ARE ITALIAN FARMERS WELL PREPARED TO TACKLE THE CHALLENGE OF SOCIAL NETWORKS?

GALLUZZO N.
ASGEAR
(Association of economic and geographical studies of rural areas)
Rieti
Italy
asgear@libero.it

Paper prepared for presentation at the 141th seminar EAAE

(European Association of Agricultural Economists)

'***Social Networks, Social Media and the Economics of Food***'

Montreal, Canada, May 29-30, 2014

Abstract. *New information communication technology is a good opportunity to exchange information and to get feedback from customers shortening the traditional channel of social relationships. In different countries over the time there has been a significant growth of social interactions by social networks but in Italian farms internet and social networks are not so widespread. Anyway farmers specialized in certified quality food are more involved in using internet and social media with the purpose to increase their commercialization opportunities. The quantitative method of analysis has been pivotal to estimate the role of Italian farms in tackling the challenges of social network and internet. Summing up, social networks and internet may be the best chances to solve the sense of remoteness in rural areas in particular in Italy where the generational turn-over, by many initiatives financed by the Common Agricultural Policy both in 2000-2006 and also in 2007-2013, has been intense enough to develop a young generation of farmers highly sensitive in using social media and proud to be a part of these virtual communities.*

Keywords: Certified quality food, Kohonen map, multiple regression model, agro-tourism, rural diversification

JEL code:

1. Introduction

In 2013 a wealth of Italian farms have produced a lot of high quality food identified by the label Protected Designation of Origin (PDO), which are more than 250 disseminated in all Italian regions (Inea, 2013). According to the data of the European Commission, in economic term the total value of the European commercialized certified quality food was equal to 16 billion of euro and in Italy this is equal to 12 billion of euro (European Commission, 2014). The impact of certified quality food has been very positive for Italian farmers with direct and indirect economic effects on farms' incomes due to a direct commercialization of products in order to reduce the oligopolistic buyer's power and the information asymmetry (Sodano, 2004; Akerlof, 1970).

In Europe over the last three years there has been a growth of diffusion of internet and specifically of socials network (Eurostat, 2014). Recent findings have underlined as three quarter of farms with 10 employees use internet and have a website but in Italy only 25% of agricultural enterprises use regularly social media; on the contrary, in Ireland or Iceland more than 45% and almost 60% of people in the countryside use internet and social media, bearing out a dichotomy about the social media divide and web technology among the north and the south of European countries (Eurostat, 2014).

The last data published by Eurostat has pointed out as there has been in 2013 a most important discrepancy between the country of north Europe and south and this gap is increased (Graph. 1). The reasons of this social media divide are tightly linked to a significant growth of internet diffusion which is more than 70% in some European states whereas in other ones is less than 50% (Graph. 2).

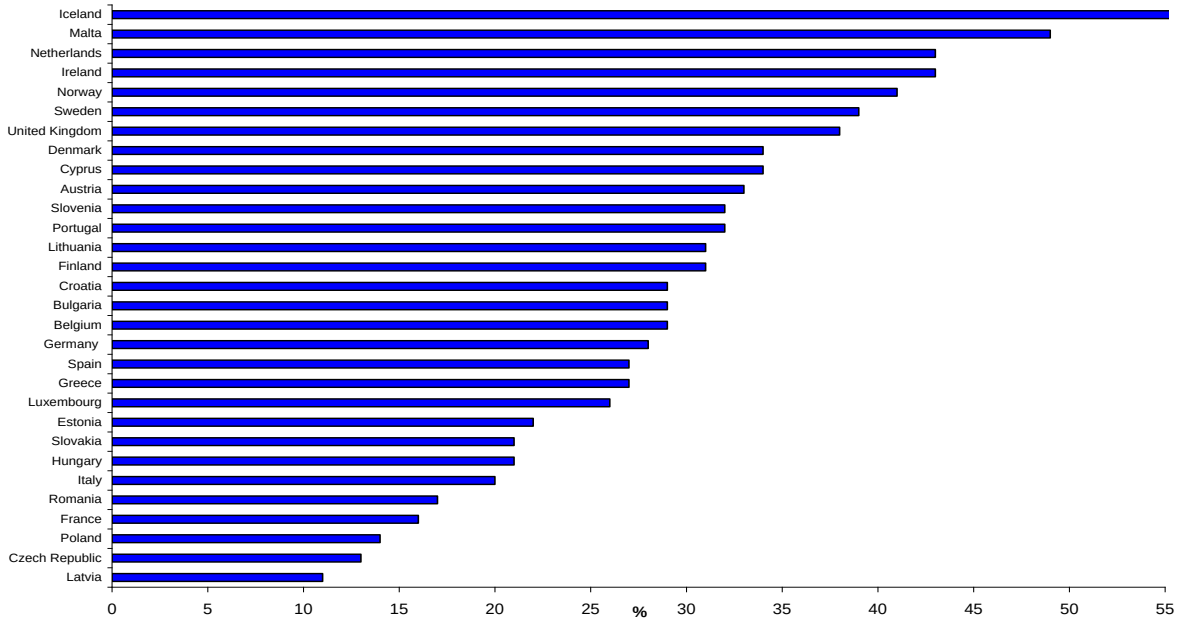
In 2012 the diffusion of social media was particularly concentrated in the northern European countries even if in some states of the Mediterranean area only 45% of population use social media sites to exchange opinions, comments or idea (Fig. 1). Even if in the same time in sparsely populated areas as rural territories in all European countries the data have pointed out a less diffusion of social media than the urban areas where there is an high concentration of living people (Fig. 2). This has implied an increase the sense of remoteness and isolation of rural areas, which may find on internet and in new social media an appropriate solution and a good change to solve the marginalization in these areas attracting more people to live in the countryside.

