of the younger generation has also strengthened our inspiration. Based on the results of the correlation studies, it can be stated that, in principle, the users with the highest potential could be the people with higher occupation. Another important correlation is that as respondents spend more and more money per month on food, their willingness to use online systems to obtain information and make purchases increases. Furthermore, respondents who would be willing to buy produce from a greater distance are more willing to use this online system. In other words, those who are willing to travel greater distances to obtain local produce tend to be more open to such a system. Another important result for the propensity to buy local products through the online system is that 71% of respondents under 35 would use this system. It can be seen that as the age of the respondents has increased, the propensity to use the online system has decreased. This suggests that the younger generation could be a potential user category.

According to the predictors, the first important question is whether we are willing to travel for local produce. The second is how much we spend on food each month. The factors that influence willingness to spend are slightly different. In order of importance: first, consumers' willingness to travel for local produce. Next comes the occupation, followed by the environmentally friendly/sustainable production of the product, and price.

The predictors and the data from the first analysis are very useful because they define the conditions that a producer needs to meet in order to successfully sell his/her products in such a system. Thus, a producer should advertise to people who are basically young professionals and who would be willing to travel for such a product. It is important that the products should come from environmentally friendly/sustainable production and preferably with a trademark. Our research suggests that dairy products, pickles or vegetables are the most recommended products for such a scheme. The decision tree confirmed these results.

It was our important goal to examine the feasibility of such an online system in the Kecskemét district. As a first step, we categorized all the districts of the country. Based on multivariable analysis, there are several differences between the Hungarian LAU1 level areas/districts caused by economic status, peripherality/accessibility, general tourism, agricultural activity, rurality/rural tourism and demographic factors. Based on these factors, the districts were grouped into seven different clusters.

Based on the producer/farmer survey, the following conclusions can be drawn: information about producers' products is usually passed on to customers by word of mouth, while it is also increasingly typical for producers to sell via Facebook. In general, producers would rather use the online system to gather information than to sell their products directly. In the first case (information), 47% of producers showed willingness, while 44% in the latter one (selling). According to 80% of respondents, the most

important information about consumers should be their place of residence and their interests. Benefits of an online system would include more consistent sales and better prices. Concerns against this system include that ensuring up-to-date information would be time-consuming (60% mentioned) for farmers, and in many cases, the personal contact is fundamental in selling local products.

Based on the interviews, the opinions of the settlement leaders related to the online system (both in case of using that for gathering information and for buying local products) were very positive. This system could be supported by the increasing conscious food consumption behavior and demand for local food. This system could be operated optimal in 10–20 km range, would be available for locals, and could mean higher income for the farmers in the area. Some of the possible barriers summed up are as follows: the rural society is not fully opened for that kind of innovation; the people need for personal relationship with the food producers and physical contact with the products in many cases. But the spread of urbanized way of living in rural areas could accelerate the changes necessary for that kind of online systems, so it could have bigger and bigger importance. According to municipal leaders, the biggest obstacle to making local producers more competitive is the lack of cooperation. The online system can help, but further improvements are needed in areas ranging e.g., from irrigation to the development of the processing industry. In general, a new attitude is needed on the part of both buyers and producers.

However, as a main conclusion based on the opinions, the online system under study could greatly contribute to improving rural services and the opportunities for rural economic actors, while contributing to broader EU objectives (e.g., sustainability, tackling climate change, environmental protection, diversification of the rural economy, etc.) as well.

The limitations of the research are mainly due to the territorial extent of the study. There is certain need to broaden the experience on consumer habits and the online system. Likewise, an extension of the samples included in the study may be desirable. The first steps to extend the study to a wider area are described in the recommendations.

6. Recommendations

Based on our results, it may be ideal and verified to further investigate the possibilities of an online local food system in six Hungarian micro-regions. The most important result is that our study area also belongs to this group. We recommend further investigation of the analysed online system in these areas. We would also suggest piloting the online system at least in one of the recommended districts. This would allow to screen out shortcomings and weaknesses and, of course, to test in real life whether such a system could be operational in a market environment.

Based on our research findings and stakeholder feedback, we summarize the key recommendations for implementing the online local product system in Table 2, categorizing them by focus areas and their practical implementation aspects.

