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Social capital and rural innovation process. The evaluation of the measure 124 "Cooperation for Development of New Products, Processes and Technologies in the Agriculture, Food and Forestry Sector" in the Umbria Region (Italy)

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Abstract

The most recent theories on innovation point out the role of social networks, demonstrating how knowledge is intertwined with network communities and social capital represents an essential factor to comprehend innovation. The social network dimension of the innovation process is also acknowledged in the actual definition of an agricultural innovation system (AIS). This study attempts to assess the role played by social capital in agricultural innovation projects co-financed by the Measure 124 of the Rural Development Program (2007-2013) of the Umbria Region (Italy), based on the analysis of 5 evaluation criteria (relevance, innovation, effectiveness, sustainability, and social capital) in relation to 8 selected projects. The obtained results confirm the validity of the proposed methodology both for the purpose of internal monitoring of the project and for the assessment of the measure on the basis of tangible and intangible factors, such as social capital.

Keywords
Social capital, Agricultural innovation, Rural Development Program; Umbria

Introduction

Innovation represents a key challenge for European agriculture and serves as transversal objective in the Rural Development Policy (REG. EU 1305/2013) by means of the European Innovation Partnership (EIP). In particular, European Union promotes the development of innovation through interactive models among different stakeholders, based on a bottom-up approach and network relationships (Frane and Westlund, 2013). This policy objective – financed in the 2007-2013 EU programming period by the Measure 124 Cooperation for development of new products, processes and technologies in the agriculture and food sector and in the forestry sector – has promoted innovation-related investments based on territorial

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networks composed by agricultural and food-processing enterprises, research institutes (both public and private), and associations of producers.

Indeed, the ability to propose and promote innovation is strictly linked to the tacit local knowledge and structure of interactions among the actors involved (Cecchi et al., 2008). All these elements depict the components of a social and economic systemic approach to innovation where the target is to achieve a common goal – a better economic performance at the level of the single firm but also of the local economic cluster – based on collective actions (EU SCAR, 2012). Such an approach underlines the importance of the key contextual factors of the local socio-economic system in the innovation process (Van de Ven et al. 1999; Frane and Westlund, 2013). Therefore, social capital – intended as network together with shared norms, values and understandings that facilitate co-operation within and among groups (OECD, 2001) – has to be analysed in order to understand the socio-economic determinants of the innovation process (De Devitiis et al., 2009).

This study aims to assess to role of social capital in agricultural innovation projects financed by the Measure 124 of the Rural Development Program 2007-2013 in the Umbria Region (Italy)[1], based on the assumption that the individual endowment of social capital is one of the determinants of the actors' innovative capacity and consequently we hypothesize that the social capital of different actors taking part to an agricultural innovation system (a network based on a project) increases its capacity to produce better economic outcomes.

Agricultural innovation

Innovation can be defined as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organisation or external relations" (OECD, 2005: 46). The definition evidences the contemporaneous understanding of the concept intended as an evolution from the initial Schumpeterian vision of a new or improved combination of available economic resources (Schumpeter, 2002) to the application of an invention that changes the enterprise's knowledge and its relationship with the market and its actors (Rogers, 2003; EC, 2003; WB, 2007). Consequently the enterprise mixes explicit and implicit knowledge, internal and external capabilities and resources for producing sound economic and social variations (Fagerberg, 2006). For these reasons, the present-day perception of innovation cannot only be based on classical research and development activities (R&D) focused on the single enterprise, but it also requires additional organizational and institutional changes realized in partnership with different actors (WB, 2007; Esposti, 2012; EU SCAR, 2012; OECD 2013). This last point represents an essential passage connecting the microeconomic vision of the innovation to its acknowledgement as a social phenomenon, which requires, among the other factors, institutional and social instruments needed to promote it.