Nevertheless, there is a meaningful diffusion of internet in Italian population, only a low percentage of Italian farms have a direct connection to Internet and use it to become a member of social community networks. The reason of this is due to the aging of farmers, in fact more of Italian farms are hold by people over 55 years old, who are not well prepared in using new technologies to promote their farms and to exchange information by social network. Some findings in Italian organic olive oil and in chestnut productions (Galluzzo, 2004; Galluzzo, 2006) have underlined the role of Internet and of an appropriate website in improving selling opportunities of farmers in particular in farm located in less favored areas (Galluzzo, 2010).

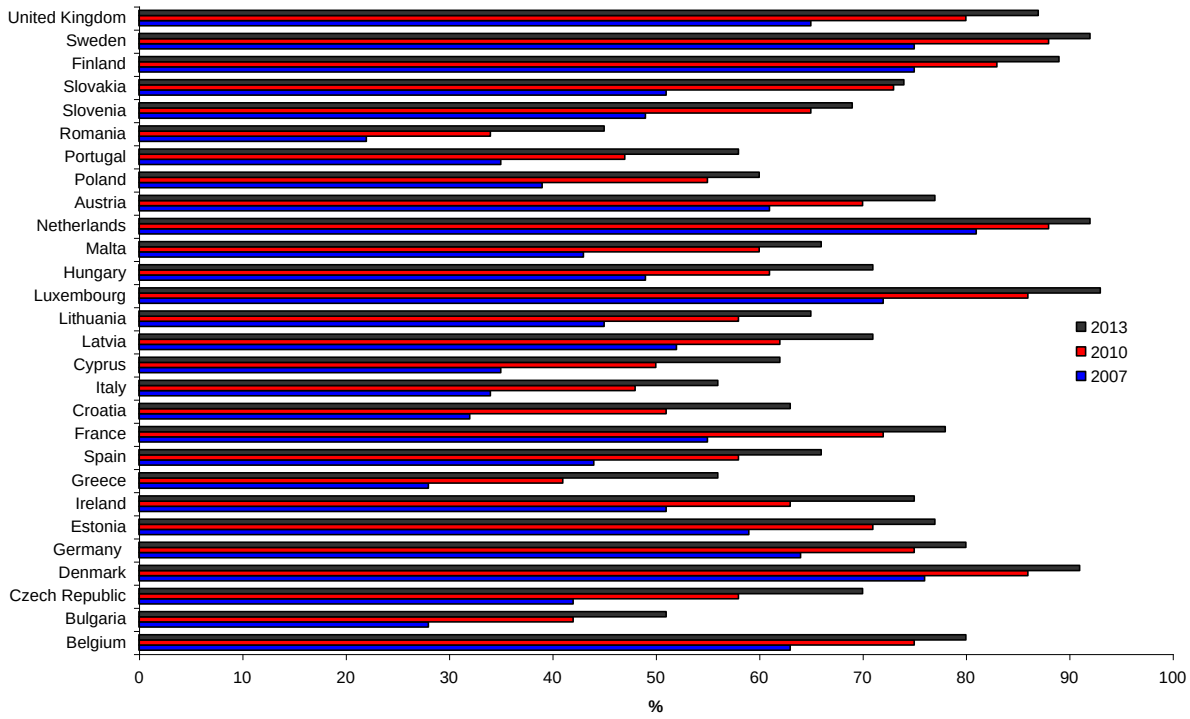
It is pivotal to underline as social networks have a double fundamental effect both in promoting food, farm activities and rurality and also in enhancing the selling opportunities and farmers technical-

economic efficiency because immediate is the dialogue among different people connected each other, becoming aware instantly of negative aspects and critical points related to the product or the service in case of rural tourism. Specifically this is particularly true in some territories located in upland Italian areas where the social networks are a fair chance to reduce the socio-economic marginalization and to lessen the sense of remoteness in the countryside.

The social network is the first and foremost tool to promote the farm and to communicate its activity as well with an high impact in all the world, due to more than 1 billion of people are member of Facebook, Twitter and so on, with a low level of cost finalized not only to promote the farmer's activity but to stimulate a multifunctional approach giving value to the territory and to the products and tourism.



Graph. 1- Diffusion of social media in 2013 in European countries *(Source: Eurostat, 2014)*



Graph. 2- Diffusion of Internet in different European countries over the time (*Source: Eurostat, 2014)*