Tab 2. Summary of recommendations for short food supply chain online system Source: authors' own research

Focus Area	Key Recommendations	Implementation Aspects
System Design	Simple and convenient shopping interface Interactive features (chat, customer service) Flexible payment and delivery options	User-friendly platform development Direct producer-consumer communication Multiple payment methods
Producer Requirements	Eco-friendly packaging and production Stable production volume Secure delivery system	Quality standards establishment Supply chain management Logistics optimization
Quality Assurance	Common trademark system Performance monitoring Pre-defined quality criteria	Certification process Automatic evaluation system Standards development
Additional Services	Non-food local products integration Tourism services connection Community building functions	Product range expansion Regional development Social platform features

In summary, the development and operation of the studied online platform should focus on user needs, while sustainability and support for local producers remain key priorities. All our proposals aim to strengthen the link between consumers and producers and to promote local food systems. With successful implementation and continuous improvement, the online platform can contribute to strengthening short supply chains and the rural economy (and society).

Acknowledgments

This paper is an extract from the original PhD thesis of Dr. Zsolt Ádám Orbán PhD (see Orbán, 2023b) written under the supervision of Dr. habil. Krisztián Ritter PhD, Doctoral School of Economic and Regional Sciences, Hungarian University of Agriculture and Lifesciences

Academic references

[1] Aguiar, L. D. C., Delgrossi, M. E. & Thomé, K. M. (2018). Short food supply chain: characteristics of a family farm. *Ciência Rural* 48(5). DOI: 10.1590/0103-8478cr20170775.

[2] Alonso, A. D. (2011). Farmers' involvement in value-added produce: the case of Alabama growers. *British Food Journal* 113(2), 187–204. DOI: 10.1108/00070701111105295.

[3] Annoni, P. & Dijkstra, L. (2017). Measuring and monitoring regional competitiveness in the European Union. In Huggins, R. & Thompson, P., eds., *Handbook of regions and competitiveness – contemporary theories and perspectives on economic development* (pp. 49–79). Cheltenham: Edward Elgar Publishing.

[4] Bański, J. (2024). Urban-Rural Knowledge Transfer – A Theoretical and Methodological Approach. In *International Conference on Information Technology & Systems* (pp. 321–330). Cham: Springer. DOI: 10.1007/978-3-031-54235-0_30.

[5] Belhadi, A., Kamble, S., Subramanian, N., Singh, R. K. & Venkatesh, M. (2024). Digital capabilities to manage agri-food supply chain uncertainties and build supply chain resilience during compounding geopolitical disruptions. *International Journal of Operations & Production Management* 44(11), 1914–1950. DOI: 10.1108/IJOPM-11-2022-0737.

[6] Benedek, Z., Fertő, I. & Szente, V. (2020). The multiplier effects of food relocalization: A systematic review. *Sustainability* 12(9), 35–24. DOI: 10.3390/su12093524.

[7] Bertalan, A., Gyenge, B. & Kacz, K. (2023). Examining the Evolution of Technological Conditions from the Point of View of the Application of Blockchain-based Data Management in Food Supply Chains. *Chemical Engineering Transactions* 107, 517–522. DOI: 10.3303/CET23107087.

[8] Bimbo, F., Bonanno, A., Viscecchia, R. & Nardone, G. (2015). The hidden benefits of short food supply chains: farmers' markets density and body mass index in Italy. *International Food and Agribusiness Management Review* 18(1), 1–16. DOI: 10.22004/ag.econ.197756.

[9] Blanquart, C., Gonçalves, A., Vandenbossche, L., Kebir, L., Petit, C. & Traversac, J. (2010). The logistic leverages of short food supply chains performance in terms of sustainability. In Viegas, J. M. & Macario, R., eds., *Proceedings of the 12th World Conference on Transport Research Society* (not paged). Davis, CA: WCTRS.

[10] Bovet, D. & Sheffi, Y. (1998). The brave new world of supply chain management. *Supply Chain Management Review* 2(1), 14–22.

[11] Boyer, K. K., Swink, M. & Rosenzweig, E. D. (2005). Operations strategy research in the POMS journal. *Production and Operations Management* 14(4), 442–449. DOI: 10.1111/j.1937-5956.2005.tb00232.x.

[12] Brinkmann, S. & Kvale, S. (2018). *Doing Interviews*. 2nd ed. London: SAGE Publications. DOI: 10.4135/9781529716665.