Social and economic changes in the last century have produced an amazing technological development in the agricultural sector. Innovation has been spread into the farm, through the activities of universities, national research centres, extensions and industrial companies (Esposti, 2012; EU SCAR, 2012, Moschitz et al., 2015). Today the agricultural sector is

[1] The Measure was co-financed by the Umbria Region (Italy), the public support amounted to 70% of eligible expenditure of the projects, while the 30% of the financing was supported by the partners.

strongly affected by: i) the international prices dynamics, ii) the speediness in product transformation, iii) the farm endowment of new knowledge and technologies, iv) the effective use of ICT within the farm, v) the changing of the educational framework in agriculture, v) the market relations and contracts (WB, 2007). Due to these multiple reasons, the neoclassic interpretation of the innovation process is unsuitable to afford the new competitive challenges required by the national and international markets: innovation is no longer proposed as a linear process, starting from the research and ending with the final product "ready to the market" through a sequence of fixed phases, but it is now intended and analysed within a systemic or mixed approach where different actors perform different collaboration or cooperation activities, supported by network interactions (Chaminade and Edquist, 2010). Therefore, knowledge and innovation are co-created by means of disorderly and sustained interactions of all the actors participating to the process (Landry et al. 2002; Knickel et al. 2008; Brunori et al. 2008; Galeazzi, 2014; Cristiano and Proietti, 2014).
Based on these premises the actual understanding is that innovation in the agricultural sector is now acknowledged as an agricultural innovation system (AIS) defined as "the network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into social and economic use, together with the institutions and policies that affect their behavior and performance" (WB, 2007: 14). OECD (2013) considers AIS an essential flexible structure for a sustainable agricultural development. Consequently in order to assess the performance of the systemic innovation process, new models of analysis are needed, and more specifically the network approach, which is inherently part of the theory of social capital.

Social capital and innovation

Many academics have tried to understand the role of the social capital in the innovation activities at individual, local and regional levels (Landry et al., 2002; De Devitiis et al. 2009; Molina-Morales and Martínez-Fernández, 2010; Murphy et al., 2015). According to Landry et al. (2002) the success of the innovation process rests upon the interactions and exchanges of knowledge involving a large diversity of actors in situations of interdependence. For this reason the study of social networks regarding the actors involved in the innovation process is essential in order to understand their performances and the expected outcomes of the innovation process.
It must be noted that the scientific literature evidences the lack of a clear and commonly accepted definition of social capital due to its multidimensional nature (OECD, 2001; Sabatini, 2009; Bjørnskov et al., 2010). Sociologists, political scientists and economists have used many different definitions of social capital in order to answer multiple research questions regarding their specific research domains (Adler and Kwon, 2002). However, the OECD has provided an international recognized definition of social capital used for its statistical measurement: "networks together with shared norms, values and understandings that facilitate co-operation within or among groups" (OECD, 2001: 41).

Specific indicators of social capital in agricultural and rural development projects have been proposed by some Italian researchers in relation to the LEADER approach2 (Nardone et al. 2010, Pisani, 2014, Franceschetti et al., 2015). They all have considered three dimensions of social capital: i) structural that describes the interpersonal configuration of linkages between people (Nahapiet and Ghoshal, 1998), or rather it identifies the social framework that allows the interaction among individuals by focusing on their bridging or bonding socio-economic structures: the first ones normally involve heterogeneous partners and/or stakeholders pertaining to different economic sectors and they normally promote improved economic outcomes compared to the second ones characterised by relationships among actors having the same socio-economic background; ii) normative that refers to the kind of norms of interaction (such as trust) produced among the individuals as a result of long-lasting relationships; iii) cognitive, that comprises elements of social organization (values, beliefs, etc.), which allow individuals belonging to a group to reach a shared vision of their own community.

Based on the previous classification of social capital dimensions, we assume that the innovative performance of the actor pertaining to an agricultural innovation system is strictly determined by its personal endowment of social capital (the higher the endowment of social capital the higher the innovative performance of the actor), and consequently we hypothesize that the higher the endowment of social capital within a network (innovation project) the higher the capacity of the agricultural innovation system to produce better economic outcomes.