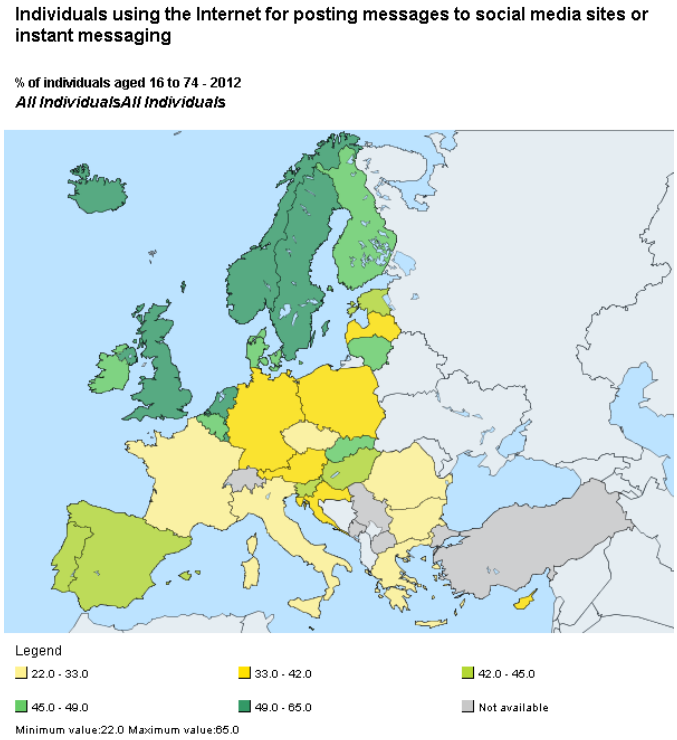


Fig. 1- Diffusion and use of social media in different European countries *(Source: Eurostat, 2014)*

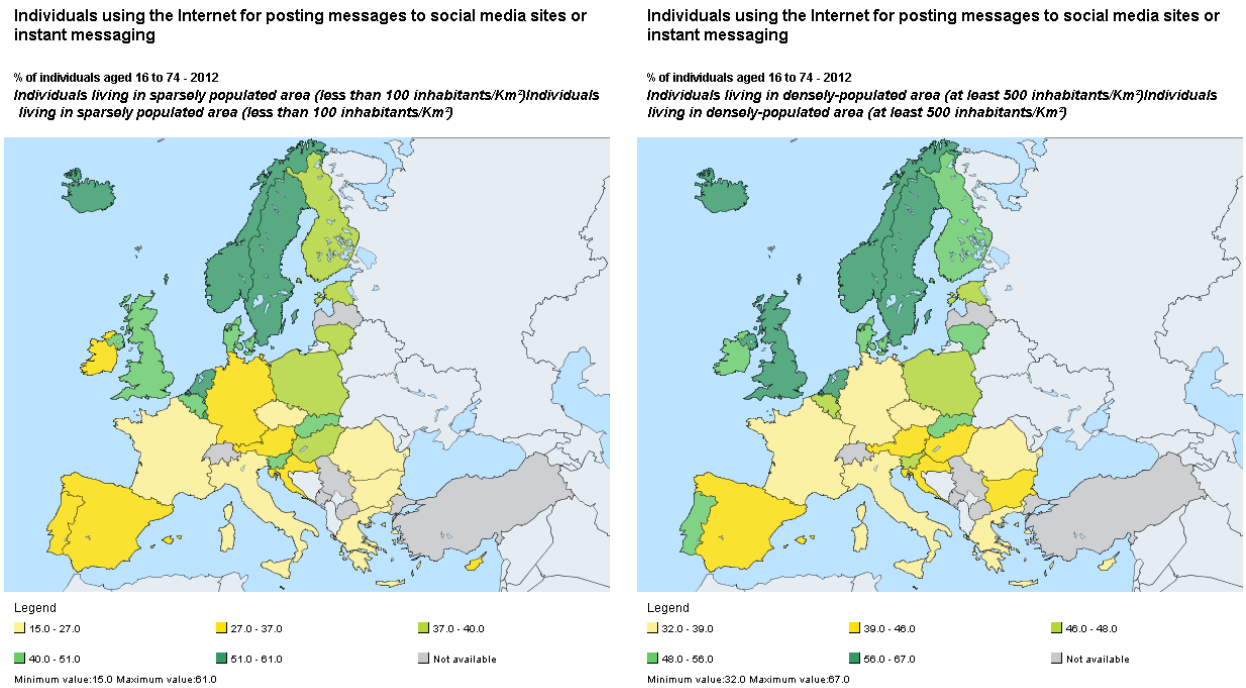
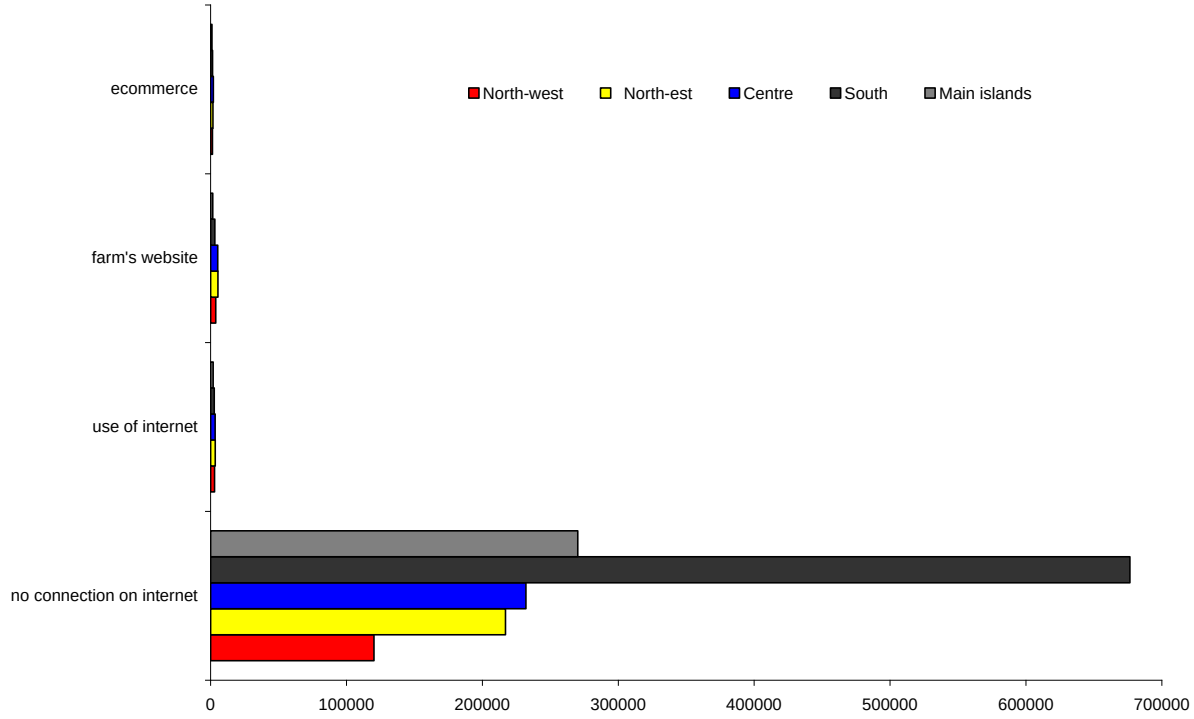


