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Innovation behaviour among smallholders: Evidence from the peach value chain in Cochabamba, Bolivia

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Abstract

There is increasing empirical evidence that farmers not only decide to innovate on the basis of economic and personal considerations, but also on the context of the social interactions they maintain among themselves and with agents who promote change. The focus of this study was on how communication within the social networks of farmers influences their decision to innovate. Three communities in the Valle Alto of Cochabamba, Bolivia, were studied with regard to their social interactions and the degree to which innovations in peach production and marketing were applied. Variables denoting the embeddedness of farmers in the networks were derived using social network analysis. The results show that the connectivity of farmers in social networks allows the exchange of information on improved practices and innovations in peach production and marketing. Though, the effect on innovativeness is significant, its effect is marginal. Results also show that farmers do not communicate actively on such issues. A further analysis of the type of innovations available to the farmers reveals that many of them did not yet contribute to substantial increases in production and income. One may argue that the available innovation –for this particular case- were simply not substantial enough to make diffusion through the network and application on farmers' fields worthwhile.

Keywords: *Social Networks, Diffusion of Innovations, Change Agents, Peach Value Chain*

JEL classification: *Z13, Q13, Q32*

1. Introduction

1.1 Social networks as a key factor to foster the diffusion of innovations

Social networks are of particular relevance for smallholders, who rely more on informal than formal sources of information (Matuschke 2008). Matuschke y Qaim (2009) stated that analyzing social networks can improve the understanding of their role in adoption decisions and can help policy makers to develop more targeted strategies to foster agricultural innovations and rural development. In this sense, the innovation systems perspective, takes into account interaction occurring in a network-like structure. This interaction facilitates a continuous learning process and assures the participation of primary producers and change agents. The concept of change agents goes beyond extension agents and government officers. Other change agents are processors, buyers, input providers, local leaders, local development programs and NGOs, educational institutions, and many other actors, including other farmers (Hartwich and Scheidegger 2010; Matuschke and Qaim 2009).

In fact, embeddedness in social networks can be considered as a crucial factor in an equation that explains farmers' decisions to innovate, alongside with variables depicting endowment with resources and other socio-demographic factors (Hartwich, pers. comm.). There are some studies which include social networks as variables which influence farmers' decision to innovate (eg. Bandiera and Rasul, 2006; Matuschke and Qaim 2009). However, approximating embeddedness and understanding its influence on innovation behaviour empirically is a new research field which requires the combination of social network analysis and econometrics tools. It is in this field that the proposed study contributes to the current academic discussion.

1.2 Why social network analysis?

Social Network Analysis is defined as a methodology which allows explaining social phenomena through the study of interaction patterns among social actors, as well as patterns at different level of analysis, like individuals and groups (Wasserman and Faust 2009). At the individual level, nodes with higher centrality[1] are opinion leaders who tend to be early adopters of culturally acceptable innovations (Becker 1970). At the dyad level (two actors or nodes), attitude and behavior are affected by the frequency, multiplexity, strength and asymmetry of interaction (Erickson 1988; Sparrowe and Liden 1997, 2005). The analysis at the triad level (three actors or nodes) has to do with structural balance and transitivity concepts (Wasserman and Faust 2009). Because of the forces occurring in a triad structure, a non adopter tied to two adopters will end up adopting (Krackhardt 1998, 1999). At the network level, centralized structures favor and accelerate the pace of diffusion as soon as the diffusing element – information, knowledge, or technological innovations – reaches the core actors in the network, such as opinion leaders (Rogers 2003).

The theory of social networks provides a quantitative and qualitative basis for fostering the diffusion of innovations. When we just ask people who is whom in a given structure, we get subjective results. By doing social network analysis, we get a more realistic picture of what is going on and more reliable information about the actors of a given network, who could facilitate or hinder a diffusion process and how to make the best of that given structure in order to promote change and foster rural development.

1.3 The importance of promoting the information flow

The information flow is a driving force for the success of the diffusion of innovations. The greater the range of information, the greater the possibility that producers know about innovations in the production and marketing of crops and about the experiences that their peers have (social learning). This will allow them to decide to adopt a proposed innovation and to learn how to make better use of it, adapted to the local conditions. Studies about the importance

1 By «centrality», Becker refers to the extent to which an individual is socially incorporated into the major informal communication networks of his group and also refers a partial measure of the degree of prestige and acceptance accorded the individual.

of social learning for innovation adoption include: Barret 2005, Feder and Savastano 2006 and Granovetter 2005.

