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Modelling the multiplier effect of a local food system

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Abstract. Revitalisation of rural communities, benefits for local farmers and environment are expected outcomes of local food initiatives which are emerging as an opposition to the adverse social and economic effects of globalization. Local food networks diversify the rural economy, promote greater economic independence and local potential, improve the area's image and reduce GHG emissions. The purchase of local food increases incomes of both the community and local producers, as well as increases employment and related multiplier effects at the local level, for example, increased value of new production, import substitution, increased incomes, and created additional jobs. Revitalisation of rural communities, benefits for local farmers and environment are expected outcomes of local food initiatives which are emerging as an opposition to the adverse social and economic effects of globalization It has been revealed that much of current research on local and regional food networks lacks a strong theoretical grounding and quantitative rigor; however, community development practitioners and planners need objective and research-based information for food system design and implementation in order to produce community or regional wellbeing. The aim of the paper is to develop the concept of an integrated assessment model of local food systems based on the analysis of the literature, which would provide a basis for empirical analysis. The analysis model contains dimensions of sustainable development, allowing us to assess not only direct effects (income, reduced greenhouse gas emissions etc.) but also indirect ones (economic, social and environmental resilience of local communities).

Key words: local food system, food systems model, food system evaluation.

INTRODUCTION

Owing to new policy initiatives and the debate on the impacts of Covid-19 on the wellbeing of regional populations, local food systems have become an important part of the scientific debate. Equal access to food, sustainable and secure food chains leading to food justice has been increasingly emphasized (e.g. O'Hara &Toussaint, 2021). Local food initiatives are promoted as opposition to the disempowering social and economic effects of globalization; thus, revitalisation of rural communities, benefits for local

farmers and environment are expected outcomes of reduced physical distance between producers and consumers (Fonte, 2008). The concept of local food often in not well-defined, even though it is used to describe local food systems, short food chains where food is produced near the consumer or from within their own region (Acciani at al., 2021). Some authors focus on specific local food such as indigenous local food systems which are significant for managing culturally important ecosystems (Leigh & Turner, 2020). Also, in modern western capitalist society's cultural values, place-based identities related to food production and consumption patterns become increasingly valued. The term local food is usually associated with the food that is produced and processed in a particular geographical area, relatively close to where it is sold and consumed (Kneafsey, 2013). In the context of this theoretical explanation, parallels could be drawn with other commonly used concepts - short and long (global) food supply chains. Short food supply chains are defined as a system of supplying locally produced products, in which the producer is located close to the consumer and fewer companies are involved in delivering the product to the consumer. In long food supply chains, the producer is located far away from the consumer, and several intermediaries are involved to deliver the product to the consumer. Both concepts provide a systemic view of food production and have contributed to a wide-ranging debate on what characteristics define food as local, its link to a local community and cultural traditions or globality (decoupled from one community or traditions of one culture).

It is clear that the processes of globalization and production intensification provide a relatively high quality of life in many regions (Gravina & Lanzafame, 2021). At the same time, the global distribution of benefits creates a number of social and environmental externalities, which makes us discuss sustainable globalization (Beumer et al., 2018). One solution would be to tackle social and environmental externalities when they emergence by emphasizing the introduction of market-based lobbying initiatives (Catola & D'Alessandro, 2020). Another solution is to review the extent of market globalization and try to find a new balance between the international and the local food system. Attempts to define the role of local systems in the modern food supply chain should lead us to a fully clear understanding of the framework of this system and the direct and indirect effects it creates, or an integrated model for assessing the local food system.

METHODS

We are convinced that the analysis of the local food system is possible only by integrating into the evaluation model the most important factors of the development system, which in their essence reflect the dimension of sustainable development. Integrated assessment is a platform for scientific analysis rather than a strictly defined method. It provides a broader, more integrated view that provides a context for political or economic decision-making. The integrated modelling approach is most often used in socioeconomic research, as it not only assesses the direct effects of a process or activity but also defines a wider field of effects, which identifies and calculates indirect effects, often defined as externalities. It is the elimination of externalities that is the most important challenge for economic policies. The generally Integrated Impact Assessment (IIA) contain tree dimensions: social, environmental and economic (Santoyo-Castelazo & Azapagic, 2014), yet it is possible to view any process through the prism of the fourth dimension: a) equality and diversity; b) health and prosperity; c) the environment; d) the

