Building social capital and promoting participatory development of agricultural innovations through farmer field schools: The Greek experience

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Abstract

More than 25 years after the first implementation of Farmer Field Schools (FFS), there is a rich corpus of evidence that participation in FFS improves farmers' knowledge, skills, and competencies. On the other hand, several studies converge to show that FFS, by strengthening group action, have the potential to build-up social capital among participants and, thereafter, within local communities. However, it is not yet clear if this social capital is reflected in the levels of knowledge gained by FFS participants and to what extent it promotes farmers' participatory engagement in the process of innovation development. To answer these questions we used between and within-subjects approaches. Data were drawn from facilitators and cotton farmers who participated in an FFS project aimed at the development of competencies in three domains: integrated crop management, farm management, and occupational safety. In a first step we developed three measures to assess the levels of social capital among farmers, the degree to which each participant contributed to the co-production of innovations within the framework of the project, and the knowledge gained by farmers. Regression analyses confirmed that the levels of social capital – and especially bonding social capital – do indeed predict both the co-production of innovations by farmers, and the levels of knowledge they gain through their participation in FFS. These findings indicate that cultivating social capital among FFS participants is a key element in facilitating the construction of knowledge and the co-evolution of agricultural innovations by farmers, two of the core foci of FFS approach.

Keywords

Farmer field schools, social capital, innovations, agricultural extension, participatory innovation development, integrated crop management

Introduction

Farmer Field Schools (FFS) were first implemented in Indonesia in 1989, as a way to help rice farmers reduce their reliance on agrochemicals and to promote integrated pest management (Van de Fliert, 1993). In FFS, groups of 20-25 farmers meet on a regular basis with an expert (facilitator), to observe, analyze and experiment in real-farm settings. Participants, under the guidance of the facilitator, try to find problems and to solve them using the shared knowledge they construct during the course of FFS. FFS curricula are not strictly mandated, thus allowing farmers to self-regulate their learning. The FFS cycle follows the life cycle of the crop (planting to harvesting). Hence, participants have the opportunity to deepen their understanding of the wide-ranging and complex factors which affect their crops, as well as to enhance their problem-solving competencies.

As Kenmore (2002) notes, the core aim of FFS is to help farmers increase their analytical skills, improve their decision-making capacities and sharpen their critical thinking skills. FFS philosophy goes beyond traditional models of agricultural knowledge diffusion. The principles of social learning (Pretty and Buck, 2002), transformative learning (Taylor et al, 2012), and experiential learning (Nederlof and Odonkor, 2006) occupy central positions in the FFS approach. Learning in FFS emerges as the output of hands-on experimentation and interactive learning, while farmer-to-farmer learning activities help participants to increase their communication and collaborative skills (Braun and Duveskog, 2008; Van den Berg and Jiggins, 2007; Feder et al, 2004). During the course of FFS, farmers actively participate – both individually and collectively – in the development, implementation and evaluation of time- and context-specific innovations (Charatsari, 2015). This participatory process paves the way for the adoption of innovative technologies, ideas, and practices.

Despite the critics on their ability to reach a wide range of farming communities (Thiele et al, 2001), to attract farmers from all social strata (Simpson and Owens, 2002), and to produce a stable increase in economic gains (Praneetvatakul and Waibel, 2006), FFS remain an effective model in the developing world, where this alternative approach continues to climb in popularity especially among poor farmers (Davis et al, 2012). Research has repeatedly proved that participation in FFS sharpens farmers' specialised knowledge and expertise (Ortiz et al, 2004), strengthens their system thinking skills (Yang et al, 2008), helps them to achieve a more holistic comprehension of the ways farm practices affect crop responses (Dalton et al, 2014) and, consequently, improves their abilities to solve the problems of their crops (Dzeco et al, 2010) and increases their decision-making performance (Yang et al, 2005). As a result, FFS participants enjoy higher yields (Cai et al, 2016) and higher incomes (Mutandwa and Mpangwa, 2004).

