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ORIGINAL ARTICLE

Building network for innovation and proximity in local development; sustainable farming initiatives in Izmir

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Abstract

Despite the increasing demand for food, agricultural systems are struggling with new challenges such as climate change, depletion of natural resources, loss of biodiversity and disease. This struggle requires not only ecological changes but also building economically and socially sustainable and resilient agricultural systems. Transitions to more sustainable practices are referred to as sustainability transitions, and the multi-level perspective (MLP) provides a framework for their analysis. In this study, based on information from primary and secondary sources in Izmir, Turkey, the MLP was used as a starting point, and using the literature on adoption/diffusion and economic geography with social network analysis, the role of human capital, social relations and regional capacity in restructuring the current regime for developing sustainable agricultural practices at a geographic scale is discussed.

KEYWORDS

adoption, geography of transitions, innovation, social network analysis, sustainability transitions

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INTRODUCTION

The world today faces new and unpredictable challenges alongside familiar old ones (Altenburg & Assmann, 2017). Comprehensive policies such as the sustainable development goals recognise that economic development worldwide should be environmentally sustainable and socially inclusive, and steps in this direction have been taken, particularly in the last decade (UN, 2019). Despite increasing demand for food around the world, due to the growing population, agricultural systems are struggling with new challenges such as natural resource depletion, biodiversity loss, disease and the impacts of climate change. According to food and agriculture organization of the United Nations (FAO) (2018), there is a need to build a sustainable agricultural system that supports resource efficiency in addressing challenges, protects natural resources and biodiversity, is resilient to challenges such as climate change and sudden shocks, and sustainable agriculture that must be not only environmentally but also economically and socially beneficial.

According to organisation for economic co-operation and development (OECD) (2016), innovation needs to be supported and sustained in order to struggle with new challenges facing agricultural systems. Sustainable agriculture, on the other hand, is an innovation as its production and post-production processes are different from traditional practices, as it encompasses different business segments from traditional practices in the areas of processing and marketing of products and can support agritourism opportunities as well as the formation of related small businesses in rural areas.

On the other hand, environmental problems pose different social challenges because they are multidimensional and require ambitious transformations (Turnheim et al., 2015). Multilevel perspective (MLP), which includes many different components and has been enriched in recent years with ideas from different scientific fields, provides a productive framework for studying the dynamics of change towards sustainable practices (Köhler et al., 2019). According to the MLP framework, sustainability transitions are the result of non-horizontal interactions between three analytical levels: the niches (areas where innovation emerges), the socio-technical regime (existing systems) and the socio-technical landscape as the external framework that determines the interactions between the niches and the regime (Geels, 2011).

Particularly in the MLP literature, which focuses heavily on radical innovation and has produced a large number of studies on large-scale transformations, less attention is paid to the social and geographic contexts in which the changes take place and to the attitudes and behaviours of the process actors affected by the changes (Geels, 2019; Köhler et al., 2019). Although socio-technical transition processes in agricultural systems require multilayered and profound changes, the social, geographic, socio-demographic and psychosocial contexts operative in the broader adoption and diffusion of innovation have significant potential for structuring change processes. In this sense, the main objective of the study is to demonstrate the role that human capital, social relations and regional capacity play in the development of sustainable agricultural practices at a geographic scale and the role that these factors can play in restructuring the existing system.

Within the scope of the study, the information collected from secondary sources in Turkey's Izmir was completed with 80 interviews with associated actors. To overcome the limitations of MLP, the study utilises the adoption/diffusion literature, which provides an efficient framework for human capital, learning, social networks and network relationships while focusing more on the qualities of adopters and the economic geography literature, which has a broad knowledge of regional capacities, policies and social capital related to geography. In addition, social network analyses are used to reveal network relationships.

The article advances as follows: The next section discusses the theoretical background of the study. The third section provides brief information about the methodology of the study and describes how the data collection was designed and carried out in the study area. The fourth section addresses the qualitative analysis of the data collected in the study area and the social network analysis carried out. Furthermore, it investigates the roles of socio-demographic characteristics, individual capacities, attitudes and social processes of the process actors, which are considered as human capital in the study, in the adoption of sustainable practices and what kind of role geography-specific policies, regional capacities and social capital play in the development of sustainable agricultural practices. Next, the results obtained from the qualitative data analysis and social network analyses are evaluated, and in the light of these data, the conditions of restructuring the socio-technical regime are discussed in the conclusion and evaluation section of the study.

The study, following a system approach by employing the MLP framework, the adoption/diffusion and the economic geography literature with process actors at a micro-scale, contributes to the transition literature by presenting a broad framework and a comprehensive methodology based on the findings examining the effects of the geographic contexts in which socio-technical transitions occur and the factors specific to human actors affected by the transitions towards more sustainable practices.

THEORETICAL BACKGROUND AND LITERATURE REVIEW

In the analysis of transition processes and dimensions towards sustainable practices, MLP, which has been enriched in recent years with ideas from different fields of science, offers an efficient framework (Köhler et al., 2019). According to Geels (2019), MLP includes many different social groups such as producers, consumers, civil society, policymakers and researchers in the context of rules, institutions beliefs and norms, as well as the actions of these various actors such as learning, discussion and negotiation. In doing so, it also allows for better awareness and understanding of transition processes and opportunities for intervention (Turnheim et al., 2015). MLP views sustainability transitions as the result of non-horizontal interactions at three analytical levels: niche (areas of innovation), socio-technical regime (existing systems, established practices) and socio-technical landscape as an external framework that determines the interactions between niche and regime.

The socio-technical landscape, conceptualised as the most stable level, refers to a very broad context and external environment that affects both niche and regime dynamics beyond the direct influence of niche and regime actors, such as macro-economy, deep cultural patterns, macro-political developments, wars, financial crises, accidents and oil crises (Geels, 2011).