[13] Brochado, A., Teiga, N. & Oliveira-Brochado, F. (2017). The ecological conscious consumer behaviour: are the activists different? *International Journal of Consumer Studies* 41(2), 138–146. DOI: 10.1111/ijcs.12321.

[14] Broderick, S., Wright, V. & Kristiansen, P. (2011). Cross-case analysis of producer-driven marketing channels in Australia. *British Food Journal* 113(2), 1217–1228. DOI: 10.1108/00070701111177656.

[15] Brown, P. (2015). Ethics for Economics in the Anthropocene. In Brown, P. & Timmerman, P., eds., *Ecological Economics for the Anthropocene: An Emerging Paradigm* (pp. 66–88.). New York: Columbia University Press. DOI: 10.7312/brow17342-003.

[16] Bui, T. N., Nguyen, A. H., Le, T. T. H., Nguyen, V. P., Le, T. T. H., Tran, T. T. H., Nguyen, N. M., Le, T. K. O., Nguyen, T. K. O., Nguyen, T. T. T., Dao, H. V., Doan, T. N. T., Vu, T. H. N., Bui, V. H., Hoa, H. C. & Lebailly, P. (2021). Can a Short Food Supply Chain Create Sustainable Benefits for Small Farmers in Developing Countries? An Exploratory Study of Vietnam. *Sustainability* 13(5), 2443. DOI: 10.3390/su13052443.

[17] Bujdosó, Z. & Gyurkó, Á. (2018). A „márkavárosok" szerepe a turizmusban Magyarországon In Csapó, J. et al., eds., *Generációk a turizmusban. I. Nemzetközi Turizmusmarketing Konferencia: Tanulmánykötet* (pp. 62–77). Pécs: PTE KTK.

[18] Bujdosó, Z., Kovács, G., Szűcs, C. & Rita, N. D. (2016). Strategic Tools and Methods for Promoting Cultural Tourism. In Nedelea, A., Korstanje, M. & George, B., eds., *Strategic Tools and Methods for Promoting Hospitality and Tourism Services* (pp. 65–88). Hershey, PA: IGI Global. DOI: 10.4018/978-1-4666-9761-4.ch004.

[19] Canfora, I. (2016). Is the short food supply chain an efficient solution for sustainability in food market? *Agriculture and Agricultural Science Procedia* 8, 402–407. DOI: 10.1016/j.aaspro.2016.02.036.

[20] Cembalo, L., Lombardi, A., Pascucci, S., Dentoni, D., Migliore, G., Verneau, F. & Schifani, G. (2015). "Rationally local": consumer participation in alternative food chains. *Agribusiness* 31(3), 330–352. DOI: 10.1002/agr.21419.

[21] Cesaro, L., Dries, L., Ihle, R., Marongiu, S., Peerlings, J., Poetschki, K. & Schioppa, A. (2020). *Impact of Farmer's Engagement in Food Quality Schemes and Short Food Supply Chains on Farm*

Performance. strength2food.eu/wp-content/uploads/2020/02/D4.2-Impact-of-farmers-engagement-in-FQS-and-SFSC-on-farm-performance.pdf. (Retrieved: 12.09.2022.)

[22] Chen, M. C., Hsu, C. L., Hsu, C. M. & Lee, Y. Y. (2014). Ensuring the quality of e-shopping specialty foods through efficient logistics service. *Trends Food Science and Technology* 35(1), 69–82. DOI: 10.1016/j.tifs.2013.10.011.

[23] Chiffoleau, Y., Millet-Amrani, S., Rossi, A., Rivera-Ferre, M. G. & Merino, P. L. (2019). The participatory construction of new economic models in short food supply chains. *Journal of Rural Studies* 68, 182–190. DOI: 10.1016/j.jrurstud.2019.01.019.

[24] Christensen, C. M., McDonald, R., Altman, E. J. & Palmer, J. E. (2018). Disruptive innovation: An intellectual history and directions for future research. *Journal of Management Studies* 55(7), 1043–1078. DOI: 10.1111/joms.12349.

[25] Christopher, M. (1996). From brand values to customer value. *Journal of Marketing Practice: Applied Marketing Science* 2(1), 55–66. DOI: 10.1108/EUM0000000000007.

[26] Corsi, A., Barbera, F., Dansero, E., Orlando, G. & Peano, C. (2018). Multidisciplinary approaches to alternative food networks. In Corsi, A., Barbera, F., Dansero, E., Peano, C., eds., *Alternative food networks: An interdisciplinary assessment* (pp. 9–46). Cham: Palgrave Macmillan. DOI: 10.1007/978-3-319-90409-2_2.