Therefore, the general objective of the research is to highlight the role of social capital in agricultural innovation projects co-financed by the Measure 124 of the Rural Development Program 2007-2013 of the Umbria Region (Italy) and the specific research objectives are:

1. To assess the achievements of the financed projects based on different evaluation criteria (relevance, innovation, effectiveness, sustainability);
2. To highlight the role of social capital in the agricultural innovation process based on the previously described assumption and hypothesis.

Method

The analysis focused on 8 of the 31 projects carried out in the first implementation phase of the Measure, co-financed by the Umbria Region from 2009 to 2015. Of the 8 projects, involving 40 partners, 4 are concerning wine sector and 4 regards the husbandry sector. Table 1 presents the main features regarding the selected projects, also taking into account a statistical analysis concerning all the projects eligible for funding during the implementation phase of the Measure (Torquati et al., 2015).

A direct survey by means of a questionnaire was carried out from December of 2014 to March of 2015 to assess the results achieved by the projects in terms of innovation and to highlight the role of social capital in the innovation process. The data collected were elaborated in order to propose an original set of indicators. More specifically, two different

[2]Reg. CE n. 1698/2005, art. 64

types of questionnaires were used corresponding to the two categories of actors involved in each project: (i) individual partners and (ii) leaders of the partnership. The questionnaire administered to all the partners includes 29 questions divided into 8 sections: (A) general assessment of the project; (B) engagement of partners; (C) reputational power; (D) collaboration; (E) trust; (F) project costs; (G) characteristics of the partner; (H) benefits from the project. The questionnaire administered to leaders is based, instead, on 8 questions concerning the section (I) impact on the territory. The connections of the different sections of the questionnaire with the evaluation criteria are represented in Figure 1.

Table 2 specifies the different dimensions of social capital and the 14 specific indicators used to assess them in the 8 projects. The analysis of social capital was carried out by using also the Social Network Analysis (SNA) that allows the researcher to represent the existing relationships (ties) between the actors involved (nodes) in formal and informal groups, organizations and so on (Wasserman e Faust, 1994) elaborating them with indexes and graphs.

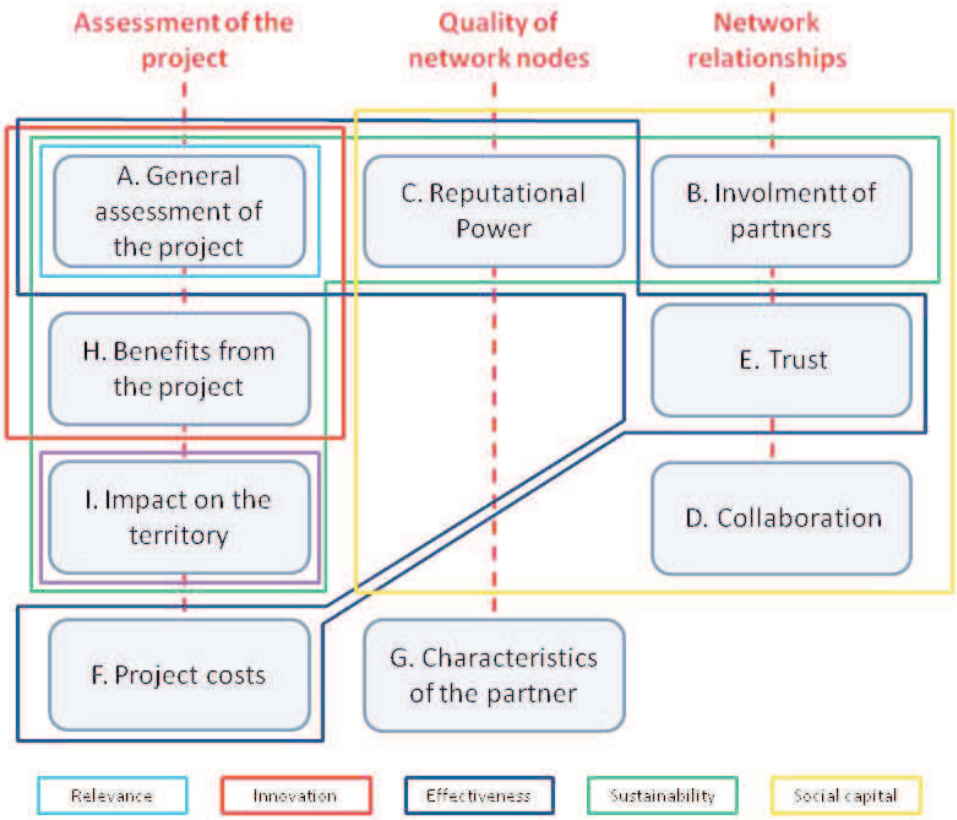
Table 1. Selected project co-financed by Measure 124 of the RDP 2007-2013 Umbria Region