Interestingly, these benefits of FFS extend beyond individual-level frameworks. FFS participants are able not only to apply the knowledge produced and shared within FFS but also to effectively transfer this knowledge to other farmers (Jørs et al, 2016). Moreover, participation in FFS is associated with a reduction of agrochemicals use (Tripp et al, 2005) and an increase of social capital within farming communities

(Settle and Garba, 2011). In this vein, FFS also have positive environmental and social impacts.

Over time, FFS curricula started to incorporate non-farming issues, related to important problems of farming communities in the developing countries, such as domestic violence, or HIV prevention (Friis-Hansen et al, 2012). In other cases, FFS-based approaches – like "Farmer Livestock Schools" in Vietnam (Minh et al, 2010) or "Climate Field Schools" in Indonesia (Siregar and Crane, 2011) – were designed to address specific needs and/or to target specific population groups. Recently, some successful attempts have also been made in the developed world, like the "East Bay FFS" in San Francisco, U.S.A. (Berman, 2016), and the FFS for cotton and rice producers in Greece (Charatsari, 2015).

Enabling social capital through FFS

Social capital is a concept widely used in many disciplines, from sociology to medicine (Macinko and Starfield, 2001), management sciences (Adler and Kwon, 2002), economy (Knack and Keefer, 1997), and politics (Jackman and Miller, 1998). Hence, literature on social capital is characterised by a broad variety of definitions and a wide range of foci, which complicate any attempt to compare social capital in different contexts. In addition, the measurement of social capital is a difficult task, since, as Paldam (2000: p. 649) notes, in social capital literature "there is far more theory and speculation than measurement".

Social capital encompasses multiple layers, including social trust (Fukuyama, 2001) and reciprocity (Whiteley, 2000), social bonding (Larsen et al, 2004), social cooperation (Newton, 2001), willingness and/or ability to form social networks (Onyx and Bullen, 2000), social connection (Morrow, 1999), and psychological engagement with a group of people (Brehm and Rahn, 1997), to mention only a few. Nevertheless, from the pioneering work of Bourdieu (1980) until today there is a general consensus among researchers that participation in social groups – for example, religious associations (Strømsnes, 2008), ethnic organisations (Brettel, 2005) or groups of volunteers (Peachey et al, 2015) – facilitates the development of social capital.

FFS, by definition, have been developed around the idea of creating strong social ties and networks not only among participants but also within farming communities. Participants in FFS form social bonds with their co-learners (Palis, 2006), develop a sense of confidence with their colleagues (Pretty and Buck, 2002), reshape their perceptions toward gender roles (Najjar et al, 2013), build collaboration schemes with other farmers (David, 2007), and develop a logic of collaborative action (Friis-Hansen and Duveskog, 2012) and mutual support (Dzeco et al, 2010); all signs of social capital creation.

The present study

The rich body of literature on FFS offers a variety of findings on the effects of this alternative approach on the creation of social capital. However, the reverse

relationship has not been studied yet. That is, two central questions remain open. First, how does social capital affect the levels of knowledge participants acquire? And, second, to what extent does the social capital developed in the group of farmers affect the degree to which they participate in the process of co-production of innovative solutions and problem-solving techniques? Hence, unlike much of the abovementioned literature, the present study focused on the ways social capital among trainees influences two key-factors that determine the effectiveness of an FFS project: the levels of knowledge gained by farmers over the course of the programme, and the degree to which farmers participate in the process of the co-development of innovations.

Moreover, another point that differentiates our study from previous works which examine the relationship between FFS and social capital is our focus on different dimensions of social capital. Most contemporary efforts to conceptualise social capital within the FFS framework consider just one – or only few – aspects of this multidimensional concept. For example, Mancini et al (2007) and Palis et al (2005) described social capital in terms of access to social assets (e.g., networks, groups); David and Asamoah (2011) used farmers' participation in communities of interest to define social capital, while Mancini and Jiggins (2008) added the dimension of trust. In a meta-analysis, Phillips et al (2014) refer to social capital as social connections, whereas Settle et al (2014), in a study based on retrospective data, provide an example of a collective help-giving behaviour as an indication of social capital development after FFS participation.