economy (Fife Council, 2015). Different policies could require a specific perspective on policy effects, therefore the following kinds of assessment have been developed: social impact assessment, health impact assessment (Milner et al., 2005), environmental impact assessment (Dendena & Corsi, 2015), sustainable assessment (Sala et al., 2015) and others. Aledo-Tur with his colleagues has analysed social impact assessment (SIA) from the multidimensional paradigm perspective and can creatively, by means of six questions, characterise the SIA from the methodological, theoretical, government involvement, epistemological, ontological and axiological perspectives. He has concluded that the SIA has to encompass as much precise potential effects of a measure as possible, which could specify the potential unjust social reality, supplementing the SIA with cross-cutting elements, contributions from regional science and spatial analysis (Aledo-Tur & Dominguez-Gomez, 2017). Another analytic framework to look at the local food systems as socio-ecological systems and agrifood systems theoretically and empirically is from the perspective of Actor Network Theory (ANT) (Latour, 1996; Oña-Serrano & Viteri-Salazar, 2020). This perspective is useful to better understand relationships between actants (humans and non-humans) through identification and description of all elements and networking processes, practices and discourses linked to production, distribution, exchange, consumption and availability of food. All elements of the food system form a specific network comprising human and non-human actors (Latour, 1996) where all actors are important whether they are of macro level (e.g. state, the global economic system, nature) or micro level (e.g. farmers, consumers). An integrated assessment model must include three basic elements:

a) key drivers of integration;
b) methodological aspects requiring integration;
c) aspects of the system to be integrated (Hamilton et al., 2015).

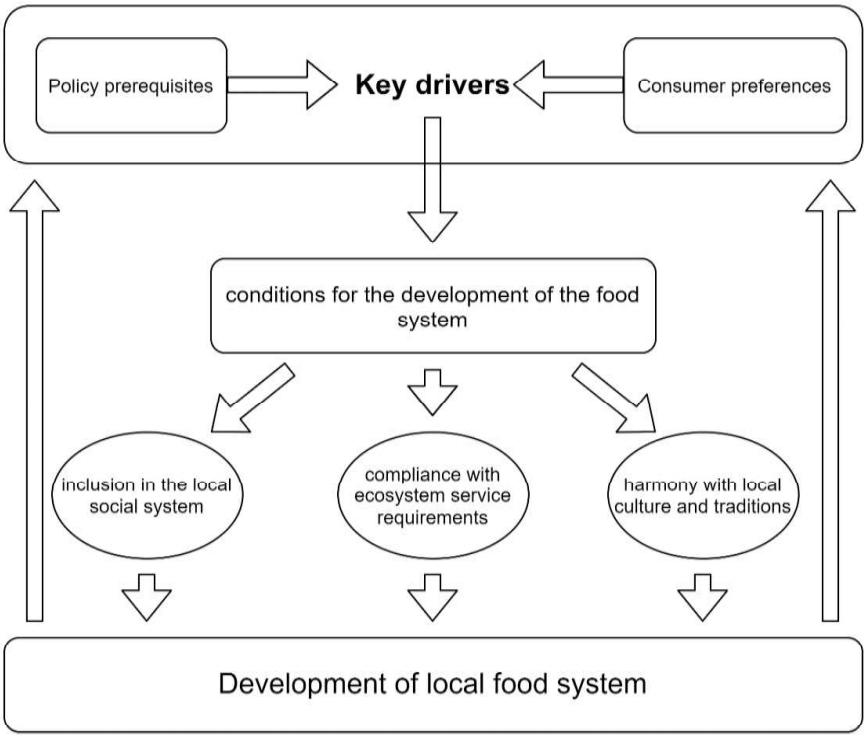

Figure 1. Local food system development framework.

The paper aim is to identify the necessary elements of the local food system and to create an integrated local food system evaluation model. The article analyses the key drivers that determine the development of the system (Fig. 1), the methodological aspects, as well as the aspects of the system that need to be integrated.