The socio-technical regime refers to an established system of sustainability transitions (Geels, 2011). It is a deep and rigid structure of rules that guides and co-ordinates the activities of social groups such as highly institutionalised, cognitive routines and shared beliefs, abilities and competencies, lifestyles and user practices, institutional and legal regulations, mutually constructed by actors in the system (Fuenfschilling &Truffer, 2014).

According to Geels (2019), change occurs gradually due to numerous lock-in mechanisms such as existing infrastructure and investments, low costs and ease of application of existing practices, routines, shared perspectives and attitudes, low social capital, user habits and lifestyles, existing legislation, standards, policies, relationships with political actors and interests. Therefore, incubation areas are needed to protect novelties from the rigidities of the socio-technical regime, as

well as to support learning, networking and development processes (Bui et al., 2016). Geels (2011) defines these areas as 'niches'. The wider diffusion of niche-level innovation depends on internal regime-level dynamics that may result from a sudden change in the socio-technical landscape or normative pressures (Elzen et al., 2011). According to Fuenfschilling and Truffer (2014), niches can evolve and destabilise regimes over time.

According to El Bilali (2019), there are very few empirical studies on how niche, socio-technical regime and landscape levels work in agricultural systems. These few empirical studies highlight the significance of network development, learning and capacity-building processes to survive niche-level innovation. According to those, networks systematically co-ordinate organised learning and learning triggers innovation (Diaz et al., 2013; Drottberger et al., 2021; Ingram, 2018; Ingram et al., 2013).

In studies related to transitions to sustainable agricultural practices organic farming (Darnhofer, 2015; Smith, 2007), agroecological agriculture (Isgren & Ness, 2017; Levidow et al., 2016; Pant, 2016), permaculture (Ingram, 2018), multifunctional agriculture (Hassink et al., 2014), alternative production systems (Davidson et al., 2016), alternative food networks (Bui et al., 2016; Drottberger et al., 2021; Lutz & Schachinger, 2013) and alternative food movements (Morris et al, 2014) are considered innovation at the niche level.

The socio-technical regime level, which is mainly characterised by the industrial agriculture system, one of the areas where the need for change is seen most, includes legislation, policies (Diaz, 2013; Elzen et al., 2011; Li et al., 2012), social practices (Morrissey et al., 2014), infrastructures, institutions (rules, values, lifestyles), human actors, organisations, social groups (Darnhofer, 2015) and network relations (Diaz, 2013).

The socio-technical landscape is conceptualised as the most stable level and refers to sudden and large-scale changes. It includes international treaties, (Li et al., 2012) food crises (Davidson et al., 2016), lifestyles and changes in consumption habits (Immink et al., 2013; Morris et al., 2014), macroeconomics (Pant, 2016), climate change and biodiversity (Pant, 2016; Zwartkruis et al., 2018).

Although MLP is used as a productive framework in the analysis of transition processes, it has been criticised for providing very limited explanations of social and geographic contexts, attitudes/reactions of process actors and policies, lacking an empirical basis and producing too many studies on large-scale transformations, while there are limited studies at the local and micro-level scales (Geels, 2019; Köhler et al., 2019).

However, according to Köhler et al. (2019), these limitations can be overcome by applying ideas from other scientific fields to MLP efficiently. For example, although neglected in early studies, a whole new area called the geography of transitions has sprouted within MLP by combining the basic concepts of economic geography with the MLP. Studies in the field of geography of transitions aim to develop an understanding of how geography-based factors such as institutional capacity, local culture, social networks, infrastructures and local resources influence the emergence and development of sustainability transitions, the role of different scales from local to global in the transition process and the innovation networks that enable the diffusion of novelties.

Although socio-technical transition processes in agricultural systems are multifaceted and require major transformations (Turnheim et al., 2015), farmers represent the focus group in the agricultural sector, and the adoption behaviour of farmers plays a major role in the diffusion of innovation (Rogers, 1983). According to Rogers (1983), a farmer adopts an innovation that is transmitted to other farmers through network relations, and the wider adoption and diffusion of innovation leads to change. However, many different mechanisms on a micro-scale level play a significant role in the decision of adoption by determining the cognitive frameworks of users. Studies dating back to the early 1900s to explain why and how people adopt new technologies

practices lacked a coherent conceptualisation until Van Oorschot et al. (2018) diffusion of innovation theory (Van Oorschot et al., 2018). Numerous empirical studies in the literature on adoption and diffusion provide an efficient framework for human capital, learning, social networks and network relationships that constitute the limitations of MLP literature (Wigboldus et al., 2016).

Numerous empirical studies define financial or cost factors as the most important barrier to innovation adoption in the agricultural sector (Long et al., 2016). However, according to Czyzewski et al. (2021), the more crucial the traditional production factors are, the more crucial the human factor is for the adoption of innovation. Although the role of the human factor is relatively less analysed in agricultural studies than economic factors, there are fruitful studies on the effects of socio-demographic characteristics such as age, gender, education level and income level (Alam et al., 2010; Mwangi & Kariuki, 2015; Ntshangase et al., 2018; Yang & Sang, 2020) on adoption behaviour. For example, according to Czyzewski et al. (2021), human capital, conceptualised in relation to abilities and skills and whose driving forces are education and training, plays a significant role in farmers' adoption behaviour by improving their decision-making capacity.

Furthermore, studies show that farmers' behaviours and attitudes have an impact on their adoption intention environmentally conscious practices, but behaviours are also strongly influenced by social factors, not entirely under the control of farmers (Dessart et al., 2019). In recent years, many studies dealing with psychosocial factors that express farmers' attitudes such as their personalities, goals, motivations and values have provided favourable findings regarding the intention to adopt sustainable practices and possible future actions by looking at the attitudes of farmers with psychosocial models (Dessart et al., 2019; Martinez-Garcia et al., 2013; Menozzi et al., 2015).