Although all the above mentioned aspects represent different forms of social capital – grounded in the seminal works of Coleman (1998), Portes (1998), and Pretty (2003) – other dimensions of social capital that can emerge within the FFS framework have not been yet operationalised. In our study, drawing on works from social psychology (e.g., Cook, 2005), work psychology (e.g., Carmeli et al, 2009) and economic sociology (e.g., Nahapiet and Ghoshal, 1997), we tried to take into account some new (emotional and cognitive) components of social capital.

The study used data drawn from cotton farmers and extensionists who participated in an FFS project conducted in Thessaly (Greece) during the growing season of 2015 (thirteen weeks from early June to early September). The aim of the project was threefold: to help farmers understand the principles of integrated crop management, to increase their knowledge on occupational safety issues, and to enhance their farm management skills. A variety of learning activities were designed so as to provide the basis for the integration of knowledge, skills and attitude change on these three areas.

It is worth noting that this was the first attempt to implement FFS in Greece. Given that FFS philosophy was built around the developed countries' special contexts and needs, a couple of minor methodological adaptations were made in order to tailor the current project to the specific social, cultural and attitudinal background of Thessalian farmers as well as in order to better fit the project with the competencies of the facilitators. First, a group of three to five extensionists (agronomists) was used to guide and facilitate the learning process of each group of farmers (20-25 persons). The use of groups of extensionists was preferred because it permits the collaboration

of scientists with different knowledge bases. This need has to do with the high degree of Greek agronomists' specialization (one of the major shortcomings of higher agricultural education system in Greece), which eliminates their ability to engage in a vast range of topics. Second, instead of focusing on the "technology development", the project aimed at the participatory development of innovative solutions – not technological but rather conceptual or managerial.

Method

Participants and procedure

Data for this study were drawn from 36 farmers (34 men, mean age=40.53yrs., S.D.=14.72) and 6 trainers/facilitators (5 men, mean age=44.83yrs., S.D.=14.22) who participated in the FFS project. Farmers came from 27 local communities. Twelve of the participants (33.33%) reported having social relationships with other trainees (mean number of social relationships with other trainees=0.56, S.D.=0.91) before the starting day of the FFS project. Most of the farmers had secondary education (44.44%), while their average income was €13,680 (S.D.=4,078).

Trainees completed a series of instruments, including the In-Group Social Capital Scale (completed after the end of FFS), and a questionnaire aimed at exploring the levels of knowledge gained through their participation in the project (answered before the start and after the end of the project). Trainers also completed a questionnaire designed to assess multiple facets of the FFS programme, as well as to collect information about the degree to which each farmer contributed to the co-production of innovations over the course of FFS.

Measures

In-Group Social Capital Scale

To assess the social capital in the group of trainees we first developed 20 7-point items, pertaining to different dimensions of social capital. Items were selected from a wide range of fields (sociology, social psychology, cognitive science) so as to reflect a wide spectrum of concepts, extending from the pleasure offered by the involvement and participation in a group of people to the identification to the group and the development of a sense of common fate. In a next step, items were rated for content relevance and face validity by four researchers, on a 3-point scale (from "poor" to "fair" to "good"). Items with less than 75% "good" ratings were discarded. After this phase, the final list included 14 items (Table 1).

This final list was administered in the last meeting of FFS. An exploratory factor analysis using alpha factoring and varimax rotation was performed to explore the factorial structure of the scale. The analysis revealed four factors with eigenvalues greater than 1.00, which cumulatively explain 89.28% of the total variance (Table 2). Cronbach's alpha values exceed 0.8 for all factors. The first factor was labeled "Social bonding" (M=4.32, S.D.=0.96) and includes four items that refer to the development of bonding social capital between the participants in the FFS project.