KEY DRIVERS

Inclusion in local social system. At the governmental level, a clear definition of local food is needed to develop and administer the relevant legal framework and policy funding programmes. The European Commission in its Regulation (EU) No 807/2014 of 11 March 2014 on rural development for the new CAP programming period recognizes the importance of short supply chains and local food producers while recommending the number of intermediaries as a criterion for defining short supply chains and distances from farms as a criterion for defining the local food market, taking into account the specifics of the particular area. Regulation (EU) No 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) provides the following definition: a short supply chain is a supply chain involving a limited number of economic operators committed to cooperation, local economic development, and close geographical and social relations between producers, processors and consumers. Improvement in the quality of food and trade flows increases consumers' sense of responsibility for the value and waste of food, thus helping to reduce the impacts of food on climate change. Cvijanovic et al. have focused on interpretations of the term local, which usually have the attributes commonly assigned to locally grown products: freshness, environmental sustainability and support for the local economy (Cvijanović et al., 2020). Consumers pay more attention to food quality and origin, which means the demand for local organic products tends to increase. This is a significant change in consumer preferences (Adams & Salois, 2010). From an awareness perspective, three different types of consumers can be identified for short food chains: active consumers, potential consumers and the general public. Food information and its health characteristics are key elements in attracting consumers to short food chains (González-Azcárateab et al., 2021). Locavorism is a significant trend that is often rooted in the sentiment of residents and tourists. Local food consumption is an important aspect of local tourism. Restaurants that stress the consumption of locally sourced produce can effectively create a choice argument for the consumer (Kim & Huang, 2021). Consumer choice plays the leading role in the development of local food production. From a governance perspective, it is essential to ensure that local food systems provide safe food (WHO, 2013). On the other hand, introducing the same requirements for small local producers as for large producers would be a significant administrative burden for the small producers. Control systems vary widely, from individual random control to comprehensive local food control systems. Establishment of clear procedures for enforcement, orientation of personnel and peer review within the local control units, in addition to cooperation, cross-auditing and discussion about the alignments between the units should be further enhanced to improve the consistency of implementing the evaluation and disclosure system and enforcement practices (Kettunen et al., 2018). A research study by Le Velly highlights the territorial dimension and collective identity as determinants of the sustainability and permanence of short or local food supply chains, as they are based on social, organizational and territorial innovations

that are still being structured (Le Velly, 2017). Small-scale producers, farmer associations, and NGOs become active and innovative policy actor in the regulation and governance of agricultural commodities and natural resource' (Starobin, 2021). Starobin (2021) refers to an emerging evidence that small scale producers may be 'leaders, rather than laggards, in the transition towards more climate resilient, ecologically-minded, and just forms of agriculture' (Starobin, 2021). Granvik et al. point out that the flexible understanding of local food by actors involved in the food production chain, which varies according to the relative position of the actor in the supply chain and their role in the food production process. Producers in the primary sector emphasize their role in the production of local raw materials, while those in the secondary sector state that locally produced food is the food produced by a company located close to the consumer, mostly from domestic and imported raw materials. Companies in the service sector (catering companies) consider the food prepared in their kitchens to be locally produced, not emphasizing the origin of raw materials (Granvik et al., 2017). Schoolman divides local food supply chains into two categories: direct-to-consumer supply chains that include the farmers' market, community supported agriculture (CSA) and farms, with long direct contacts having been established between farmers and consumers, and intermediated supply chains, which include farm-school programmes, partnerships with restaurants (from farm to fork) and food centres where one or more actors process fresh produce or livestock products delivered from farms and supply the processed food to final consumers (Schoolman, 2020). In many countries, there are also collective initiatives to revitalize the sector through fairs and local events, local partnership chains linking consumers and producers to supply 'food baskets' on a contractual basis. This indicates that territorial communities (municipalities) are becoming important actors in promoting more sustainable food systems, with local food producers playing an important role in supplying cities with food, thereby helping to maintain flexible, equitable and culturally appropriate food systems.

Compliance with ecosystem service requirements. Community activities for the preservation of natural resources could be viewed as a system that focuses on the rational interaction between local human activities and the environment, thereby seeking to ensure the preservation of specific natural objects and human participation in the restoration and rational use of natural resources (Paula & Kaufmane, 2020). Human impacts on ecosystem development make it difficult for the society to be provided with so-called ecosystem services, which is already a well-established scientific fact. At the same time, human interactions at the sectoral level make it difficult to assess the true anthropogenic impact. The Swedish multisectoral analysis approach has proved that the true anthropogenic impact is complex and must be assessed through the prism of the *water-energy-food-land-climate interaction* (Van Den Heuvel et al., 2020). It cannot be unequivocally asserted that local food is more sustainable. In some cases, global products have smaller impacts on climate change and food security (Schmitt et al., 2017). It is a popular belief that foods transported from remote regions have a higher GHG intensity, i.e. the so-called foodmile debate. However, the situation is ambiguous, as GHG emissions from transport are often only part of the emissions from the food system. The most significant part of GHG emissions is emissions from the cultivation and processing of basic products (meat, milk, cereals, vegetables), which also determines whether local food is more climate-friendly (Avetisyan et al., 2014). Agroecology is important from this perspective. Agroecology is an integrated approach that

simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system. (FAO, 2018) Despite the integrated concept of agro-ecology, the analysis more often links it directly to the production and sale of products. The main values defined for agroecology and searched for by actors relate to health and organoleptic characteristics of agro-ecological products, thus indicating that there is not a clear demand for 'agro-ecological' products per se. (Loconto et al., 2018) Although the concept of agro-ecology seems to be cognitive parallel to the concept of local food systems, their values are similar, but it does not allow the food system to be assessed as it is based on primary production and does not take into account the importance of food system processing, marketing and related services such as tourism.