For smallholders to become involved in value chains, it is important to promote the information flow, as well as to foster the cooperation and networking among farmers and between farmers and change agents. In fact, this becomes a core objective of most extension services (Darr and Pretzsch 2006). It is important to understand that farmers have an important role, at the individual and group level, in promoting or hindering the diffusion of knowledge and innovations. That is why top-down approaches have failed in achieving their goals and the new tendency is to promote and support the horizontal communication and the cooperation among farmers.

Fostering farmers' association has become a priority for extension works and there are other promising approaches like the «Farmer-to-Farmer» and «Farmer Field Schools» (See Fetien et al. 2001, Simpson and Owens 2001). Social network analysis could be an important tool to support and success in such approaches (Matuschke and Qaim 2009). For farmers to be able to improve their skills and the technologies they use, it is necessary a process of diffusion of information, learning, absorption and adaptation to local conditions which eventually leads to the «upgrading» of the methods farmers use in the production and marketing of their products (Foster and Rosenzweig 1995).

1.4 Research questions and hypothesis

The idea is that by promoting the communication and cooperation among farmers and change agents, farmers can achieve better yields, better quality and better prices, which can help them to improve their livelihoods.

In this study, we focused in the communication among farmers and the aim was to understand how this communication influences their decision to innovate, as well as other factors influencing their innovation behaviour. This research wanted to show empirically the following assumptions:

1. **The communication among farmers influences their decision to innovate**. By having more contacts (ties) and on a frequent basis, a farmer should have more access to information and resources. Therefore, his/her innovation score should be higher.

2. **Business ties (contractual arrangements for the exchange of products) influence the farmers' decision to innovate**. Due to contractual arrangements, farmers have orders to deliver at a given time and in most of the cases quality matters. In the peach context, having an arrangement with buyers assures that farmers can better sell their product even in weeks when the offer is too high and prices sink. That's why we want to prove that those farmers who have contractual arrangements are more innovative.
3. **There is an inequitable distribution of income among farmers in the peach value chain and this is related to their innovativeness**. Farmers who have better income have the possibility to invest. We assumed that the mere fact of earning more money should allow them to innovate more, in contrast to those farmers who are not profiting from their plots.
4. **The patterns of interaction in social networks influence the communication among farmers with regard to innovation**. Social networks have given structures which determine the flow of resources and information. Those patterns can foster or hinder the communication flow and therefore, make the situation unequal for many farmers. In the first assumption we cover the quantitative aspects of the communication in networks (how many contact a farmer has in his individual network), but in this research question we go for quantitative, qualitative and structural aspects. A centralized network may have a positive effect in a community, once the information reaches the center of the network it can rapidly spread through the network. But depending in one or a few actors may be a drawback for the information flow if the interests of this actor(s) are at the personal and not community level.

2. Methods

2.1 Study area

The Valle Alto of Cochabamba has a well known reputation regarding its peach production. Around 10.200 tons are produced yearly in approximately 1.100 ha (FDTA-Valles 2007; Duarte 2005). The municipalities producing this fruit are: San Benito, Punata, Tolata, Tarata, Cliza y Arbieto (see Figure 1). Yield is approximately 9,2 ton/ha, which is far below its competitor countries (10–40 ton/ha). Besides, around 85% of the production is consumed fresh, which means a demand of fruit of high quality.
Around 70% of the producers are smallholders (3'500–5'500 m^2 of peach production), 25% are medium-sized farmers (5'500–10'500 m^2) and 5% are big producers (> 10'500 m^2)[2]
Peach farmers are struggling against problems like drought, frost, pests, diseases and marketing constraints. Therefore, the Swiss Agency for Development and Cooperation designed the Fruit PIC project (Program of Continuous Innovation). In the second phase of this project (2009–2011) innovations are being developed. Those innovations are based on the demand of farmers, according to their needs. The demands are collected in a new institution, created as a product of the PIC Project. This institution is called PLACIIT-FV (Plataforma de Coordinación Interinstitucional de Innovación Tecnológica de Frutas del Valle) and its members are the different stakeholders of the peach value chain at the regional level, including farmers, ONGs, the private and public sector.