However, these studies reveal that farmers' attitudes are easily influenced by their social interactions with external actors such as consultants, suppliers, co-operatives and extension services (Dessart et al., 2019). Many studies reveal that social learning, which is built with social processes, compared to other industries, has become much more important in the learning processes of actors in agricultural systems (Fry & Thieme, 2019; Rios et al., 2017). A neighbouring farmer who has adopted a sustainable practice can pass on his/her knowledge of the real costs, adoption of benefits and risks to nearby farmers (Dessart et al., 2019).

The presence of more diverse and dense social networks, characterised by social capital, determines the capacity for innovation since information about an adopted innovation is mostly disseminated and reproduced through interactions in social networks (Kemeny et al., 2016). Geels (2019) considers the weakness of social capital as one of the lock-in mechanisms for the development of innovation. In addition, regional capacities such as geography-specific legislations, policies, values, norms, infrastructures, network relations and social capital determine how the external world will be understood and interpreted individually and socially and can have an impact on the adoption decision as it creates cognitive frameworks (Darnhofer, 2015).

METHODOLOGY OF THE STUDY

Although socio-technical transition processes in agricultural systems require multifaceted and large-scale transformations (Turnheim et al., 2015), the social, geographic, socio-demographic and psychosocial contexts that are effective for the wider adoption and diffusion of innovation have significant potential for structuring change processes by determining the cognitive frameworks of actors directly affected by the innovation. In this regard, the main objective of the study is to reveal the role of human capital, social relations and regional capacities in the development of sustainable agricultural practices at a geographic scale and to explore the role these factors may

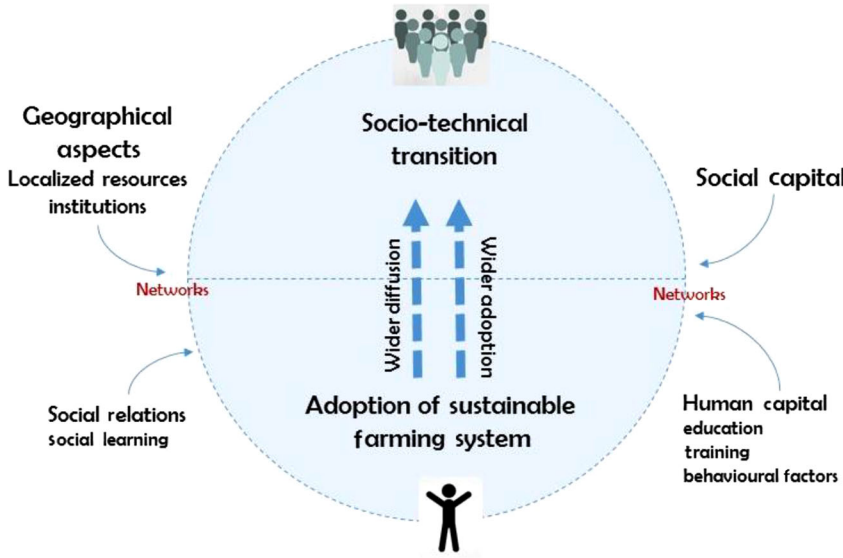


FIGURE 1 An integrated framework for the study

play in restructuring the current regime. This study examines the role that socio-demographic characteristics, individual skills, attitudes and social processes of human capital process actors may play in the adoption of sustainable practices and the role of geographically specific policies, regional capacity and social capital in the development of sustainable agricultural practices (Figure 1).

Based on the broad definitions of sustainable agricultural practices by FAO (2018) and OECD (2016), in addition to all sustainable production practices, other innovative initiatives that may undertake outside of the pure production function of agriculture and that contribute to the protection of natural resources and biodiversity are included in the sustainable agricultural practices.

Although the limitations of MLP are that it provides little explanation and does not have an empirical basis for the effects of social and geographical contexts, policies and process actors on transitions, according to Köhler et al. (2019), these limitations can be overcome by applying ideas from the different scientific fields efficiently to MLP. For this reason, the MLP framework used as the starting point in the study is used in conscience with adoption/diffusion and economic geography literature.

In the study, the individual capacities and attitudes of process actors were conceptualised as human capital and the notions of the literature on adoption/diffusion were used in examining the role of human capital. According to Van Oorschot et al. (2018) and Wigboldus et al. (2016), although MLP is underused in adoption efforts, it provides a promising theoretical framework for developing an understanding of the innovation process.

According to Czyzewski et al. (2021), the driving forces of human capital are defined as education and training. From this point of view, the learning habits of process actors at the micro-level should be revealed in the study of the role of human capital in adoption behaviour. In this context, informal learning (Leeuwis, 2004; Rogers, 1983; Suri, 2011) takes place with farmers' voluntary or involuntary social processes or individual understanding and co-ordinated and institutionalised learning that includes conscious learning activities of farmers such as media tools (Fry

&Thieme, 2019; Rios et al., 2017), certification, formal research and projects, extension services (Brunori et al., 2013; Ingram et al., 2013; Rios et al., 2017; Tsienkopfs et al., 2013) and learning from supplier/producer/consumer (Boyacı, 2017), distinguished as two learning approaches in adoption/diffusion literature.

However, since the knowledge that constitutes learning is mainly disseminated and reproduced through interactions in social networks, the presence of more diverse and dense social networks characterised by social capital determines the capacity for innovation (Kemeny et al., 2016). In the study, social network analysis is used to reveal the social relations among process actors and social capital in a broader context.