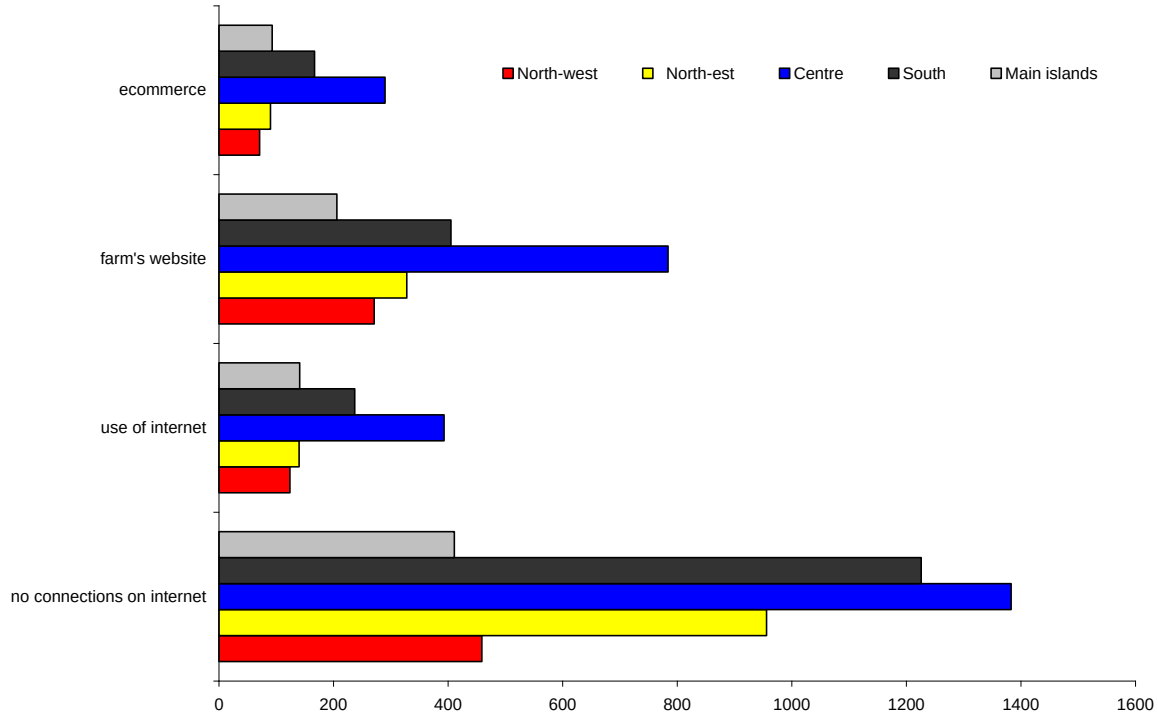
Fig. 2- Use of social media comparing urban and rural areas in some European countries *(Source: Eurostat, 2014)*

The positive aspect of social media in farmers, which have a specific website, is a direct and pluridirectorial information channel of communication compared to traditional social network and also to the blog that is able to gather lots information more than the traditional ones (Lo Surdo, 2013), able to create in a virtual world of mouth and a round table in progress where everyone can express its opinion or comments. The weakness of the social network is the time to dedicate to get a partial feedback from all people and a virtual vision of problems; anyway social networks are an useful patch

in the framework of new farm's interactions aimed to develop many opportunities of farmers and to solve their issues.



Graph. 3- Small holding farms in Italy and use of new technologies in different areas *(Source: Istat, 2011)*



Graph. 4- Limited companies farms in Italy and use of new information technologies in different areas *(Source: Istat, 2011)*

2. Aim of the research

The purpose of the analysis has been to investigate, using a quantitative approach, if the Italian farms, producing certified quality food such as PDOs, are well connected with worldwide networks.

Moreover, the analysis has sought to point out whether farmers are able to use Internet, which is a proxy variable of the diffusion of a new way to exchange information, in promoting food and farmers activities, such as agro-tourism and handmade products, and in getting to farmers feedbacks from customers or other people, who need to exchange and to share information or other points of view about quality food and rurality throughout social networks.