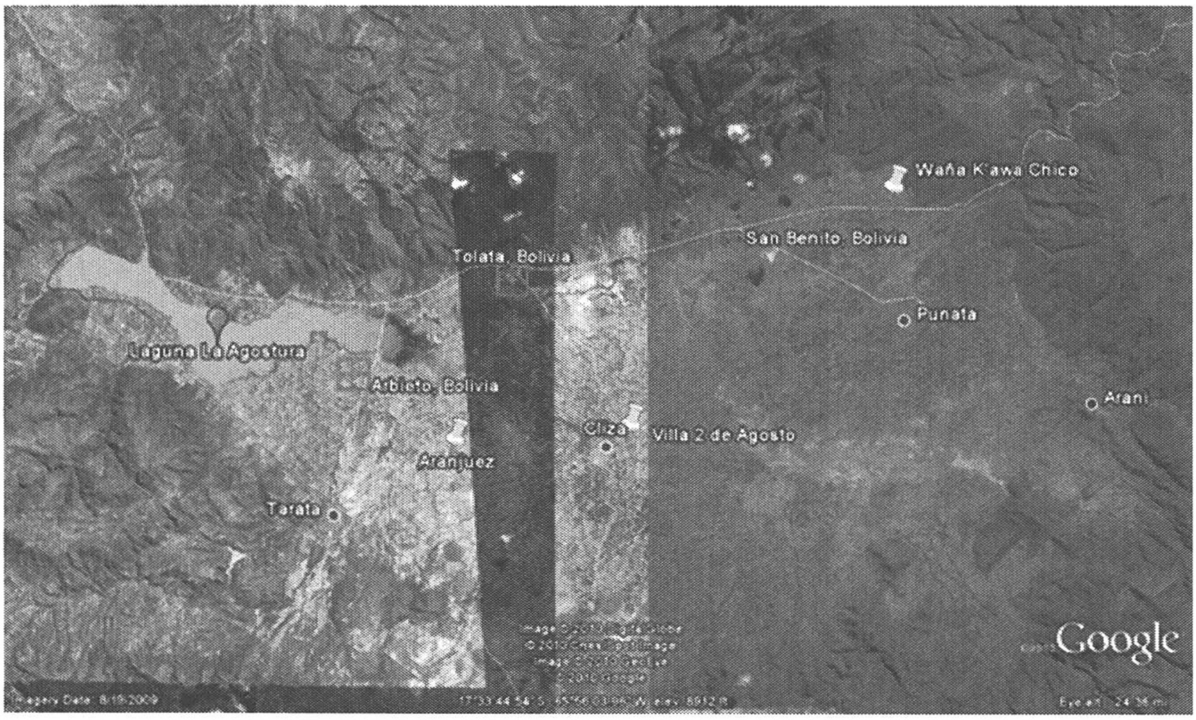
With the help of key informants, three communities of El Valle Alto were selected. The selection criteria were the following:

a) In three different municipalities, to have a clear picture of the networks. We used the communities as parameters to set the boundaries.
b) Variability on their innovation behaviour, a mix of innovative and non-innovative farmers.
c) Communities with farmers belonging and not belonging to a farmers' association, to better depict individual networks.

2 Data obtained from a participatory value chain analysis, done with the main actors of the local peach value chain.

Figure 1 highlights the three studied communities: 1) Waña K'awa Chico, n = 48, 2) Villa 2 de Agosto, n = 20, 3) Arbieto, n=12

Figure 1: Communities in the Valle Alto of Cochabamba where social network analysis was performed, from July to September of 2010



The first two communities have a peach producers association. In the third one, by the time of this study, a farmers' association was created but it was no specific for peach production.

2.2 Data collection and processing

The main objective was to collect data with regard to the social interactions in each community and the degree to which innovations in peach production and marketing were applied. During July to September 2010, 80 farmers were interviewed. A typical interview included a visit to collect data for the innovation degree and the other data, including social interaction, was collected in a questionnaire. Social interaction was collected for farmers-farmers networks and farmers-agents networks.

To collect data on the networks, key informants made a list of the peach producers in each community. By asking those farmers about their social interactions, the networks became bigger. We also did observations of the plots to know exactly who is producing peaches in each community and complete the respective list.

2.2.1 Innovation degree («innovativeness»)

In this study we did not analyze the adoption of a proposed innovation, which could be a binary variable (adopted, not adopted) nor a proportion of the plots in which, for example, a new variety was planted. For our analysis we wanted to know how innovative farmers are in the production and marketing of the peaches and to obtain a continuous variable. The response «innovativeness» was calculated based on the following aspects: fertilization, pruning, integrated pest management (IPM), varieties and marketing of peaches. All those factors were graded between 1 and 5, being 5 more innovative. Then, the values were normalized and the response variable had a value between 0 and 1, being 1 more innovative.