[27] Crutzen, P. J. (2002). Geology of mankind: the Anthropocene. *Nature 415*, 211–215. DOI: 10.1038/415023a.

[28] Dupuis, E. M. & Goodman, D. (2005). Should we go "home" to eat?: toward a reflexive politics of localism. *Journal of Rural Studies* 21(3), 359–371. DOI: 10.1016/j.jrurstud.2005.05.011.

[29] Escobar-López, S. Y., Amaya-Corchuelo, S. & Espinoza-Ortega, A. (2021). Alternative Food Networks: Perceptions in Short Food Supply Chains in Spain. *Sustainability* 13(5), 2578. DOI: 10.3390/su13052578.

[30] Falguieres, M., Kumar, V., Garza-Reyes, J. A., Kumari, A., Lim, M. K. & Rocha-Lona, L. (2015). Investigating the impact of short food supply chain on emigration: A study of Valencia community in Spain. *IFAC-PapersOnLine* 48(3), 2226–2232. DOI: 10.1016/j.ifacol.2015.06.419.

[31] Fehér, I. (2012). Direct Food Marketing at Farm Level and its Impacts of Rural Development. In Rashid, S. A., ed., *Rural Development*. (pp. 337–354). Rijeka: IntechOpen. DOI: 10.5772/29019.

[32] Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics*. 5th ed. London: SAGE Publications.

[33] Galli, F. & Brunori, G. (2013). *Short Food Supply Chains as Drivers of Sustainable Development* [Evidence Document]. Pisa: Laboratorio di Studi Rurali Sismondi.

[34] Gereffi, G. (1994). The organization of buyer-driven global commodity chains: How US retailers shape overseas production networks. In Gereffi, G. & Korzeniewicz, M., eds., *Commodity chains and global capitalism* (pp. 95–122). New York: Bloomsbury Publishing.

[35] Gerencsér, I. & Áldorfai, Gy. (2017). Közösségi szerepvállalás helyi fejlesztési stratégia kialakításában. *Studia Mundi Economica* 4(1), 26–34. DOI: 10.18531/Studia.Mundi.2017.04.01.26-34.

[36] Goodman, D. & Goodman, Mk. (2008). Alternative food networks. In Kitchin, R. & Thrift, N., eds., *International Encyclopedia of Human Geography* (pp. 208–220). Oxford: Elsevier.

[37] Hair, J. F., Black, W. C., Babin, B. J. & Anderson, R. E. (2019). *Multivariate Data Analysis*. 8th ed. London: Cengage Learning.

[38] Hayden, J. & Buck, D. (2012). Doing community supported agriculture: Tactile space, affect and effects of membership. *Geoforum* 43(2), 332–341. DOI: 10.1016/j.geoforum.2011.08.003.

[39] Higgins, V., Dibden, J. & Cocklin, C. (2008). Building alternative agri-food networks: Certification, embeddedness and agri-environmental governance. *Journal of Rural Studies* 24(1), 15–27. DOI: 10.1016/j.jrurstud.2007.06.002.

[40] Ims, K., Tencati, A. & Zsolnai, L. (2019). Gazdasági etika az antropocén korban – business ethics in the anthropocene. *Magyar Tudomány* 180(4), 481–487. DOI: 10.1556/2065.180.2019.4.2.

[41] Ivanov, D. & Dolgui, A. (2020). Viability of intertwined supply networks: Extending the supply chain resilience angles towards survivability. A position paper motivated by COVID-19 outbreak. *International Journal of Production Research* 58(10), 2904–2915. DOI: 10.1080/00207543.2020.1750727.

[42] Jarzębowski, S., Bourlakis, M. & Bezat-Jarzębowska, A. (2020). Short food supply chains (SFSC) as local and sustainable systems. *Sustainability* 12(11), 4715. DOI: 10.3390/su12114715.

[43] Juhász, A., Szabó, D. & Kujáni, K. (2019). A rövid élelmiszerláncok szerepe a települések ellátásában. In Sikos, T. T., ed., *Az élelmiszer-ellátási láncok sérülékenysége* (pp. 93–110). Budapest: Dialóg Campus Kiadó.