3. Methodology

This analysis has used a quantitative approach, that has been divided in two stages. In the first stage it has used a multiple regression model to estimate if certified quality food, rural diversification and an ample diffusion of Internet have acted on the development of a social network in all Italian farms. The parameters of the multiple regression model have been estimated by the Ordinary Least Square.
To assess the parameters and the different interrelationships among independent and dependent variables it has used a quantitative approach by a model of multiple regression.
The estimation of the parameters has used the open source software GRETL 1.8.6. In its algebraic form of matrix, the multiple regression models can be so expressed (Verbeek, 2006):

$$\mathbf{y} = \mathbf{X}\beta + \varepsilon \quad (1)$$

where **y** is a dependent variable and ε is the error but both are vectors with n-dimensions **X** is an independent variable which has dimension n x k.
In analytical terms, the model of multiple regression in its general formulation can be written in this way (Asteriou and Hall, 2011; Baltagi, 2011):

$$y = \alpha_0 + \alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 + \varepsilon_{jt} \quad (2)$$

y is the dependent variable
α_0 constant term
x_1, x_2, x_3,x_4 independent variables in the model
α, β, γ, δ estimated indicators or parameters of the model
ε_{jt} term of statistic error.

Basis assumptions, to use a multiple regression model, are:
statistic error *ui* has conditional average zero that is $E(ui|Xi) = 0$;
(*Xi*, *Yi*), $i = 1...n$ are extracted as distributed independently and identically from their combined distribution;
Xi, *ui* have no fourth moment equal to zero;
There is not correlation among regressors and random noise so that the value between β expected and β estimated is the same and to analyze if there is heteroskedasticity on standard errors, it has used White's Test on the error terms.
The second stage of the analysis has also used a quantitative approach to investigate in all Italian regions the diffusion of Internet as a tool to implement social network relationships and specifically the purpose has been to assess if social networks, indirect estimated in terms of diffusion of Internet and farm's web pages, have acted on the production of certified quality food. In this case the quantitative methodology has used the Self Organizing Maps (SOM) proposed by Kohonen (Kohonen, 1995), using for the estimation of the parameters the open source software SPICE-SOM, aimed to find if there is an unique winner neuron in terms of best Italian region.
In general Self-Organizing Maps are particularly useful to estimate by time series the structure and the evolution of some variables, such as poverty, lifestyle, health situation, development and welfare situation in different countries aimed to obtain an unique parameter by the visualization of different clusters (Kasky and Kohonen, 1996; Mehmood et al. 2011). General speaking, the light areas are the zone where there is a high level of clustering and the dark ones are the opposite (Kohonen, 1995) even if scholars proposed GTM (Generative Topographic Map) as the alternative to the SOM map (Bishop et al., 1997).
The Self-Organizing Map (SOM) is a particular quantitative model of artificial neural network which is trained using unsupervised learning to produce a low two dimensional representation of the inputs in

some training samples or maps (Kohonen, 1995). Self-organizing maps are different from other artificial neural networks because they use a neighborhood function in order to preserve the topological properties of the input space considered in the model of analysis (Meraviglia, 2001).
The self-organizing maps are useful to visualize low dimensional views of high dimensional data and consist of components called nodes or neurons. Each node is a weight vector of the same dimension as the input data vectors and also as a position in the map space and the usual arrangement of nodes is a two-dimensional regular spacing made by an hexagonal grid or rectangular box. The self-organizing map describes a mapping from an higher dimensional input space to a lower dimensional map space. The procedure for placing a vector from data space in the map is to find out the node with the closest, that implies the smallest distance metric, weight vector to the data space vector and each vector is linked with every neurons in the dataset (Kohonen, 1995).

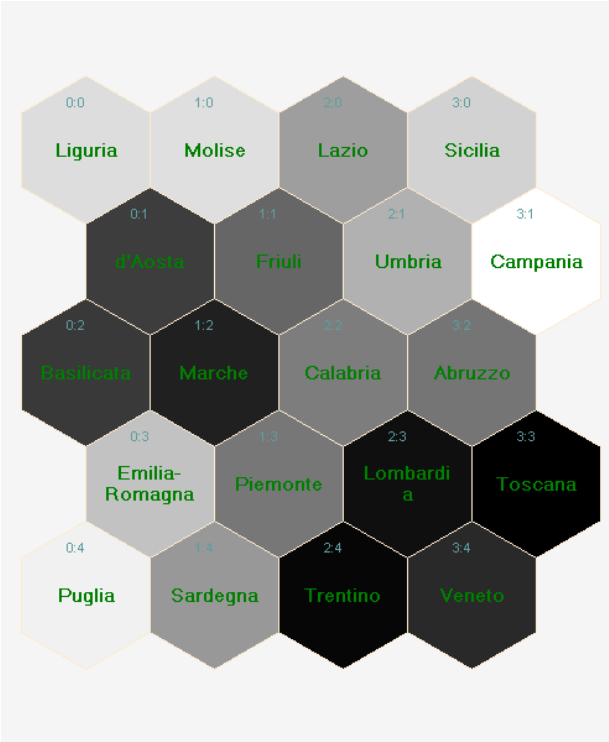


Fig. 3- SOM in Italian farms having informatics connections *(Source: our elaboration on data Istat, 2011)*

Fig. 4- SOM in Italian farms not having informatics connections *(Source: our elaboration on data Istat, 2011)*