"Social cohesion" – the next factor (M=3.82, S.D.=0.97) – reflects the degree to which farmers have social ties with their group-mates and feel satisfied with the group membership. The third factor was named "Social identification" (M=3.26, S.D.=1.13) because it comprises three items that concern the degree to which farmers identified with the group of trainees. The fourth factor – "Social connection" (M=4.04, S.D.=1.01) – consists of three items that refer to the sense of connectedness with the other group members.

Knowledge gained over the course of FFS

A self-assessment measure was used to assess participants' levels of knowledge prior and after their participation in the project. The instrument comprises 20 items, measured on a five-point scale (ranging from 1: "very low level" to 5: "very high level"). Items were divided into three a priori specified categories, referred to the three main educational objectives of the programme, namely: integrated crop management (11 items), occupational safety (4 items), and farm management (5 items). Farmers were asked to assess their level of knowledge about these 20 topics pre- and post-participation in the FFS. This way, we calculated a baseline knowledge score (before FFS) and a final score (after participation in FFS). After deducting baseline from final scores we calculated the knowledge gained in each one of the three categories.

Table 1. Items included in the final "In-group social capital scale" and sources from which they were derived

Item	**Source**
1. I feel connected with the other members of the group, even those who I don't know well	Putnam (1995)
2. I feel that I belong to a group that shares a common aim	Forrest and Kearns (2001)
3. I feel that with these people we are a homogeneous group	Putnam (1995)
4. I feel that with my co-learners we face the same problems	Jansen et al (2006)
5. To participate in this group of people is really important for me	Luhtanen and Crocker (1992)
6. I don't feel that I have any special commitment to this group*	Ellemers et al (1997)
7. It is really important for me to know that I belong to this group of people	Baumeister and Leary (1995)
8. Sometimes I feel isolated within the group*	Epley et al (2008)
9. With the other farmers we can understand each other	Kearns and Forrest (2000)
10. I like to offer support to the other participants	Turner (1999)
11. I really feel that I can trust my co-trainees	Adler and Kwon (2002)
12. I really like the sense of being a member of that group	Friedkin (2004)
13. I take part in every join action in the group	Marsh et al (2009)
14. To be member of that group is an integral part of my life	Leach et al (2008)

*Note: * Negatively worded item*

Table 2. In-group Social Capital Scale: Factors, loadings, eigenvalues and explained variance

Subscale/item	**Loading**
Social bonding (Eigenvalue: 4.48; Explained variance: 32.01%)	
I really feel that I can trust my co-trainees	0.92
I like to offer support to the other participants	0.91
I feel that with these people we are a homogeneous group	0.91
It is really important for me to know that I belong to this group of people	0.86
Social cohesion (Eigenvalue: 3.74; Explained variance: 26.74%)	
I feel that I belong to a group that shares a common aim	0.95
With the other farmers we can understand each other	0.88
I feel that with my co-learners we face the same problems	0.85
I really like the sense of being a member of that group	0.84
Social identification (Eigenvalue: 2.48; Explained variance: 17.72%)	
To be member of that group is an integral part of my life	0.94
I don't feel that I have any special commitment to this group*	0.92
To participate in this group of people is really important for me	0.87
Social connection (Eigenvalue: 1.79; Explained variance: 12.81%)	
I take part in every join action in the group	0.95
Sometimes I feel isolated within the group*	0.94
I feel connected with the other members of the group, even those who I don't know well	0.87

*Note: * Negatively worded item*

Participatory development of innovations

To assess the degree to which trainees engaged in the process of joint development of innovations we designed and used a three-item measure. Trainers/facilitators were asked to rate each farmer who attained the project on the degree to which he/she: i) involved in the joint activities designed to promote the development of innovations (*He/she actively participated in the collective processes of discovering gaps and proposing new ways to overcome them*), ii) shared innovative ideas with the other trainees (*He/she proposed and discussed with the other members of the group innovative ways to solve problems*), iii) facilitated the integration of his/her co-trainees into the spirit of FFS (*He/she helped other trainees to make sense of the experiences they have encountered during FFS and to generate ideas collaboratively*).