According to Boschma and Frenken (2009), the role of networks in the innovation process has become one of the main research areas, especially in recent years. Social network analysis is a method to study the interactions between actors such as individuals, groups and organisations. With a simple approach, nodes can be defined as 'users/individuals', and ties represent relationships between the nodes (Kumar et al., 2013). In social network analysis, network density is the sum of the values of all ties divided by the number of possible ties. In networks, more connected actors are often exposed to more and more diverse information. Therefore, the density of networks means that information spreads rapidly among actors and has high levels of social capital, while low-density networks mean the opposite (Hanneman & Riddle, 2005).

Study area and data collection

Study area Izmir, which is one of the leading metropolitan cities of Turkey, also appears as a developed agricultural city with a significant agricultural production capacity (İZKA, 2014). From this point of view, it provides a very rich framework for observing the development of consistent innovations by bringing together rooted institutions and innovative formations in the agricultural system.

Within the scope of the study, attended a meeting that was held in Izmir brought together industry stakeholders in order to raise awareness about the dynamics of agricultural systems and the actors involved in the system. Although the focus group consists of farmers, it includes a wide range of actors such as agricultural systems, agricultural companies, co-operatives, suppliers, consumers, non-governmental organisations, producer and consumer associations, universities, research institutes, extension services and public agencies. Furthermore, according to Wilson (2009), policies and/or social movements at the global and national levels differ in their reflection on policy practices and institutions at the regional level, as well as in their reflection on farmers. Therefore, a process was designed in which research and analysis are carried out at three different levels and research points: institutional, local and niche (Table 1).

Within the scope of the study, 20 interviews were conducted with representatives of public agencies, universities, non-governmental organisations and the private sector operating primarily in the fields of agriculture and rural development at the institutional level in Izmir. In these interviews, institutional capacities were identified at the regional level, and data were collected for local-level research. Those interviewed at the institutional level were asked about policies and practices at the regional level regarding the development of sustainable agricultural practices in Izmir's agriculture, the culture of innovation, the source of innovations, lock-in mechanisms for innovations, the actors within the sector, the relationships between actors, the general profile of farmer and the relationship of farmers with novelties. In addition, subjective opinions were sought

TABLE 1 Interviewed actors

Actors interviewed at the institutional level	
Actors	**Number**
Izmir Metropolitan Municipality	2
Izmir Directorate of Provincial Agriculture and Forestry	5
Development Agency	2
University	7
Non-governmental organizations (NGO)	2
Freelance researcher	1
Private sector	1
Sum	**20**
Actors interviewed at the local level	
Actors	**Number**
Representatives from Chambers of Agriculture	14
Head of co-operative	6
Farmers	17
Complementary actors (suppliers and private consultants)	5
Sum	**42**

Niche-level initiatives	**Number of interviews**	**Sustainable practices**
Urla Wine Route	9	Organic farming, short-distance supply chains, rural tourism (wine route, accommodation)
Olive Academy	1	New farm activities (ecological literacy), social activism
Nature School	3	New farm activities (ecological literacy), social activism
Köstem Olive Oil Museum and Organic Farm	1	Organic farming, short-distance supply chains, rural tourism (olive museum, accommodation), new farm activities (ecological literacy)
Complementary interviews	4	
Sum	**18**	

on niche-level examples that implement sustainable agricultural practices within the agricultural system.

Due to institutional procedures, interviews were conducted with the officials assigned to public institutions. In this regard, officials specialised in livestock, vegetable production, agricultural research and development (R&D), sustainable agriculture from Izmir Directorate of Provincial Agriculture and Forestry (IDPAF), the local agency of the central administration, two experts from the Izmir Metropolitan Municipality (IMM), one in charge of rural development projects and the other in charge of metropolitan planning and two project co-ordinators working in rural development at the Development Agency were interviewed. To identify other key actors at the institutional level, the snowball sampling was used, and these interviewers include agricultural economists, regional planners, a food company executive, the president of an association for innovative agricultural technologies and a food activist. Given the objective of the study and the interviews conducted at the institutional level, five separate research points were identified for interviews at the local level.

At the local level, the attitudes and perspectives of farmers regarding sustainable farming practices, the social relations of farmers, their learning habits and their relationship with novelties were asked to the interviewers from all research areas. In addition, information was obtained about the socio-demographic characteristics of farmers in direct interviews with farmers and organisational routine, practical and network relations in the interviews with co-operative representatives.

The first focus of research at the local level is the Chambers of Agriculture, which have a semi-public characteristic. Chambers of Agriculture have the opportunity to experience the local reflection of public policies at the national and regional level and to observe the profile of farmers, their relationship with innovative practices, social processes and problems by establishing a direct relationship with farmers.

Another research focus is on farmers directly. Based on the opinions of the actors interviewed at the institutional level, it was decided that the interviews with farmers would be conducted at two local producer markets in different regions of Izmir. In these markets organised by IMM, it is aimed that producers deliver their products to the consumer directly. Although farmers in these markets use traditional methods in their production, they benefit from short-distance supply chains by establishing a direct relationship with the consumer and may have some concerns about adapting their production to consumer expectations.

For the interviews at local producer markets, the sample was randomly selected. Of the 17 farmers interviewed, six were women and 11 were men. The age of the women interviewed ranged from 30 to 50 years, while the age of the men ranged from 25 to 55 years. While three male farmers have university degrees, one of the female farmers has a university degree and she stated that she had adopted a rural and more sustainable lifestyle to get away from the complexity of city life.

Since co-operatives are the predominant organisations in agriculture, they were identified as another research focus in order to understand the impact of being part of an organisation on the network development and learning processes of the farmers. Based on the interviews conducted at the institutional level, the interviews were held with the representatives of six major co-operatives with a total membership of 5500 farmers.

At the local level, interviews were held with suppliers and freelance consultants, identified as complementary actors in farm activities in the study. Snowball sampling was used to determine complementary actors.