The purpose of the learning process in the SOM is to define different parts in the network made by SOM able to match with patterns of different inputs. The weights of the neurons are initialized either to small random numbers or values sampled from a subspace crossed by the two larger eigenvalues of the principal component analysis able to increase the training because initial weights are a good approximation of the weights of the SOM (Kohonen, 1995). When a training sample input is put in the network, its Euclidean distance is calculated from all vectors of weights. The neuron with weight vector most similar to the input is called the Best Matching Unit (BMU). The weights of the BMU and neurons close to it in the SOM lattice are closer to the input vector and the intensity of the approach decreases over time and in function of the distance of the neurons by the BMU.
The formula used for updating the weights of a neuron is Wv (Lucchini, 2007):

$$Wv(t+1) = Wv(t) + \Theta(v, t)\,\alpha(t)\,[D(t) - Wv(t)]$$

where $\alpha(t)$ is a monotone decreasing learning coefficient and D(t) is the input vector. The function that defines the neighborhood $\Theta(v, t)$ depends on the distance in the lattice between the BMU and the neuron v. In a simplified form of competitive network the value is equal 1 for all neurons close to BMU and 0 for others, even if the most common choice is similar to a Gaussian function. In general,

regardless of the kind of used function, the neighborhood function decreases over time; initially, when the neighborhood is broad, the self-organization takes place on a global scale and when the neighborhood is reduced to only a few neurons weights converge to a local estimate called tuning phase. This process is repeated for each input vector, for a variable large number of cycles.

Fig. 5- Main results in SOM in Italian farms able to produce certified quality food *(Source: our elaboration on data Istat, 2011)*

4. Results and discussion

The results have pointed out as the diversification in rural activity, throughout the agro-tourism and certified quality food, have acted on the breakthrough of Internet in Italian farms. The role of social networks in Italian farms, producing certified quality food, have generated new ties among farmers and users, which are pivotal to develop a greater level in diversification of farmer activities in the multifunctionality development of rural areas.

The Self Auto Organized Map have underlined as in some Italian regions in which the agro-tourism and the certified quality food are so developed over the time there has been an high diffusion and utilization of Internet. In fact, the darkness of the component planes have underlined the Italian region where there has been an high diffusion of new technologies tightly linked to certified quality food and agro-tourism. The findings in this case have highlighted a meaningful dichotomy among north and south regions (Fig. 3). The results in farms which do not have Internet connections have pointed out as a clusterization in the Italian regions with a good diffusion of certified quality food and agro-tourism where lower is the value of component planes (Fig. 4). The regions in hexagonal nodes whitish are characterized by a low level of Internet, certified quality food and activities able to diversity the production. Summing up the main results have underscored as the development of certified quality food has been the first and foremost pillar to guarantee an high diffusion and growth of agro-tourism farms (Fig. 5) with three clusters of regions in function of the development of internet.