2.2.2 Variables denoting the embeddedness of farmers in social networks

For this, we focused on farmers-farmers networks (1-Mode networks). These variables were derived using social network analysis with the software UCINET 6. The exchange networks were divided in four topics regarding the communication among farmers on: traditional knowledge on peach production (C1), innovation on peach production (C2), marketing of peaches (C3) and organizational issues (C4). Only frequent communication (at least once a month) was taken into account, except for marketing networks due to the seasonality of the production. For each network (C1–C4), variables like Degree of Centrality, InDegree of Centrality and OutDegree of Centrality were calculated. Then, the means of such values were obtained for each farmer. For those values, and other socio-demographic, income and production variables (e.g. age, gender, level of education, density of plants, plot area, distance to the market, income, contractual arrangements, etc), a Pearson product-moment correlation coefficient was calculated with R to determine the linear dependence between those variables and the response «innovativeness».

The variables showing correlation with the response were used in a multivariate regression analysis to determine if «embeddedness in social networks» significantly contributes to the continuous variable «innovativeness» of farmers.

The information exchange networks were also visualized using NetDraw software (Figure 2) The visualization of networks and quantitative data (other variables from the social networks were derived using UCINET 6, e.g. density[3], transitivity[4]) allowed to determine patterns of interaction among farmers and between farmers and change agents and to relate those patterns to the innovativeness of the farmers at the individual and community level. For farmers-agents networks, we sumarized the interactions they maintain in a graph to show to what kind of agents farmers have contact with. For this, we classified the type of farmers according to their innovativeness (no innovative = Q25, less innovative = Q50, and innovative = Q75). Moreover, a Pearson's Chi-squared test was done to determine whether there is a difference in the outgoing ties farmers have (in farmer-agent networks) and their innovativeness.

3. Results

3.1 Variables influencing the response innovativeness. The effect of centrality, business ties and income

The results show that the connectivity of farmers in social networks allows for the exchange of information on improved practices and innovations in peach production and marketing. By controlling the effect of other variables in the multivariate regression model, we could have a more realistic idea of the effect of «embeddedness in social networks» on the response. The variable «Centrality» showed a significant effect on innovativeness. Therefore, only that variable appears in the proposed models. For this variable, though the effect on «innovativeness» is significant (p-value = 0.009), its effect is marginal (coeffici-

3 Network density is the count of ties in a network divided by the maximum number of possible ties between nodes (Borgatti and Everett 1997).

4 When there is a tie from i to j, and also from j to h, then there is also a tie from i to h.

ent = 0.002). The variable InDegree on the second model has a better coefficient, still too low to prove our assumption. Moreover, the variables income and business ties showed a significant effect on the innovativeness of the producers (Table 1).

Table 1: Regression models to determine the variables influencing the innovativeness of peach farmers

Variable	**Model (1)**	**Model (2)**
	n=53[a]	**n=53**
Intercept	0.128	0.139
X1. Gender	0.021	0.022
X2. Age	31.4x10-5	47.4x10-5
X3. Years education	0.008 **	0.008 **
X5. Full time producers	0.047 .	0.051 *
X8. Peach area	-0.10x10-5	0.06x10-5
X9. Plant density	1.20x10-5	1.38x10-5
X12. Receive technical assistance	-0.045	-0.047 .
X15. Business ties	0.040 *	0.034 .
X17. log (Income 2010+10)	0.033 ***	0.030 ***
X18. NrmDegree	0.002 **	
X19. NrmInDegree		0.004 **
Fit measures:		
Standard error of residuals	0.074 (42gl)	0.073 (44 gl)
R^2	0.592	0.595

[a] Taking into account only the farmers whose plants are older than 3 years to evaluate the variables income and business ties.

Degree: The count of the number of ties to other actors in the network.

InDegree: The count of the number of outgoing ties an actor has.