The final research point of the study is niche-level initiatives with sustainable agricultural practices. Based on the institutional-level interviews, Seferihisar Nature School, Karaburun Olive Academy, Urla Köstem Olive Oil Museum and Organic Farm and Urla Wine Route Initiative, which constitute geographical integrity as they are located in the part of Izmir referred to as the Peninsula, were identified as niche level of study. Finally, 18 interviews were conducted with these innovative initiatives. Questions were asked about the founding stories, values, motivations, network relationships, learning habits and ways of engaging with the socio-technical regime. Of these initiatives, the Olive Academy and the Nature School are two examples that are non-profit and have their origins in non-governmental organisations. They aim to raise ecological awareness and pass on the culture of nature to future generations. Urla Wine Route is an exclusive boutique wine route established by seven winemakers clustered in a geographical area. Köstem Olive Oil Museum and Organic Farm is an organic production farm with the world's largest olive oil museum.

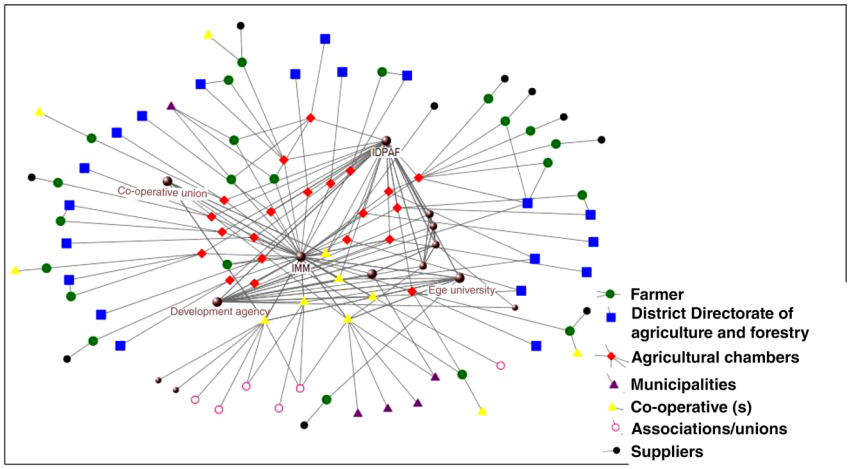


FIGURE 2 Networks in socio-technical regime. IDPAF, Izmir Directorate of Provincial Agriculture and Forestry; IMM, Izmir Metropolitan Municipality

ANALYSIS AND RESULTS

The niche level was considered as a separate analysis unit in the analysis, in accordance with the MLP framework. In this context, based on the data obtained from the institutional and local level interviews, the relations between the actors were processed using the NodeXL program and social network analysis was performed (Figure 2).

According to the results of the network analysis, the most influential actors institutionally involved in agriculture and rural development in socio-technical regimes are the IMM, IDPAF, and the Development Agency, which have the highest degree of centrality in the network. Ege University plays a very dominant role in the knowledge system of the socio-technical regime.

Izmir has been a very important port city throughout history and has always shown an external characteristic with its location and structure. It is one of the leading centres of agriculture and food industry in Turkey and the world with favourable climatic conditions and rich biodiversity. In addition to this agricultural culture from the past, the city is also a science centre that hosts many of Turkey's leading universities, agricultural research laboratories and R&D centres. With these characteristics, it is one of the three provinces with the most developed social capital in Turkey (IZKA, 2014). In the institutional-level interviews, it was emphasised that large-scale agro-food companies benefit greatly from the network relationships and advanced human and social capital in Izmir at the national and global levels and that these factors play an important role in the location selection of new investments (I. 1,2,6,7,8). In addition, awareness of healthy food consumption has developed significantly in Izmir. Izmir is one of the first cities in Turkey where social movements have emerged in response to the industrial food system (Karakaya, 2020). Organic farming practices were implemented in Izmir in the 1980s for the first time in Turkey. The Ecological Agriculture Organization, which is the only organisation in Turkey that unites ecological agriculture-related organisations under one roof, was founded in Izmir in 1992 (Ataseven & Güneş, 2008).

However, according to the interviews, it is stated that agricultural policies at the national level in recent years have played a restrictive role in the development of sustainable agricultural practices in Izmir as well as throughout Turkey. In the past, it has been stated that public incentives for

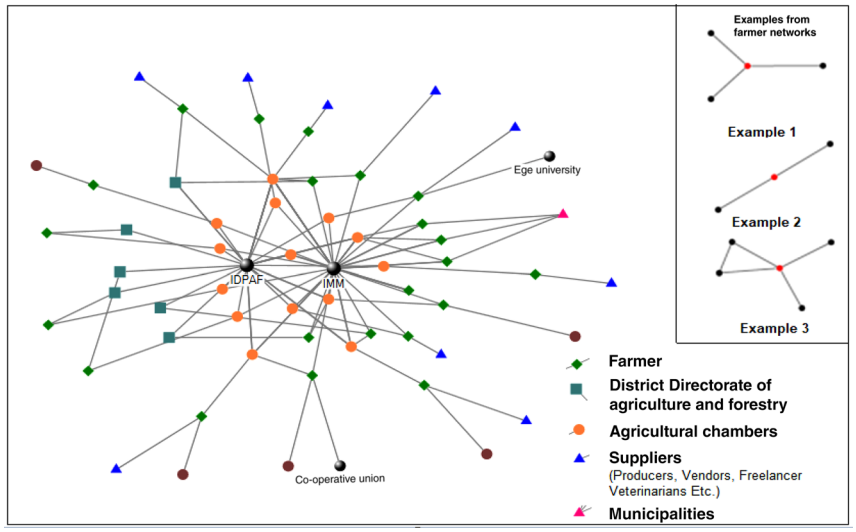


FIGURE 3 Network ties at the local level. IDPAF, Izmir Directorate of Provincial Agriculture and Forestry; IMM, Izmir Metropolitan Municipality

sustainable agricultural practices allow farmers to cover costs or even increase their profitability, but the decline in grants has resulted in farmers being unable to afford the costs of sustainable agricultural practices and a significant decline in the number of farmers willing to adopt these practices (I.6). At the regional level, IDPAF and the Development Agency are organisations that follow national policy entirely (I.3,4,5,6). Although the IMM performs very important innovative practices to support farmers at the local level, it is stated by IMM authorities that none of these is aimed at promoting sustainable agricultural practices directly (I.1,7,11).