A 5-point scale from 1 (not at all) to 5 (very much) was used. For each farmer a new variable reflecting the degree to which he/she participated in the co-development of innovations during the FFS project was calculated as the mean of ratings across the three items (Cronbach's α=0.69). The mean score of the variable was 3.78 (S.D.: 0.95).

Data analysis

To provide a brief overview of our data we used correlations (Pearson's r for normally distributed variables and Spearman's ρ when at least one of the variables had not a normal distribution), independent sample t-tests, paired sample t-tests and Mann-Whitney U tests. Moreover, we used regression analyses to answer the main questions of the study.

Results

Preliminary analyses

In a first step we conducted Pearson's product-moment correlations to examine for possible associations of farmers' age, education and income with the basic variables of the study. Age was significantly correlated with two subscales of in-group social capital – social bonding ($r=-0.37$, $p=0.027$) and social cohesion ($r=-0.35$, $p=0.037$) – while another significant correlation was observed between level of education and social bonding ($r=0.48$, $p=0.008$). On the contrary, income did not show any significant correlation with the basic variables of the study ($r<0.31$, $p>0.05$ in all cases). Moreover, the analysis proved that the number of previous social relationships did not correlate with social bonding, cohesion, identification and connection ($\rho<0.11$, $p>0.05$ in all cases). Mann-Whitney U tests were used to ascertain if participants who had previous social relationships versus those who did not, differed in their scores on the four social capital subscales. In all cases, no significant differences were yielded ($p>0.05$).

Furthermore, no significant correlations were found between trainees' demographics and their contribution to the development of innovations during the project or their levels of knowledge before and after the attendance of FFS. We also examined all the basic study variables for gender differences. The only gender effect observed was for social cohesion ($t=-1.82$, $p=0.000$), with women reporting higher levels of cohesion with co-trainees than men. Additionally, paired sample t-tests were used to assess the levels of knowledge gained by farmers over the course of the FFS project. The tests revealed significant increases in all three pre-specified thematic areas (Table 3).

Table 3. Knowledge levels of farmers before and after their participation in the FFS project

Category	Example item	Cronbach's α	Score		Mean difference
			Before FFS	After FFS	
Integrated crop management	Integrated disease management	0.73	2.58	2.77	0.19 (t=5.02*)
Farmer's safety	Use of protective equipment	0.71	2.63	2.99	0.36 (t=5.50*)
Farm management	Cultivation practices	0.70	2.82	3.14	0.32 (t=5.30*)

*Note: * p<0.01*

Social capital and participatory development of innovations

To examine the influence of the different forms of social capital on the degree to which farmers participate in the process of co-development of innovations within the framework of FFS, we regressed farmers' scores onto the four dimensions of in-group social capital. In a second step we entered also gender, age and level of education as control variables. In the first step ($F=4.98$, $p=0.030$) we found that social bonding ($\beta=0.42$, $p=0.007$) and social connectedness ($\beta=0.42$, $p=0.006$) were significant predictors of the level of the dependent variable. These effects remained significant after controlling for demographic variables in the second step ($\beta=0.40$, $p=0.027$ and $\beta=0.46$, $p=0.008$ respectively) as illustrated in the Table 4.

Table 4. Results of hierarchical regression analysis

Predictors	**Model 1**		**Model 2**	
	R^2	**β**	**R^2**	**β**
Step 1	**0.39**		**0.41**	
Social bonding		**0.42**		**0.40**
Social cohesion		-0.02		-0.01
Social identification		0.06		0.03
Social connection		**0.42**		**0.46**
Step 2				
Gender				0.11
Age				0.05
Education				-0.06

Note: Significant coefficients are presented in boldface ($p<0.05$)