Projects	Leader Typology	Sector	Score	N. Partners	% Farm and processing	Inn. Type [1]	Eligible costs	% Eligible costs/total costs	Clusters [2]
1	Farm	Wine	82	6	67	1	424,263	85	1
2	Research institute	Wine	50	6	82	2	317,004	72	6
3	Producer Association	Wine	38	6	50	2	405,458	81	6
4	Research institute	Wine	29	4	40	2	241,030	52	6
5	Research institute	Husbandry	86	10	70	3	316,600	64	2
6	Producer Association	Husbandry	85	8	78	4	402,253	81	1
7	Research institute	Husbandry	49	3	86	2	334,420	70	6
8	Research institute	Husbandry	40	6	50	2	325,075	65	6

[1] Innovation Type: 1 - Improvement of process and improved environmental performances; 2 - New products/process/technologies/systems and working methods; 3 - Use of products and by-products; 4 - Processing/marketing and distribution of products. [2] Clusters, projects: 1 - Excellent for score and partnership composition; 2 - Excellent overall; 6 - Moderate for quality of partnership composition

Source: own elaboration based on official data of the Umbria Region

Figure 1. The structure of the questionnaire with the evaluation criteria



Source: own elaboration

Table 2. Dimensions of SC, specific indicators, range and question codes

Dim	Indicators	Range	Questions
NSC	Level of trust in the members of the partnership	[0-100]	E.1
NSC	Density of the trust network*	[0-100]	E.2
SSC	Density of the engagement of the network (a proxy of reputational power)*	[0-100]	B.1
CSC	Average rate of participation of the partner	[0-100]	B.1.b
CSC	Average rate of participation of all the partners	[0-100]	B.1.b
SSC	Rate of active actors in the formulation phase of the project	[0-100]	C.1.a
SSC	Rate of active actors in the implementation phase of the project	[0-100]	C.1.
SSC	Rate of active actors in the formulation and implementation phases of the project	[0-100]	C.1.a, C.1.b
CSC	Rate of intervention of the partners in conflict resolutions	[0-100]	C.3
SSC	Density of the collaborative network (before the project)*	[0-100]	D.1.a
SSC	Density of the collaborative network (after the project)*	[0-100]	D.1.b
SSC	Change of the density of the collaboration network (before-after)*	[0-100]	D.1.a, D.1.b

SSC: structural social capital; CSC: cognitive social capital; NSC: normative social capital; * measured using SNA