According to the results of interviews at the local level, farmers mainly connect with other farmers. This is followed by the relations established with the supplier and with the co-operative if the farmer is a member of the co-operative. In addition, district agriculture directorates, which are local departments of IDPAF and the IMM are among the actors with whom the relationships are established. In fact, the IMM prefers to connect with co-operatives in order to encourage them to organise rather than connecting directly with farmers as a policy (I.7). However, the local producer markets organised by the municipality have become a platform for establishing direct ties between farmers and the municipality. According to social network analysis, the local-level network has low density, and farmers within this network are low-connected actors (Figure 3).

Farmers have very restricted access to extension services or formal information sources of socio-technical regimes such as universities, research laboratories and R&D organisations. It is not common among farmers to seek professional consultancy in pre-and post-production processes (5%). Social and individual learning has a very significant role in farmers learning practices. The most effective learning tools at the farm level are media tools such as the Internet, television and social media (25%), and daily conversations with close friends create learning from each other (26%). Farmers, who have problems during the production phase, first consult with the farmers they are in close contact with, and if they cannot find a solution, they consult the suppliers from whom they supply agricultural inputs. If they cannot find a solution there either, they apply to the Chambers of Agriculture and district agriculture directorates. The interviewees mostly state that the farmers exchange information with each other uninterruptedly. However, these exchanges

take place haphazardly in daily conversations with close friends, not through institutionalised or co-ordinated processes.

The condition for adopting sustainable practices among farmers is predominantly income maximisation. Environmental concerns are becoming a little more important in better-educated farmers. In the study area, farmers have only awareness of organic agriculture within the practices of sustainable agriculture and have a predominantly negative view. Sixty-seven percent of the farmers interviewed stated that they do not intend to adopt organic farming practices. Some of these farmers have tried organic farming before but have given up in recent years due to the high input costs (12%). While 23% of farmers say they can adopt it if it is profitable, 12% say they have no idea.

Interest in novelties varies according to education level, age and personality characteristics. In particular, farmers over the age of 50 stated that they have never experienced sustainable farming practices but never intend to adopt them (17%). Farmers over the age of 50 reacted very strongly to questions about sustainable agricultural practices. It has been observed that one of the reasons for this is that common negative discourse among farmers in the study area has a very decisive role. Many farmers point out that the reason for their negative view is what they hear from other farmers and even from others. In addition, farmers over the age of 50 are opposed to anything that changes their current practice. However, 74% of the farmers interviewed stated that their knowledge of sustainable agricultural practices was also low. Farmers aged 25–40 are more interested in innovation in order to improve their farms and increase their income (58%). In addition, it has been observed that the personalities of farmers are effective in their perspective on innovation. In the interviews, it was found that some farmers are much more enthusiastic and much more willing to improve their farms. Three of the farmers interviewed stated that they tended to improve network relations and sources of information by making connections with different actors within the system through their own efforts.

According to the interviews held with the representatives of the co-operatives, all six co-operatives are in constant contact with the main actors of the socio-technical regime such as IMM, the Development Agency, and IDPAF. Except for one co-operative, all co-operatives receive consulting services from Ege University. All co-operative leaders believe that network connections with political actors, especially at the socio-technical regime level, are very important for the future of co-operatives, and there is a strong tendency to expand these connections. It was noted that the awareness of the importance of direct links with the consumer has greatly improved in recent years such that the possibilities of social media have been used to develop these links and that tools such as certification have been used to improve the relationship of mutual trust. In co-operatives, it was found that the most effective learning tools within the organisation are training (26%), consultancy (20%) and certification activities (20%). However, the platforms where co-operative members can be involved in management processes are quite limited. In almost all of the co-operatives, no regular meeting is held except for the general assembly. The key people interviewed at the institutional level mainly criticise the limited culture of democracy and participation in the major co-operatives (I.8,12,59). All of the co-operatives interviewed produce under their own brands, and only two of them sell through the website. While four of the co-operatives have members who produce organically, there are no organic farmers in two of them.

According to the interviews, participation in a co-operative offers many opportunities to farmers. Apart from economic factors, farmers are expanding their networks by becoming part of a network of diverse actors. Co-operatives are bridging farmers to access the basic information sources of the socio-technical regime while producing new information through their R&D departments and disseminating it to members through internal communication tools. In this way,