[44] Kacz, K. (2019). Local Products Within Short Food Supply Chains in Hungary. *Annals PAAAE* 21(4), 172–181. DOI: 10.5604/01.3001.0013.5952.

[45] Kalwani, M. U. & Narayandas, N. (1995). Long-term manufacturer-supplier relationships: do they pay off for supplier firms? *Journal of Marketing* 59(1), 1–16. DOI: 10.1177/0022242995059001.

[46] Kamble, S, S. & Mor, R, S. (2021). Food supply chains and COVID-19: A way forward. *Agronomy Journal* 113(2), 2195–2197. DOI: 10.1002/agj2.20515.

[47] Kass, G. V. (1980). An exploratory technique for investigating large quantities of categorical data. *Applied Statistics* 29(2), 119–127. DOI: 10.2307/2986296.

[48] Kavanagh, P. H., Vilela, B., Haynie, H. J., Tuff, T., Lima-Ribeiro, M., Gray, R. D. & Gavin, M. C. (2018). Hindcasting global population densities reveals forces enabling the origin of agriculture. *Nature Human Behaviour* 2(7), 478–484. DOI: 10.1038/s41562-018-0358-8.

[49] Ketchen, Jr., D. J. & Hult, G. T. M. (2007). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management* 25(2), 573–580. DOI: 10.1016/j.jom.2006.05.010.

[50] Kiss, K., Ruszkai, Cs., Szűcs, A. & Koncz, G. (2020). Examining the Role of Local Products in Rural Development in the Light of Consumer Preferences – Results of a Consumer Survey from Hungary. *Sustainability* 12, 5473. DOI: 10.3390/su12135473.

[51] Kneafsey, M., Venn, L., Schmutz, U., Balázs, B., Trenchard, L., Eyden-Wood, T. & Blackett, M. (2013). *Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics* [JRC scientific and policy reports]. Luxembourg: Publications Office of the EU. DOI: 10.2791/88784.

[52] Kovács, P., Bodnár, G. & Lengyel, I. (2023). Relationships between factors of regional competitiveness in Central and Eastern Europe. *Journal of International Studies* 16(3), 78–96. DOI: 10.14254/2071-8330.2023/16-3/4.

[53] Kumar, R. (2019). *Research Methodology: A Step-by-Step Guide for Beginners*. 5th ed. London: SAGE Publications.

[54] Kumar, V., Wang, M., Kumari, A., Akkaranggoon, S., Garza-Reyes, J. A., Neutzling, D. & Tupa, J. (2019). Exploring short food supply chains from Triple Bottom Line lens: A comprehensive systematic review. In *Proceedings of the International Conference on Industrial Engineering and Operations Management. Bangkok, Thailand, 5–7 March 2019.* (pp. 728–738).

[55] Lakner, Z. (2022). Élet és tudomány: az agrárközgazdasági kutatás időszerű kérdései az MTA újjáválasztott Agrárközgazdasági Bizottságának nézőpontjából – Life and Science: Current Problems

of Hungarian Agricultural Economics Research. *Gazdálkodás* 66(4), 301–323. DOI: 10.53079/GAZDALKODAS.66.4.t.pp.

[56] Lakner, Z., Kiss, A. & Pfeiffer, L. (2020). Agrárgazdaság a XXI. században: perspektívák és dilemmák. *Gazdálkodás* 64(80), 3–14. DOI: 10.22004/ag.econ.302628.

[57] Levidow, L. & Psarikidou, K. (2011). Food relocalization for environmental sustainability in Cumbria. *Sustainability* 3(4), 692–719. DOI: 10.3390/su3040692.

[58] Maggino, F. (2017). Developing indicators and managing the complexity. In Maggino, F., ed., *Complexity in society: From indicators construction to their synthesis* (pp. 87–114). Cham: Springer.

[59] Malak-Rawlikowska, A., Majewski, E., Wąs, A., Borgen, S. O., Csillag, P., Donati, M. & Wavresky, P. (2019). Measuring the economic, environmental, and social sustainability of short food supply chains. *Sustainability* 11(15), 4004. DOI: 10.3390/su11154004.

[60] Malhotra, N. K. (2020). *Marketing Research: An Applied Orientation*. 7th ed. Harlow: Pearson.

[61] Marsden, T., Banks, J. & Bristow, G. (2002). Food supply chain approaches: exploring their role in rural development. *Sociologia Ruralis* 40(4), 424–438. DOI: 10.1111/1467-9523.00158.