Harmony with local culture and tradition. Although research studies in various countries give similar definitions of local food, there are some differences in the definitions. According to research studies done in the UK, local foods are the foods produced and marketed within a radius of 50–65 km (30–40 miles) (DEFRA, 2003) in rural areas, while urban areas increase this distance by up to 160 km (100 miles) (La Trobe). In contrast, research studies done in the USA indicate that locally or regionally produced agri-food products might have a transport distance of up to 640 km (400 miles) from their place of origin (Martinez et al., 2010). According to the Canadian Food Inspection Agency (CFIA), local food in Canada is the food produced in the province or territory in which it is sold, or the food sold across the provincial boundaries within 50 km of the province of origin, thereby emphasizing local food production within the administrative territory. A similar conclusion was made by Wuben et al. (2013) who have pointed out that the term local food has a narrow meaning and emphasized only geographical proximity, while short food supply chains could be interpreted as a broader phenomenon, including social relations. However, some researchers argue that geographical proximity is not the only component included in the definition of local food, and there are several other features that consumers usually associate with local food, especially with regard to its production methods (Porro et al., 2014). It is widely believed that a closer link between producers and consumers and local food production yield many positive results. Short supply chains increase the added value and profitability of small farms through enabling consumers to buy recognized products which have a 'story' and which they are willing to pay a higher price, thereby creating dynamism and social cohesion in rural areas. It should be noted that (Marsden et al., 2000) acknowledges that in the case of short food chains, it is certainly not important how many times the product is processed or the distance over which it is eventually transported, but that the product reaches the consumer information about relationships between production process and place. Hendrickson (2020), based on extensive research in the United States, points out that consuming local food has several functions. Rural people acquire local food through self-provisioning, sharing, reciprocity and informal arrangements. These forms of acquiring food depend upon specialized knowledge or inclusion in social networks. The EU's quality policy aims to protect the names of specific products in order to promote the unique characteristics of products linked to their geographical origin, as well as traditional know-how. Product names can be granted with a 'geographical indication' (GI) if they have a specific link to the place where they

are made. The GI recognition enables consumers to trust and distinguish quality products while also helping producers to market their products better. (EU, Quatity Schemes ..., 2021) Of course, for certain products, such as wine, the place of origin has traditionally been important. At the same time, this is due not only to the specific quality of the wine, which is guaranteed by the place, but also to the traditions, ethnicity and proximity, with the size of the production (small wineries) playing a relatively small role, which means an increase in the role of ethnocetrism (Fernandez-Ferrin, et al., 2019) In summary, assessing the role of local food in the formation of traditions and identity is quite complex, as social mechanisms are complex, but at the same time very important in the development of local food systems.

METHODOLOGICAL ASPECTS REQUIRING INTEGRATION

The development paradigm of defines that any social impact is measurable if using a sustainability approach. Besides, to compare local food systems with global food supply chains, a context that includes equal requirements for each of them needs to be created. The previous key driver analysis provides the view that the integrated evaluation model of the local food system should be able to evaluate social, environmental and cultural aspects. At the same time, it must be recognized that the development of a common model methodology must be able to integrate into a common approach in both qualitative and quantitative methods. In the following, we will briefly describe the possible methodological approaches according to the sustainability dimensions and the identified drivers. Most research uses qualitative research methods through interviews or surveys to help determine the role of local food systems. The URBAL methodology proposed by Blay-Palmer (2020) and colleagues includes three stages, interviews, workshop and reflection. This methodology involves innovation holders, policymakers, stakeholder representatives and sustainable expert interviews. The main advantage of the model is that it allows to observe the interaction of the parties involved, which is worth focusing on the development of innovation in the food system. A different approach to the use of in-depth interviews is taken by Budge and colleagues (2010) to assess the impact of a localized food supply 155 in-depth interviews are conducted. Focus groups are oriented according to supply chain - farmers, retailers, service providers, community group representatives, forcing to assess the impact of local food systems on natural capital, cultural, capital, human capital, social capital, and political capital, financial capital, built capita. As a result, the approach provides a broad overview of the impact of local food systems on capital formation, while acknowledging that the results are broadly interpretable. As regards integrated impact assessment, it could also be used as an expert method which we have employed earlier to assess GHG emission reduction measures in agriculture (Naglis-Liepa et al., 2018). Research on qualitative methods is related to the evaluation of economic food systems. The most popular approach is Input-Output models, which allow estimating economic transactions between industrial sectors. Many of them use ready-made IMPLAN (Impact Analysis for PLANning) software (eg Boisvert et al., 2012; Hughes & Isengildina-Masa, 2015; Guo et al., 2017). It should be noted that the amount of data in the model focused on northern America, which limits its use in other regions. The IO approach to determining the multiplier effect of the food system is understandable, it justifiably allows to show the interaction of otherwise difficult-to-assess economic processes. The use of the IO approach must take