Source: own elaboration

In order to give an example, the indicator CS2 "Density of the trust network" was computed considering the number of effective trust links among the nodes of a network in respect to their total potential number. Moreover the interviewee was asked to grade his/her interpersonal trust perception on a scale from 0 (no trust) to 4 (high level of trust). The value of the indicator was computed using the UCINET software (Borgatti et al., 2002). The GEPHI software (Bastian et al., 2009) was employed for the SNA graphic presentation.
In relation to the evaluation of the project, 12 indicators have been identified and grouped into 4 evaluation criteria: i) relevance of the project with regard to the problems encountered by partners ii) innovation analysed in terms of problem solving capacity and economic effects, iii) effectiveness in the implementation of the project activities, iv) sustainability of the activities and partnership over time. More specifically the relevance indicators allow understanding two different features: the correspondence of the problems within the social network (R1) and the relevance of the project to the perceived problems of the network (R2). The innovation indicators highlight the innovative capacity in resolving the problems within the network (I1) and how much the economic results have changed a few months after the completion of the project (I2). The effectiveness indicators assess if the projects have achieved their purposes (E1), if the partnership was effective in its actions (E2) and how much the project leader has intervened in solving problems among partners (E3). The sustainability indicators evaluate: the real applicability of project results (S1), the external attendance to the dissemination meetings (S2), the new contacts with actors outside the partnership (S3), possible future collaborations (S4), and continuation of project actions (S5).

Results and discussion

The analysis reveals positive results in terms of innovation and social capital: the examined projects show good achievement rates in terms of relevance, innovation, effectiveness, and sustainability; for the detailed data see table 3 evidencing the values of the indicators in relation to each specific evaluation criterion and the average value for the 8 projects analysed. Of the 14 calculated indicators of social capital, we have selected the 4 presented in table 3 for our present discussion.
Indeed, the discussion of the results cannot forget the peculiarities of the partnerships and of the call. For example, the 3A "Agri-food Technology Park of Umbria" has been partner of all the projects due to the specific requirements of the call; moreover the 3A has been the informal promoter of many partnerships, particularly in the first implementation phase of the Measure. Moreover it must be noted that the normative requirement of an association, foreseen by the Measure 124, does not limit the explicative nature of our results. Here we measure the initial and final endowment of social capital within the network and its relation with the innovation process and not the factors that have determined it in the initial phase of the projects.

Table 3. Measure 124 evaluation indicators (values for the 8 projects)

Indicators	***Range***	***Projects***								***Avg***
1. RELEVANCE		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
R1. Rate of correspondence of the problems among the actors within the social network	[0-100]	80.0	100.0	66.7	83.3	55.6	61.9	0.0	60.0	63.4
R2. Level of relevance of the projects to the perceived problems of the network	[0-3]	3.0	2.2	3.0	2.5	2.4	2.8	2.0	2.8	2.6
2. INNOVATION										
I1. Level of innovative capacity in resolving the problems within the network	[0-3]	2.8	3.0	2.7	2.5	2.4	2.4	1.7	2.5	2.5
I2. Rate of variation of the economic results	[0-100]	+2.5	+2.0	+2.5	+1.8	+0.0	+2.5	+12.5	+0.0	+3.0
3. EFFECTIVENESS										
E1. Level of achievement of the project purposes	[0-3]	3.0	2.2	3.0	2.5	2.7	3.0	2.3	2.8	2.7
E2. Rate of effectiveness of partnership actions	[0-100]	87.5	100.0	73.6	89.6	78.3	88.5	97.2	87.5	87.8
E3. Rate of intervention of the project leader in solving problems	[0-100]	16.7	16.7	66.7	75.0	70.0	100.0	100.0	100.0	68.1
4. SUSTAINABILITY										
S1. Level of real applicability of the innovation	[0-3]	2.8	3.0	2.7	2.8	2.8	2.5	1.7	3.0	2.7
S2. Level of attendance to the dissemination meetings	[0-3]	2.6	2.3	2.6	2.3	2.2	1.8	2.1	1.9	2.2
S3. Rate of contacts with new actors outside the partnership	[0-100]	83.3	83.3	66.7	0.0	60.0	37.5	0.0	33.3	45.6
S4. Rate of future collaborations with partners and external actors	[0-100]	83.3	83.3	33.3	50.0	80.0	50.0	33.3	50.0	57.9
S5. Rate of partners willing to continue project actions	[0-100]	20.0	100.0	40.0	33.3	55.6	28.6	0.0	40.0	39.7
5. SOCIAL CAPITAL										
CS 1. Density of trust network*	[0-100]	23.3	73.3	36.7	25.0	35.6	26.8	33.3	23.3	34.6
CS 2. Density of the collaboration network (before-project) *	[0-100]	26.7	73.3	53.3	33.3	28.9	37.5	33.3	13.3	37.5
CS 3. Density of the collaboration network (after-project) *	[0-100]	73.3	80.0	60.0	33.3	40.0	50.0	33.3	33.3	50.4
CS 4. Change of the density of the collaboration network (before-after)*	[0-100]	+46.7	+6.7	+6.7	0.0	+11.1	+12.5	0.0	+20.0	+12.9
* Indicator calculate by means of SNA										