[62] Maslaric, M., Nikolicic, S. & Mircetic, D. (2016). Logistics response to the Industry 4.0: The Physical Internet. *Open Engineering* 6(1), 511–517. DOI: 10.1515/eng-2016-0073.

[63] Mentzer, J., Stank, T. & Myers, M. (2007). Why global supply chain management? In Mentzer, J., Myers, M. & Stank, T., eds., *Handbook of global supply chain management* (pp. 1–16). London: SAGE Publications. DOI: 10.4135/9781412976169.

[64] Narkhede, S. (2018). Understanding Auc-Roc curve. *Towards Data Science* 26(1), 220–227.

[65] Olsen, N. V. & Bánáti, D. (2014). Ethics in Food Safety Management. In Motarjemi, Y. & Lelieveld, H. eds., *Food Safety Management: A Practical Guide for the Food Industry* (pp. 1115–1125). New York: Elsevier Inc. DOI: 10.1016/B978-0-12-381504-0.00046-9.

[66] Orbán, Zs. Á. (2023a). Investigation of local product consumption habits and their impact in the Kecskemét sub-region. *Studia Mundi Economica* 10(2), 62–73. DOI: 10.18531/sme.vol.10.no.2.

[67] Orbán, Zs. Á. (2023b). *Helyi termék információs és értékesítési online rendszer feltételeinek vizsgálata: fókuszban a Kecskeméti járás* [PhD dissertation]. Gödöllő: Hungarian University of Agriculture and Lifesciences.

[68] Owen, L. (2014). *Exploring the role of Short Food Supply Chains in enhancing the livelihoods of small-scale food producers: Evidence from The United Kingdom and The Gambia* [PhD dissertation]. Coventry: Coventry University.

[69] Pearson, D., Henryks, J., Trott, A., Jones, P., Parker, G., Dumaresq, D. & Dyball, R. (2011). Local food: understanding consumer motivations in innovative retail formats. *British Food Journal* 113(2), 886–899. DOI: 10.1108/00070701111148414.

[70] Reardon, T., Mishra, A., Nuthalapati, C. S., Bellemare, M. F. & Zilberman, D. (2020). COVID-19's disruption of India's transformed food supply chains. *Economic & Political Weekly* 55(18), 18–22.

[71] Renting, H., Marsden, T. K. & Banks, J. (2003). Understanding alternative food networks: exploring the role of short food supply chains in rural development. *Environment and Planning* 35(3), 393–411. DOI: 10.1068/a351.

[72] Reszkető, T. (2015). *Vidékfejlesztési program kézikönyv*. Budapest: NAK.

[73] Roep, D. & Wiskerke, H. (2006). *Nourishing Networks – Fourteen Lessons about Creating Sustainable Food Supply Chains*. Doetinchem: Reed Business Information.

[74] Rowan, N, J. & Galanakis, C. M. (2020). Unlocking challenges and opportunities presented by COVID-19 pandemic for cross-cutting disruption in agri-food and green deal innovations: Quo Vadis? *Science of the Total Environment* 748(1), 141362. DOI: 10.1016/j.scitotenv.2020.141362.

[75] Rungtusanatham, M., Salvador, F., Forza, C. & Choi, T. Y. (2003). Supply-chain linkages and operational performance: A resource-based-view perspective. *International Journal of Operations & Production Management* 23(9), 1084–1099. DOI: 10.1108/01443570310491783.

[76] Schmid, O., Brunori, G., Galli, F., van de Graaf, P., Prior, A. & Ruiz, R. (2014). Contribution of short food supply chains to sustainability and health. In Aeris, T., Knierim, A., Riecher, M. C., Ridder, R., Schobert, H. & Fischer, H., eds., Farming Systems Facing Global Challenges: Capacities and Strategies (pp. 1247–1253). Wien: IFSA.

[77] Sellitto, M. A., Vial, L. A. M. & Viegas, C. V. (2018). Critical success factors in Short Food Supply Chains: Case studies with milk and dairy producers from Italy and Brazil. *Journal of Cleaner Production* 170, 1361–1368. DOI: 10.1016/j.jclepro.2017.09.235.

[78] Sgroi, F. (2015). Socio-economic assessment of direct sales in Sicilian farms. *Italian Journal of Food Science* 27(1), 101–108. DOI: 10.14674/1120-1770/ijfs.v80.