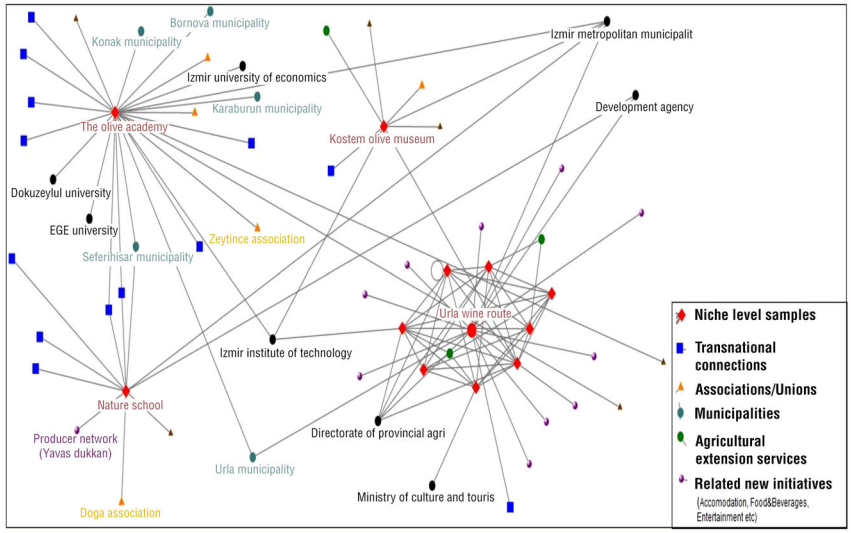


FIGURE 4 Niche-level social network analysis

farmers benefit from organisational proximity as well as the opportunity to access the sources of scientific knowledge that are difficult for them to access individually. Through shared institutional routines, information spreads easily across intra-organisation networks, creating new learning opportunities. In addition, co-operatives that organise training, field trips and demonstrations for their members from time to time can also provide them with extension services. The efforts of co-operatives to improve the quality of production in order to meet the expectations of consumers and improve market opportunities also force members to meet certain production standards. On the other hand, co-operatives do not yet have a guiding or compelling effect on members for sustainable practices. The main reason for this is that the market mechanism determines the policies of the co-operatives regarding production.

Niche level analysis

Niche-level networks are relatively interconnected and have a denser network pattern. Learning in niche-level networks has become much more co-ordinated and institutionalised. All initiatives connect with the main actors and major information sources of the socio-technical regime, and these connections can create new opportunities for both learning and development. Looking at the example of the Urla Wine Route, it is possible to say that innovation networks develop infrastructure by co-ordinating learning. Close relations, principles, rules and joint activities based on trust among Urla Wine Route members enhance organisational learning, and the learning that is mostly clustered around these partnerships creates economies of scale by improving the innovation infrastructure of the region. In the social network analysis at the niche level, it can be seen that the related new initiatives clustered around Urla Wine Route (Figure 4).

It is possible to say that the Nature Association's base that offers a rich diversity in terms of actors, being Birdlife International's partner, its activities throughout Turkey and even outside Turkey are the sources of the Nature School's relational networks that extend beyond the borders of Izmir (I.67,68,69). The academically influential actors of the Olive Academy, on the other

hand, enrich the networks by establishing transnational academic connections and creating new learning opportunities. In addition, in the Olive Academy, which has a strong democratic culture, the networks between the participants seem to be very tight and the relations are very close. It is possible to say that this makes 'learning together' one of the most effective learning tools in the organisation (I.66). Köstem Olive Oil Museum and Organic Farm, on the other hand, try to establish connections with local, regional and transnational networks through personal relationships and individual efforts of the actors in order to increase their visibility (I.63,64). The Olive Academy and the Nature School are two examples that were found entirely with environmental concerns, are non-profits and derive their source from non-governmental organisations (I.66,67,68,69). Although the Köstem Olive Oil Museum and Organic Farm and the Urla Wine Route initiative were founded for commercial purposes, they have actors who have an intense environmental concern and internalise it as a moral obligation (I.63,64,70).

DISCUSSION AND CONCLUSION

In the face of new and unpredictable challenges such as depletion of natural resources, loss of biodiversity, diseases and the influences of climate change our world is struggling, it is necessary to build a sustainable agricultural system that must ensure not only environmental health but also social and economic equity. For answering those issues, sustainable farming as an innovation with its production and post-production processes brings new approaches in order to struggle with the unprecedented challenges facing agricultural systems. Although the socio-technical transition processes in agricultural systems require multilayered and major transformations (Turnheim et al., 2015) by determining the cognitive framework of the actors directly affected by the innovation, the social, geographical, socio-demographic and psychosocial contexts, which are effective in the wider adoption and diffusion of novelties, have significant potential in the structuring of change processes.

Based on this assumption, the purpose of this study is to demonstrate the role of human capital, social relations and regional capacity in the development of sustainable agricultural practices using primary and secondary resources in the geographic scale of Izmir and the role these factors can play in redesigning the current system. Within the scope of the study, the information collected from secondary sources was complemented by 80 interviews with relevant actors in Izmir. For this purpose, the socio-demographic characteristics, individual capacities, attitudes and social processes of the process actors considered in human capital, what roles can be assumed in the adoption of sustainable practices and how geography-specific policies, regional capacities and social capital play a role in the development of sustainable agricultural practices were researched by making use of social network analyses in a wide framework created by bringing together MLP, adoption/diffusion and economic geography literature.

The results achieved in this context are as follows:

- IMM, IDPAF, and the Development Agency are the most influential institutional-level actors in agriculture and rural development within Izmir's socio-technical system. Ege University also plays a very important role in the knowledge system of the socio-technical regime. The open structure and historical agricultural background of Izmir have made the city one of the leading agricultural centres in Turkey. Agglomerated universities, agricultural research laboratories, R&D centres, global and local enterprises and related institutions and organisations in the region create an innovation infrastructure so that Izmir has improved social capital and

human capital. The advanced social capital and regional capacities embedded in this geography contribute to the further development of the innovation infrastructure by attracting large-scale companies to Izmir with their networks and information infrastructures in the food and agriculture sector.