Observing the different partnerships, we denote heterogeneous compositions: some projects were carried out by renowned agro-processing companies with its linked farms (projects 1, 2, 4 and 7), some projects were launched thanks to the technical assistance of producer associations and/or university (projects 3 and 6) and other projects were characterized by the presence of many partners pertaining to different productive sectors and/or involving several types of business/research activities (projects 2 and 8). In terms of social capital theory, these represents bridging ties that are particularly relevant in order to transfer new knowledge and innovation capacity into the structure of the considered social network. In particular, observing the data in relation to the two main sectors (wine and husbandry) the comparison between projects is going to be facilitated. The wine sector projects were carried out by fewer partners, with a reduced share of farms and processing companies and with different category of leaders (within the partnership different economic sectors were present), while in the husbandry sector the partnerships were managed mainly by research institutes (3A - Agri-food Technology Park of Umbria). With regard to innovation typologies, the first four projects took into account mainly innovation about the development of new products, process, technologies, systems and working method (only one project aims to improve environmental performances of the process), while the last four projects also considered innovation about the use of by-products and the processing, marketing and the distribution of products.

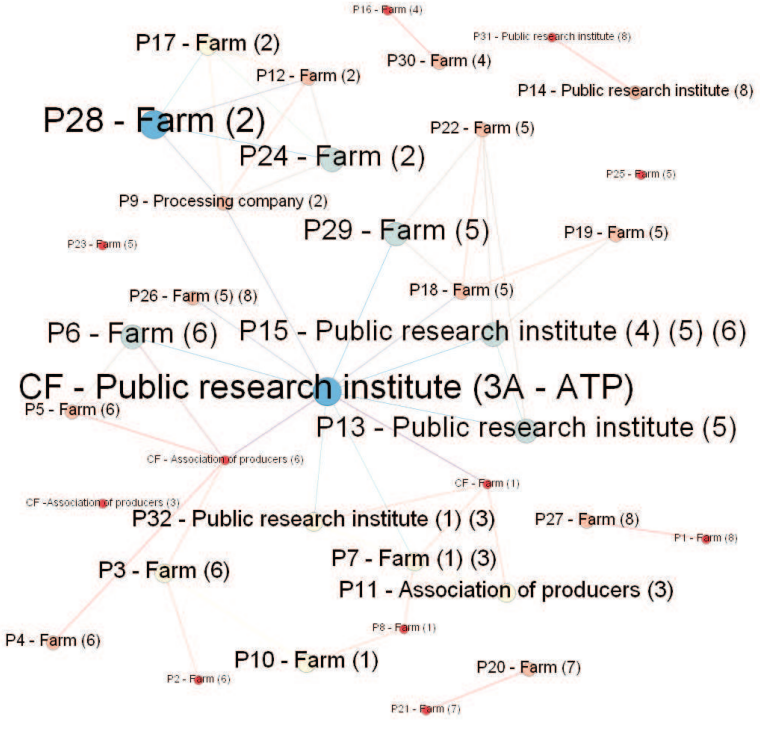
The relevance indicators underline: (i) the high level of correspondence of problems within the network (the average value of the 8 projects is equal to 63.4%), attesting that the network shares the problems and the project is focusing on a valence issue; (ii) the high importance of the projects objectives in relation to the perceived problems (the average value of the 8 projects is 2.6 above the maximum level of 3).