Social capital and knowledge gained

Next, we examined the associations of the three scores referred to the knowledge gained by farmers over the course of FFS with the four forms of in-group social capital. To this end, the four subscales of in-group social capital were entered into three regression equations, one for the level of knowledge gained on each one of the three main topics of the FFS project; i.e., integrated crop management ($F=3.01$, $p=0.033$, $R^2=0.19$), farmer's safety ($F=3.31$, $p=0.023$, $R^2=0.21$), and farm management ($F=4.41$, $p=0.006$, $R^2=0.28$). The analysis revealed that the development of social bonding significantly predicted the levels of knowledge in all three equations ($\beta=0.42$, $p=0.011$ for ICM; $\beta=0.33$, $p=0.038$ for occupational safety; $\beta=0.38$, $p=0.015$ for farm management). In addition, as shown in Table 5, the development of a sense of connection to the group of trainees was significantly positively associated with the levels of knowledge gained in the areas of farmer's safety and farm management ($\beta=0.40$, $p=0.013$ and $\beta=0.29$, $p=0.049$, respectively). On the other hand, in-group

identification had significant positive effects upon the levels of trainees' knowledge on issues pertaining to farm management (β=0.42, p=0.012).

Table 5. Coefficients (β) of regressions used to test the association of social capital with knowledge gained over the course of FFS

Predictors	Knowledge score		
	I.C.M.	Farmer's safety	Farm management
Social bonding	**0.42**	**0.33**	**0.38**
Social cohesion	0.24	-0.09	-0.08
Social identification	0.04	0.09	**0.42**
Social connection	-0.04	**0.40**	**0.29**

Note: Significant coefficients are presented in boldface (p<0.05)

Discussion and conclusions

In this study we attempted to establish preliminary evidence that the cultivation of social capital among FFS participants on the one hand promotes the participatory development of innovations within the FFS framework and, on the other hand, fosters the construction of knowledge by farmers. In doing so, the present research goes beyond the existing literature on the association between FFS attendance and social capital in a number of ways. First, despite the value of past research on the relation between FFS participation and social capital, most of the work published on this issue examines the social capital as the output of participation in FFS. In our study, we investigated whether social capital among FFS participants triggers knowledge creation and acquisition and facilitates farmers' involvement in the process of innovation development. Second, most past research relies on qualitative methods or on unidimensional assessments of social capital. In the current work, by developing a multidimensional instrument, we tried to capture – and examine – different forms of social capital. Hence, despite the limitations associated with the small sample size, this work offers some new insights and plots a course for future research.

Our results indicate that social capital and in particular its most "soft aspects" (social bonding and social connection) positively affect farmers' engagement in the process of innovation development, while the dimension of social identification also predicts the levels of knowledge gained by FFS participants. These findings imply that the creation of social capital – and especially bonding social capital – should be a top priority for facilitators. In addition, when considered in conjunction with previous work which concludes that farmers participate in FFS not only to gain knowledge but also to cover their basic psychological need to belong to a group of people (Charatsari et al, 2015), our results suggest that social benefits from participation in FFS deserve more attention by both researchers and FFS designers.

Hence, the question "what strategies can facilitators use to nurture social capital within the group of participants?" emerges. To address this question, FFS planners should put more emphasis on social activities targeted to promote bonding among farmers as well as to integrate concepts and findings from different domains in the

FFS blueprinting. For example, research on organisational culture argues that the encouragement of cooperation among the members of a group positively influences the in-group social capital (Carmeli et al, 2009), while work on social psychology (Ryan and Deci, 2000) postulates that – in educational settings – the development of a sense of relatedness, not only among learners, but also between teachers and students facilitates students' integration into the educational climate and fosters their motivation to learn. A challenging priority for future research and practice is to identify and compare factors that enhance and maintain FFS participants' (farmers and facilitators as well) motivation to engage in and adhere to social capital generating behaviours. When viewed in a more general context, the conclusions from this study suggest that, to enlarge spaces for innovation, policy planners and intermediaries must focus not only on the structural conditions that support innovation process but also on the factors which create social reinforcement contingencies able to foster farmers' capacity to innovate.

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