into account - fixed prices, production within certain proportions, linear production function and unlimited production possibilities. (Schmit et al., 2016) A general equilibrium model, such as MAGNET (Modular Applied GeNeral Equilibrium Tool), is also used to determine the economic impact, providing policy analysis in various areas. (Woltjer & Kuiper, 2014) The model uses a global database and is developed by the Global Trade Analysis Project network. This model was used to assess the reduction of household food waste (Philippidis et al., 2019). In summary, there are many ready-made and adaptable tools for determining the role of the local food system, which, however, do not provide a comprehensive assessment. These differences are determined by the availability of research, the purpose of the research, and the complexity of the system itself.

ASPECTS OF SYSTEMS TO BE INTEGRATED

A significant challenge is the unified interpretation of the obtained results. Three different approaches mean a different view of the object under study. Different models or research methods may lead to different interpretations of the results, for example, the economic impact can be assessed either using econometric or some other numerical models, or using constructed market methods. Therefore, harmonization between individual methods is required as shown in Fig. 2.

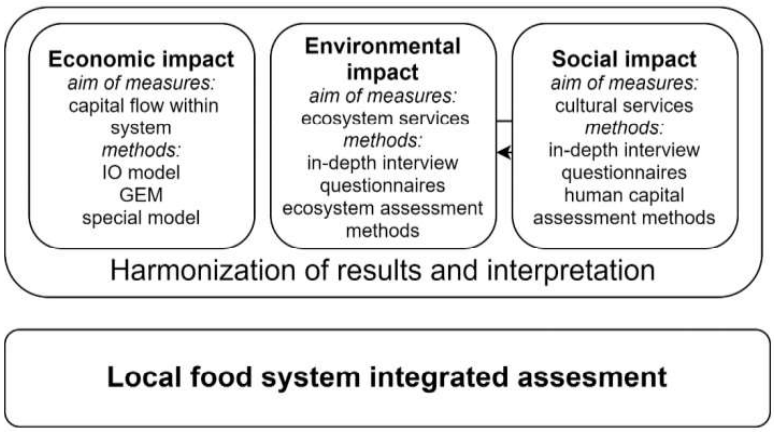

Figure 2. Conceptual model for food system assessment.

Harmonization is not about creating a master meta-model or a new single model that encompasses all other models or about declaring any single combination of models as the best or suggesting a universal combination to suit all. Harmonization is, rather, the development of one suitable solution that allows an organization's goals to be satisfied. Based on the above definition, we have defined model harmonization as being an activity that seeks to define and to configure the strategy which is most suitable for the organization's goals with the aim of relating two or more models. (Pardo et al., 2012) Often working on a larger project or model with the common goal of using data from different working groups for a single model is a challenge, so harmonizing data and assumptions and interpreting the results is an essential part of the model.

CONCLUSION

1 Local food systems are a concept, the application and understanding of which depends on the context. Local food systems contrast with global food supply chains, emphasizing the environmental, cultural or regional economic aspects of the food system. The intention to decouple these effects and create an integrated perspective on the existing phenomenon should be based not only on the food supply chain but also on emphasizing the interaction between the individuals and the policies made and implemented by them, as well as the interaction with the regional cultural element and the environmental element.

2 The development of the food system is due to the main key drivers: inclusion and role in local social system, compliance with ecosystem services, harmony with local culture and tradition. In essence, key driver's analysis provides integrated analysis of local food systems, as it is associated with changes in public values and development.

3 Integrated or multiplicative assessment requires a multidisciplinary approach, which usually involves the integration of several models or tools, where harmonization of data and appropriate interpretation of results are important processes.

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