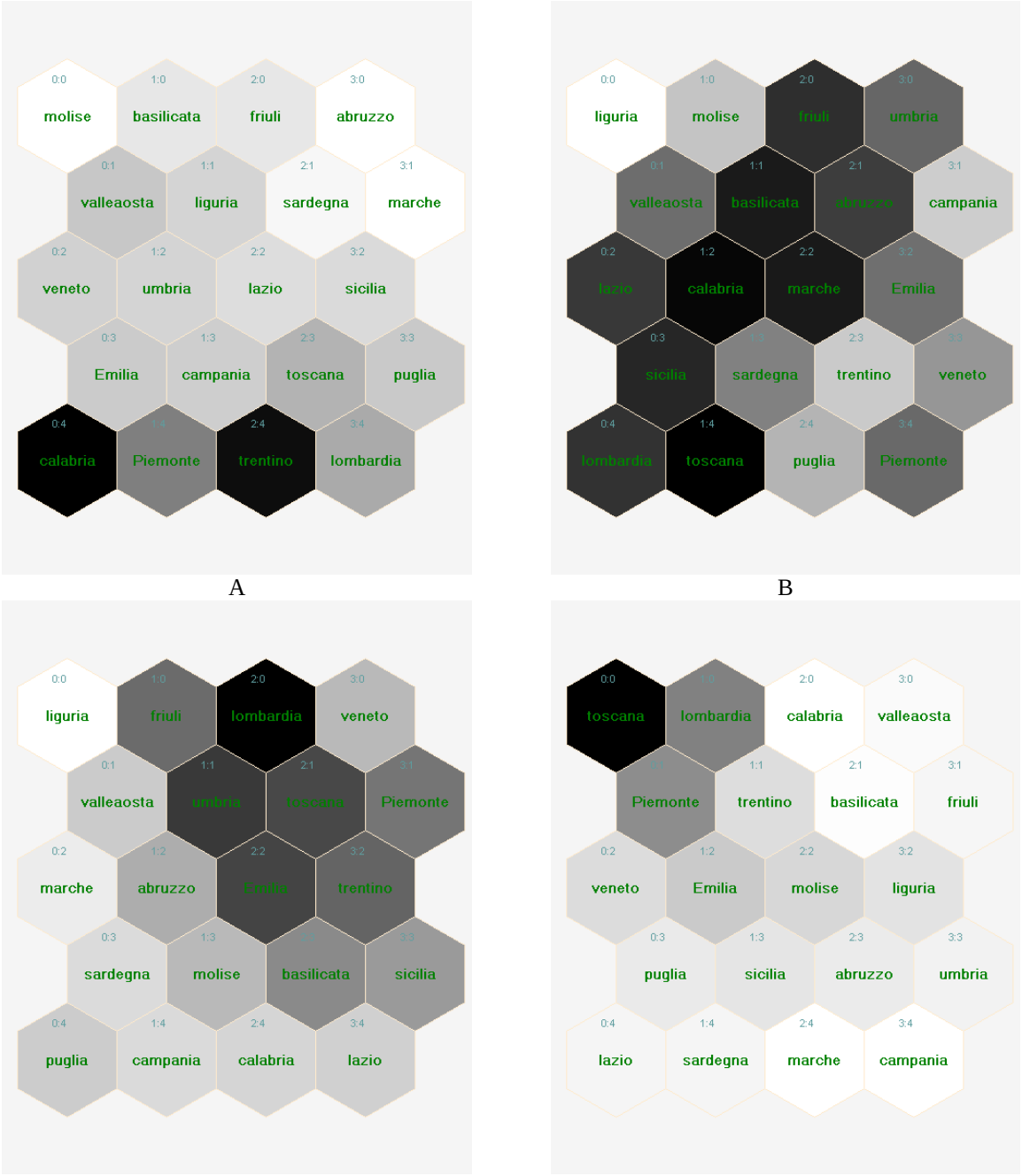


Fig. 6- Main characteristics of main aspects analyzed by SOM in Italian farms such as agro-tourism (A), pluriactivity in farms (B), diffusion of Internet connection (C) and farm's website (D) *(Source: our elaboration on data Istat, 2011)*

In general the value of inputs of the main parameters related to the farm productive diversification and to the use of new information technologies able to contribute to the SOM have pointed out a different role of agro-tourism and pluriactivity, which is less important and diffused than the pluriactivity, and the black nodes are connected to the high level of parameters instead the white ones are the lowest values example of a strong connection between internet diffusion and farm's website (Fig. 6).
Italian farms are able to use efficiently new information communication technologies and in the same time in promoting their certified quality food; the connection on Internet of these farms have been influenced in a direct and significant way by the independent variables such as farm's website in order to sell PDO productions and also by the diffusion of specific ecommerce link in the webpage (Tab.1). A negative correlation has been underlined between the independent variable diffusion of PDO farms

able to use information technology and the diffusion in the farm's website of an e-commerce space in which to sell and buy food products.

Tab. 1- Main results of the multiple regression model dependent variable Italian farms producing PDO and having the Internet connections *(Source: our elaboration on data Istat, 2011)*

Independent variable	Coefficient	Standard error	t value	p-value	significance
Constant	-169,15	84,2206	-2,0084	0,06429	*
PDO production farm with Internet connection	17,1046	2,48431	6,8850	<0,00001	***
PDO production farm with website	1,36628	1,19679	1,1416	0,27276	n.s.
PDO production farm using Internet for selling phase	-18,7585	2,4316	-7,7144	<0,00001	***
PDO production farm using Internet for buying phase	-7,13391	2,31786	-3,0778	0,00819	***
Farm using e-commerce	0,349696	0,159103	2,1979	0,04528	**

Level of significance *10%,** 5%, ***<1%

Tab. 2- Main results of the multiple regression model dependent variable Italian farms connected to Internet *(Source: our elaboration on data Istat, 2011)*

Independent variable	Coefficient	Standard error	t value	p-value	significance
PDO production farm with Internet connection	0,0651858	0,00679917	9,5873	<0,00001	***
Agro-tourims farm	0,027546	0,00997534	2,7614	0,01390	**
Farms with website	-0,0429253	0,0145196	-2,9564	0,00929	***
Farm using e-commerce	0,718306	0,0145996	49,2003	<0,00001	***

Level of significance *10%,** 5%, ***<1%

The diffusion of computer networks through Internet has been positively correlated with the independent variables presence of an e-commerce site with the ability to offer agro-tourism accommodations with the website that promotes the production of certified quality (Tab. 2). An inverse correlation has been found between the independent variable presence of a farm's website and the dependent variable as the presence and diffusion of computer networks.

Tab. 3- Main results of the multiple regression model dependent variable Italian farms with computer in farms *(Source: our elaboration on data Istat, 2011)*

Independent variable	Coefficient	Standard error	t value	p-value	significance
PDO production farm with Internet connection	1,74119	0,131684	13,2226	<0,00001	***
PDO production farm with website	-1,88428	0,684105	-2,7544	0,01551	**
Agro-tourims farm	-1,21915	0,0969312	-12,5775	<0,00001	***
Handmade craft farm	7,94952	2,93589	2,7077	0,01700	**
Farms with Internet connection	1,05662	0,397391	2,6589	0,01870	**
Farms with website	1,51546	0,548478	2,7630	0,01525	**

Level of significance *10%,** 5%, ***<1%

The diffusion of computerized farms, or rather farmers with a direct connection to internet, was affected in a direct way by the diffusion of diversified agricultural activities such as hand crafts, the farm's website, which promotes the PDO productions, the presence of a network and the use of an Internet web page able to promote the activities of the enterprises (Tab. 3). The multiple regression model has pointed out a negative correlation between the diffusion of computerized farms and the

development of agro-tourism farms with a website pivotal in promoting PDO productions and certified quality food.
The diffusion of computerized farms was directly correlated to the variables such as the widespread of the Internet and web page of the farm while there was a negative correlation between the growth of computerized farms and the presence of e-commerce sites aimed to sell the farm's agrarian productions (Tab. 4).
The diffusion of computerized farms was correlated with the independent variables such as the presence of sites for e-commerce for the selling phase and the enterprise's website; a negative correlation was found out with the independent variable as diffusion of e-commerce sites aimed to sell products and the dependent variable Italian farms with a computer (Tab. 5).
The quantitative model based on the principal components analysis has underlined as the first two principal components were able to explain more than 87% of the variance. In terms of the weights of the components in the first axis, we can mention the presence of the website to sell on line certified quality products and the development of rural tourism and agro-tourism and other activities connected to the productive diversification. The presence of educational farms and the farm holidays farm have acted on the second axis of the first factorial plane of principal components.