[79] Sharma, R., Shishodia, A., Kamble, S., Gunasekaran, A. & Belhadi, A. (2020). Agriculture supply chain risks and COVID-19: Mitigation strategies and implications for the practitioners. *International Journal of Logistics Research and Applications* 27(11), 2351–2377. DOI: 10.1080/13675567.2020.1830049.

[80] Sid, S., Mor, R., Panghal, A., Kumar, D. & Gahlawat, V. K. (2021). Agri-food supply chain and disruptions due to COVID-19: effects and strategies. *Brazilian Journal of Operations & Production Management* 18(2), 1–14. DOI: 10.14488/BJOPM.2021.031.

[81] Singh, S., Kumar, R., Panchal, R. & Tiwari, M. K. (2021). Impact of COVID-19 on logistics systems and disruptions in food supply chain. *International Journal of Production Research* 59(7), 1993–2008. DOI: 10.1080/00207543.2020.1792000.

[82] Suali, A. S., Srai, J. S. & Tsolakis, N. (2024). The role of digital platforms in e-commerce food supply chain resilience under exogenous disruptions. *Supply Chain Management: An International Journal* 29(3), 573–601. DOI: 10.1108/SCM-02-2023-0064.

[83] Stanley, C. (2020). Living to spend another day: Exploring resilience as a new fourth goal of ecological economics. *Ecological Economics* 178, 106805. DOI: 10.1016/j.ecolecon.2020.106805.

[84] Šťastná, M. & Vaishar, A. (2022). Social Farming in Czechia, Actors and Barriers. *European Countryside* 14(3), 591–603. DOI: 10.2478/euco-2022-0029.

[85] Šťastná, M. & Vaishar, A. (2023). Opportunities for the Development of a Borderland Rural Territory: A Case Study of the Hlučín Region. In: *Quaestiones Geographicae*, 42(4), 91–106. DOI: 10.14746/quageo-2023-0036.

[86] Steffen, W., Persson, Å., Deutsch, L., Zalasiewicz, J., Williams, M., Richardson, K. & Svedin, U. (2011). The Anthropocene: From global change to planetary stewardship. A*mbio* 40(7), 739–761. DOI: 10.1007/s13280-011-0185-x.

[87] Szabó, D., Kozma, T. & Mizik, T. (2017). A rövid ellátási láncok helyzete és lehetőségei Magyarországon. *Logisztikai Trendek És Legjobb Gyakorlatok* 3(2), 27–32.

[88] Tanasă, L., Brumă, I. S. & Doboş, S. (2015). The role of short food supply chains in the development of small-scale local producers case study: Harghita County. In *Agrarian Economy and Rural Development – Realities and Perspectives for Romania, the 6th edition* (pp. 286–293). Bucharest: The Research Institute for Agricultural Economy and Rural Development.

[89] Thulasiraman, V., Nandagopal, G. & Kothakota, A. (2021). Need for a balance between short food supply chains and integrated food processing sectors: COVID-19 takeaways from India. *Journal of Food Science and Technology* 58(10), 3667–3675. DOI: 10.1007/s13197-020-04942-0.

[90] Todorovic, V., Maslaric, M., Bojic, S., Jokic, M., Mircetic, D. & Nikolicic, S. (2018). Solutions for More Sustainable Distribution in the Short Food Supply Chains. *Sustainability* 10(10), 3481. DOI: 10.3390/su10103481.

[91] Troján, Sz., Miklósné, V. A. & Kacz, K. (2023). Producers in short food supply chains and the role of local farmers' markets in sales. *Review on Agriculture and Rural Development* 12(3–4), 75–82. DOI: 10.14232/rard.2023.3-4.75-82.

[92] Yang, Y., Yi, F., Deng, C. & Sun, G. (2023). Performance Analysis of the CHAID Algorithm for Accuracy. *Mathematics* 11(11), 2558. DOI: 10.3390/math11112558.

[93] Verdouw, C. N., Wolfert, J., Beulens, A. J. M. & Rialland, A. (2016). Virtualization of food supply chains with the internet of things. *Journal of Food Engineering* 176, 128–136. DOI: 10.1016/j.jfoodeng.2015.11.009.