In relation to the innovation indicators, we have to evidence that the measure supports only experimental development projects (in other words projects that cannot be necessary used or transformed into industrial applications, EC, 2006). Despite this, we have to observe that only few months after the conclusion of the project the partners perceive, on average, an increase of +3% of their economic results (index I2), but with waiving performances. We have to be careful in analyzing this value, due to the fact the data is not based on a balance sheet with a detailed assessment of costs and revenues. The question posed to assess the change in economic results was a classical cause and effect question: "After the first months from the conclusion of the project, have you perceived if the innovation brought by the project has determined or not a variation (% increase, % decrease, or not changed at all) of total revenues, total cost, and total income".

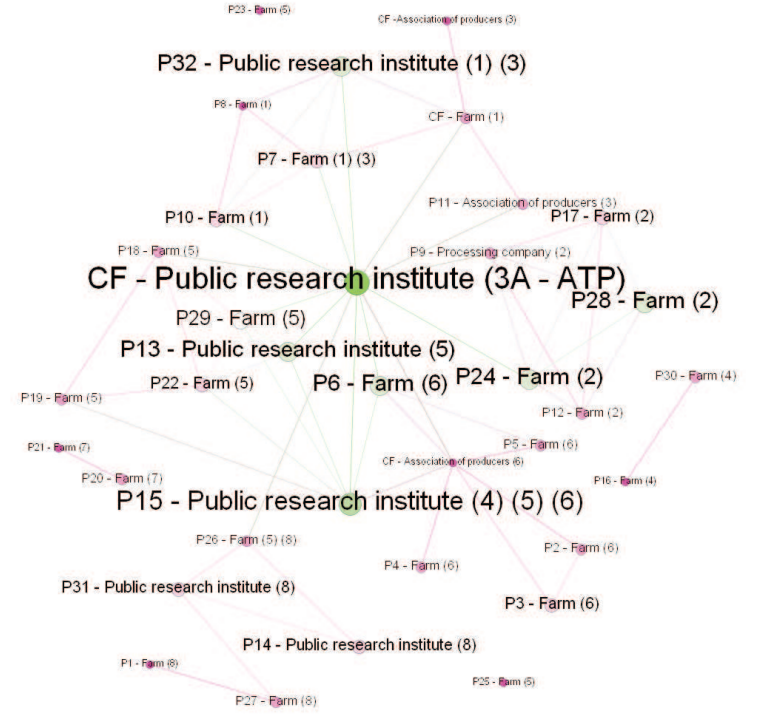
We have chosen this question for two specific reasons: the pre-competitive nature of the projects and the timeframe of our evaluation. The economic data have been collected after few months from the completion of the project, so practically the respondents couldn't have a complete and detailed analysis of their economic results. For sure during an impact evaluation assessment – to be performed after 3-5 years from the completion of the activities – a detailed economic assessment of the results of the enterprises has to be realized. But the pre-competitive nature of the projects and the time constrain has suggested us to use a perception question.