Tab. 4- Main results of the multiple regression model dependent variable Italian farms with computer in farms *(Source: our elaboration on data Istat, 2011)*

Independent variable	Coefficient	Standard error	t value	p-value	significance
Farms with Internet connection	7,13637	3,42029	2,0865	0,05330	*
Farms with website	1,79399	0,632101	2,8381	0,01187	**
PDO production farm using Internet for selling phase	-12,3646	3,17436	-3,8952	0,00129	***
PDO production farm using Internet for buying	0,384343	2,40501	0,1598	0,87503	n.s.

Level of significance *10%,** 5%, ***<1%

Tab. 5- Main results of the multiple regression model dependent variable Italian farms with computer in farms *(Source: our elaboration on data Istat, 2011)*

Independent variable	Coefficient	Standard error	t value	p-value	significance
Farms with website	2,23916	0,484623	4,6204	0,00024	***
PDO production farm using Internet for selling phase	-8,69699	2,17382	-4,0008	0,00093	***
PDO production farm using Internet for buying	5,97426	1,28243	4,6585	0,00023	***

Level of significance *10%,** 5%, ***<1%

5. Final remark

The analysis has pinpointed as few Italian farms, predominantly specialized in certified quality food, utilize Internet even if the social networks, due to the ageing of farmers, bring about lot of issues. To sum up Internet and indirectly the diffusion of social networks are two important pillars in promoting food and in enhancing the level of relationships among farmers and customers giving positive feedbacks to farmers and shrinking the level of inefficiency and information shortage in rural areas.
The social network in rural areas is a pivotal tool to implement the exchange of information and to solve the remoteness of these territories shortening the distance among rural villages and the sense of remoteness in it.
The role of social network is particularly important to improve the promotion of farm's activity and to give a sense to the multifunctionality and to give a sense to the active farm which is the new concept to get better the level of development in the countryside in particular in Italian rural areas; hence, the Rural Development Plan proposed by the European Union should promote new interconnection among farmers by a fair development of social networks and network of farmers by Internet, that is not so

common in Italian small farms, which may obtain useful information about products and feedback related to the needs of customers.

References

Akerlof George A. (1970). The Market for 'Lemons': Quality Uncertainty and the Market Mechanism". Quarterly Journal of Economics: 84(3): pp. 488-500.

Asteriou D., Hall S.G. (2011). Applied Econometrics. New York: Palgrave Macmillian.

Baltagi B.H. (2011). Econometrics. Berlin, Heidelberg: Springer-Verlag.

Bishop C. M., Svensén M., Williams C. K.I. (1997). GTM: A principal alternative to the self-organizing map. In: Proceedings 1996 International Conference on Artificial Neural Networks, ICANN'96. von der Malsburg C, von Seelen W., Vorbruggen J.C., Sendhoff B.(Editors), Springer Verlang, pp.164-170.

European Commission (2014). Geographical indications and traditional specialities. On line at: http://ec.europa.eu/agriculture/quality/schemes/index_en.htm

EUROSTAT (2014). Statistics on line. On line on: http://epp.eurostat.ec.europa.eu/tgm/mapToolClosed.do?tab=map&init=1&plugin=0&language=en&pcode=tin00084&toolbox=legend

Galluzzo N. (2004). E-commerce e cooperazione per rilanciare la castanicoltura. Terra e vita, 45(40), pp. 89-91.

Galluzzo N. (2006). Analisi economica e georeferenziata delle nuove opportunità di commercializzazione dell'olio extra vergine biologico. Atti del 2° Workshop Nazionale Agricoltura Biologica L'agricoltura biologica fuori dalla nicchia: le nuove sfide. Edizioni Scientifiche Napoli.

Galluzzo N. (2010). Rural development and agricultural specialization in some Italian areas: role and function of rural space. Aracne editrice, Roma.

Inea (2013). Annuario dell'agricoltura italiana 2012. LXVI edizione. On line at: http://www.inea.it/annuario/edizione_2012

ISTAT (2011). 6 Censimento Generale dell'Agricoltura. On line on: https://censimentoagricoltura.istat.it/

Kaski S., Kohonen T. (1996). Exploratory data analysis by the self-organizing map: structures of welfare and poverty in the world. In: Proceedings of the third international conference on neural networks in the capital markets, London (UK), Refenes A-P., Yaser A-M. Weigend A. (editors),World Scientific, Singapore, pp. 498-507.

Kohonen T. (1995) Self-organizing maps. Berlin: Springer.

Lo Surdo G. (2013) Promuovere ospitalità e vendita sui social network. L'Informatore Agrario, 69(39), pp. 30-34.

Lucchini M. (2007). L'analisi dei gruppi. In: de Lillo A., Argentini G., Lucchini M., Sarti S., Terranno M. (Editors) Analisi multivariata per le scienze sociali. Pearson Education, Milano.

Mehmood Y., Abbas M., Chen X., Honkela T. (2011). Self-organizing maps of nutrition, lifestyle and health situation in the world. In: WSOM 2011, LNCS 6371. Laaksonen J. and Honkela T. (editors), Sperling-Verlag, Berlin Heidelberg.

Meraviglia C. (2001). Le reti neurali nella ricerca sociale. Francoangeli, Milano.

Sodano V. (2004). Strumenti di analisi per l'economia dei mercati agroalimentari. Edizioni Scientifiche Italiane: Napoli.

Verbeek M. (2006). Econometria. Bologna: Zanichelli.