[94] Vermesan, O., Friess, P., Guillemin, P., Serrano, M., Bouraoui, M., Pérez-Freire, L., Kallstenius, T., Lam, K., Eisenhauer, M., Moessner, K., Spirito, M., Tragos, E., Sundmaeker, H., Maló, P. & Wees, A. (2022). IoT digital value chain connecting research, innovation and deployment. In Vermesan, O. & Friess, P., eds., *Digitising the Industry Internet of Things Connecting the Physical, Digital and VirtualWorlds* (pp. 15–128). Alsbjergvej: River Publishers. DOI: 10.1201/9781003337966-3.

[95] Vittersø, G., Torjusen, H. & Laitala, K. (2019). Short Food Supply Chains and Their Contributions to Sustainability: Participants' Views and Perceptions from 12 European Cases. *Sustainability* 11(17), 4800. DOI: 10.3390/su11174800.

[96] Wang, M., Kumar, V., Ruan, X. & Neutzling, D. M. (2018). Farmers' attitudes towards participation in short food supply chains: evidence from a Chinese field research. *Revista Ciências Administrativas* 24(3), 1–12. DOI: 10.5020/2318-0722.2018.9067.

[97] Wang, M., Kumar, V., Ruan, X., Saad, M., Garza-Reyes, J. A. & Kumar, A. (2022). Sustainability concerns on consumers' attitude towards short food supply chains: an empirical investigation. *Operations Management Research* 15, 76–92. DOI: 10.1007/s12063-021-00188-x.

[98] Wang, S., Ghadge, A. & Aktas, E. (2024). Digital transformation in food supply chains: an implementation framework. *Supply Chain Management: An International Journal* 29(2), 328–350. DOI: 10.1108/SCM-09-2023-0463.

[99] Waters, C. N., Zalasiewicz, J., Summerhayes, C., Barnosky, A. D., Poirier, C., Gałuszka, A., Cearreta, A., Edgeworth, M., Ellis, E., Ellis, M., Jeandel, C., Leinfelder, R., Mcneill, J., Richter, D., Steffen, W., Syvitski, J., Vidas, D., Wagreich, M., Williams, M. & Wolfe, A. P. (2016). The anthropocene is functionally and stratigraphically distinct from the halocene. *Science* 351(6269), 137–147. DOI: 10.1126/science.aad2622.

[100] Watts, D., Little, J. & Ilbery, B. (2018). 'I am pleased to shop somewhere that is fighting the supermarkets a little bit'. A cultural political economy of alternative food networks. *Geoforum*, 91, 21–29. DOI: 10.1016/j.geoforum.2018.02.013.

[101] Welch, R. M. & Graham, R. D. (1999). A new paradigm for world agriculture: meeting human needs: productive, sustainable, nutritious. *Field Crops Research* 60(1–2), 1–10. DOI: 10.1016/S0378-4290(98)00129-4.

Other sources

[102] European Union: Regulation (EU) no 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. *Official Journal of the European Union* L 347/487 (20.12.2013). Brussels: European Union. https://eur-

lex.europa.eu/legal-content/HU/TXT/PDF/?uri=CELEX:32013R1305&from=HR
(Retrived: 10.10.2024).

[103] FVM (Földművelésügyi és Vidékfejlesztési Minisztérium – Ministry of Agriculture and Rural Development): *Regulation No 52/2010 (IV. 30.) on the conditions for the production, processing and sale of foodstuffs by small farmers*. Budapest: FVM. https://njt.hu/jogszabaly/2010-52-20-82 (Retrived: 07.08.2023).

[104] NAV (Nemzeti Adó és Vámhivatal – National Tax and Customs Office): *Public Database Query*. Budapest: NAV. https://nav.gov.hu/adatbazisok/multilekerdezo (Retrived: 10.05.2024).

[105] TEIR (Országos Területfejlesztési és Területrendezési Információs Rendszer – National Spatial Planning and Information System): *Public Database Query*. Budapest: Lechner Nonprofit Kft. https://www.oeny.hu/oeny/teir/#/ (Retrived: 03.05.2024).

[106] Termelői Kosár – National producers portal. Budapest: Herman Ottó Intézet Nonprofit Kft. https://www.termeloikosar.hu/ (Retrived: 11.06.2023).

[107] KSH (Központi Statisztikai Hivatal – Central Statistical Office): Területi atlasz – Territorial atlas/ administrative units. Budapest: KSH. https://www.ksh.hu/teruletiatlasz_jarasok (Retrived: 20.07.2024).