It has to be noted that the economic effect could be the by-result, among other elements, of the high level of innovative capacity in resolving the problems within the network (2.5 on average above 3.0, as showed by the index I1).
In relation to the effectiveness evaluation, the level of achievement of project purposes (E1) attests a high value (2.7 on average above 3), as well as the rate of effectiveness of partnership actions (E2 is equal to 87.8% on average). Moreover the managing capacity of the project leader in solving problems is perceived relevant (68.1% on average). At this regard, it is interesting to discuss the performance of the index E3 in the two sectors: the leaders are perceived essential in the husbandry sector projects, while in the wine projects the presence of large companies in the partnerships make less important the leaders' activities in solving problems. In relation to the sustainability evaluation, we have to denote that all projects have achieved a high applicability of results (S1 average value is 2.7 above 3), with the exception of the seventh project (regarding the husbandry sector and with a S1 value of 2.0), and this confirm us that the experimental innovations proposed by different projects have different possible degrees of real applicability. The level of attendance to the dissemination meetings (S2) reaches good values (the average value corresponds to 2.2 above 3). It has to be noted that during these official moments the innovative knowledge is shared with other enterprises external to the network. Before these meetings, the rate of contacts with new actors outside the partnership (S3) presented a waiving performance: the partners of two projects (4 and 7) didn't have any links with other actors outside the partnership, while in the wine sector the rate of external contacts was quite high (83.3% of the project partners). Moreover, of peculiar interest is the S4 index regarding the future development of new projects: seven projects have continued the innovation process, although with heterogeneous and shifting rates. The rate of partners willing to continue project actions is quite high (S5 corresponds to 39.7%) but with dissimilar performances in relation to different projects. The analysis of social capital, computed by means of SNA indicators, shows the presences of networks able to cooperate both based on cognitive and normative elements regarding social capital and organizational and institutional features assessed by means of the different evaluation criteria (specifically the ones regarding relevance and effectiveness). In particular, the density of the trust network at the end of the project (CS1) reaches high values for all projects studied (34.7%), normally these values in similar projects attest a lower percentage. The density of the collaborative network before the project (CS2) corresponds to 37.5% as average value and in these networks research institutes, producer associations and large companies play a relevant role Figure 2). This is going to specify that the construction of the project is not only due to a financial possibility offered by the call, but it is related to a truly and already present social network that has increased its nodes and ties, involving new actors based on different determining factors.
It must be noted that the density of the collaboration network after-project is very high (CS3 is equal to 50.4% in average), underlining the good ability of the actors to create networks by means of formal and informal collaborations during the implementation phase of the project (Figure 2).

Figure 2: Density of the collaboration network before (a) and after (b) project
Legend: P= Partner; CF= Leader; P1= partner number 1 and so on; (number)= number of project.



(a)



(b)

The increased rate of density regarding the collaboration network (CS4), computed after one year from the finalization of the projects, and equals to +12.9% in average, represents the

percentage of the totally new collaborations effectively developed thanks to the project activity: the value is for sure remarkable and positive, attesting that the structural social capital has increased in 6 of the 8 projects thanks to the innovation process activated.
The values of the indexes CS4 (increased the endowment of social capital) confronted with I2 (improved economic results) allow us to say that our hypothesis, related to only 8 projects, is partially confirmed.

Conclusions

The analysis concerns the innovations in two of the most important sectors in Umbrian agriculture, and it highlights the good results achieved in terms of innovation promotion and structural social capital improvement. Although some difficulties have appeared during the implementation of the projects, especially related to the administrative project management, the analysis shows how the path of innovation undertaken by the rural sectors in the Umbria region is consistent with the new innovation in the programming policy. The study provides practical indications in order to support policy makers in their choices aimed at promoting the innovation capacity of territorial actors. This innovation capacity is essentially based on the linkage among small and medium enterprises (SMEs) and other actors of the agro-food sector, since innovation occurs in the mutual exchange of information. Therefore in Umbria Region, farms, processing companies, producer association, university, public and private research institutes and police makers are ready for the implementation of the European Innovation Partnership in Agriculture. The agricultural sector is aware of the importance of experience done with the Measure 124: it is required a greater integration between projects with similar aims and carried out in different sectors in order to sustain the created networks. Even if only 8 projects were examined, the study can be considered as a test for the identification of a reproducible methodology. Indeed the obtained results confirm the validity of the proposed methodology both for the purpose of internal monitoring of the project and for the assessment of the measure on the basis of tangible and intangible factors, such as social capital.
The characteristics of the partnership prove to be crucial for the implementation of the project: they enabled to develop further links between the actors of the network and other individuals outside the partnership, thus increasing social capital, innovation results and the achievement of the projects purposes. While, the relation between increase of the endowment of social capital and improve economic results is only weakly confirmed.

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