- Moreover, access to this advanced information infrastructure by farmers, who are the focus actors in the agricultural sector, is very limited. At the local level of social network analysis, the network structure has a low density, and within this network, farmers are identified as low-connected actors. Farmers have very limited access to information sources or extension services from socio-technical regimes such as universities, research laboratories and R&D organisations.
- The condition for adopting sustainable practices among farmers seems to be income maximisation. However, educational level, age and personality play an important role in the adoption of sustainable practices. Environmental concerns gain some importance for better-educated farmers, and there is more interest in innovation. Better-educated farmers tend to have more access to and benefit from sources of information. The best reflection of this can be seen in niche-level examples. Although not all actors in the niche examples are primarily educated in agriculture, they are highly educated people, and these initiatives, where learning is much more co-ordinated and institutionalised, make connections to various sources of information at the local, national, and transnational levels and see this as an opportunity for learning.
- Especially farmers older than 50 years have a very strict attitude towards sustainable farming practices as well as all innovations, while farmers aged between 25 and 40 years are more innovative in order to improve their farms and increase their income. In addition, farmers who are much more enthusiastic and willing to develop their farms tend to improve their network relationships and information sources and increase their level of innovation by engaging with different actors within the system, despite any difficulties.
- In the study area, farmers are aware of organic farming only in the context of sustainable agriculture practices and have a predominantly negative view. However, this negative point of view is a conscious attitude among only a few. Many farmers point out that behind their negative view towards sustainable practices is what they hear from other farmers and even from others. The uninterrupted exchange of information with farmers to whom farmers are socially close creates important opportunities for social learning. However, too much social proximity can create a lock-in mechanism that prevents information from new and different sources (Boschma, 2005). Considering that farmers' networks in the study area are typically low-density and have very limited access to scientific sources of knowledge, a lock-in mechanism occurs that prevents the development of innovations. Within this lock-in mechanism, widespread discourses predominantly shape the cognitive frameworks of farmers. According to Roberts and Geels (2018), the negative discourse of the masses can negatively influence the development of innovation in the transition to more sustainable practices. At this point, it is possible to say that it has become very important to develop human capital and diversify and develop network relations for the desired transitions in the agricultural system. All of the niche-level examples in the study area are aware of the importance of network relationships to survive. Therefore, they make connections with various actors at the local, regional and national levels. These connections can create new opportunities to raise awareness for political actors and wider audiences, both at the learning and regime levels.
- However, public policy at the national and regional levels remains very critical to the transition process and the adoption intention of farmers. Public policy has significant potential for the adoption and diffusion of sustainable practices, and public policy determines the pace and direction of innovation required for change. However, it is possible to say that national

public policy is left entirely to the market mechanism and that applications related to sustainable practices have a very limited place in the vision of agriculture at the national level.

As a result, social, geographical, socio-demographic and psychosocial contexts have significant potential in the configuration of change processes, but transition processes are political processes (Köhler et al., 2019), and political actors need to take some crucial steps to mobilise these potentials on the path to change. The most important action that can be taken in the short term is to raise farmers' awareness of sustainable practices and reduce prejudices about them. This can be done through public extension services and education/training programs. In addition, farmers in the study area benefit greatly from media opportunities. Organising media campaigns can prevent prejudice among farmers and address environmental concerns. In the longer term, it seems important to develop measures to expand farmers' networks. Connecting farmers to sources of scientific knowledge and incorporating co-ordinated learning as well as social learning in the learning practices of farmers can play an important role in preventing misinformation and reducing the impact of negative discourse on farmers. Although the culture of democracy and participation is weak in co-operatives, membership in a co-operative expands farmers' networks, which facilitates their access to various sources of information and knowledge and creates new learning opportunities. Therefore, supporting farmers' organisational processes can also increase farmers' knowledge and awareness.

According to Geels (2011), sudden changes in the socio-technical landscape may play an accelerating role in the transition process. Turkey's signing of the Paris Agreement and its commitments to climate change can be seen as an opportunity to re-orient public policy. However, transition processes require a long-term, integrated and diversified process that involves all stakeholders rather than traditional, isolated top-down processes (Dessart & Van Bavel, 2017). However, institutions and policies at the national level may not have the flexibility to manage such processes. At this point, IMM, which has a more dynamic structure, can play a more decisive role. In taking these steps, IMM can also benefit more from the capabilities of civil society and collective movements. At the very least, IMM can reconsider the incentive system in a way that leads farmers to a more sustainable production process. For example, when purchasing products from co-operatives, under the contracted production model, the products may be expected to meet certain sustainability criteria.

In parallel with these processes, it is also very important to support niches that provide a protective shell for innovation with public policies. Therefore, an efficient development strategy for niches will be to raise awareness in the policy field by strengthening their links with actors, especially at the political level. One step that can be taken for the Olive Academy and the Nature School is to collaborate with other NGOs to reach a wider audience, while strategies such as the Urla Wine Route and the Köstem Olive Oil Museum can be pursued to raise their visibility, for example, by adapting to broader routes or networks at national and local levels.

However, since there will be winners and losers (Geels, 2019; Köhler et al., 2019) of transition processes that begin at the niche level and move to the political and cultural spheres, the actors, interests, negotiation processes and power relations are reconciled or in conflict with each other in the changes that are occurring at the geographic level towards sustainable practices.

The study followed a system approach using the MLP framework, adoption/diffusion and economic geography literature with process actors at a micro-level, contributes to the transition literature by presenting a broad framework and methodology based on the findings to examine

the implications of the geographic contexts in which socio-technical transitions occur and the factors specific to human actors affected by transitions to more sustainable practices.

AUTHOR CONTRIBUTIONS

Conceptualisation, methodology, writing—original draft preparation, writing—review and editing: Merve Yazar Yildiztekin and Demet Erol. *Software, validation, formal analysis, investigation, resources, data curation, visualisation*: Merve Yazar Yildiztekin. *Supervision*: Demet Erol.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data reported in this study is contained within the article.

ETHICS STATEMENT

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Gazi University Ethics Committee (Ankara, Turkey) (Date of Approval: 03.08.2021; Project identification code: 2021–755).

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