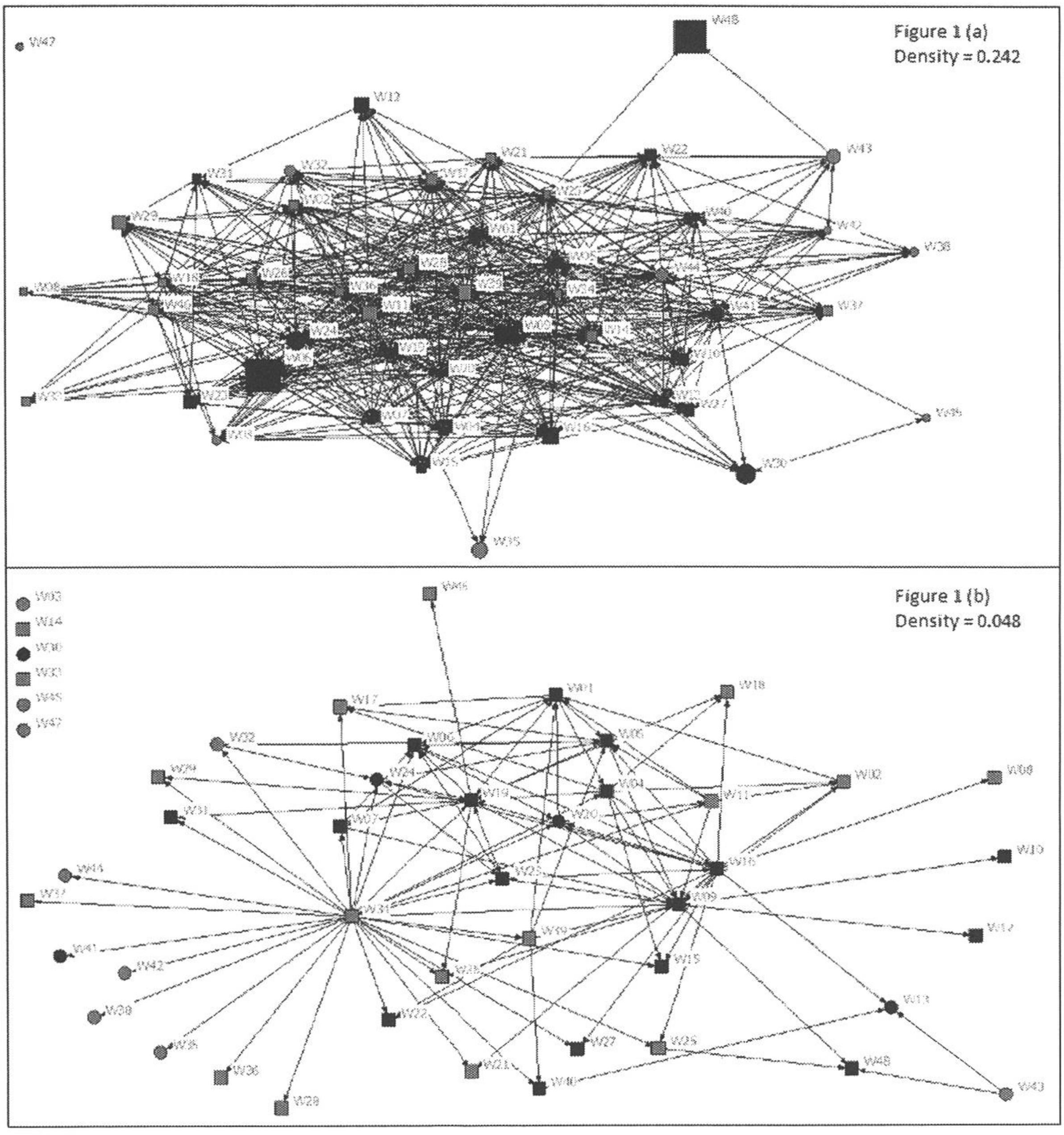
As we can also see, the variables Gender, Age, Peach area and Plant density did not show a significant effect on the response. Another interesting aspect is that those farmers who are totally dedicated to the peach production tend to innovate more (variable Full time producers). The non-significance of the variables Age and Gender show that, in the particular case of El Valle Alto, social networks cross those boundaries.

3.2 Patterns of interaction and their effect on the innovativeness of peach farmers

3.2.1 Patterns of farmers-farmers networks

Farmers interact regarding information on traditional knowledge in peach production (C1) but when analyzing their interaction regarding innovations (C2), the networks are sparse (See Figure 2). An analysis of the communication among triads of farmers show that farmers do not communicate actively on innovation (low transitivity) (Table 2).

Figure 2: (a) Communication network among farmers (1-Mode network) regarding traditional knowledge in peach production (network C1) (b) Communication network among farmers (1-Mode network) regarding innovations on peach production (network C2). Community: Waña K'awa Chico. Note: Circles = don't receive technical assistance; squares = receive technical assistance; black = innovative (≥ median); grey = less innovative; (< median); size of the nodes is proportional to the peach crop area. Density is the count of ties in a network divided by the maximum number of possible ties between nodes.



As we can see on the figure, we have the same actors in the same community, but when we asked them about their social interactions regarding «innovation» on peach production the picture changes totally. On the Figure 2b, we can distinguish some central actors (high Degree of Centrality). We can distinguish that there are more farmers isolated from the network. In figure 2a, we see that there is potential for the information to flow, farmers are interacting but «innovation» information becomes somehow less accessible.

Table 2: Innovativeness and network properties of the studied communities

Community	Network	Density	Transitivity[a] (%)
1. Waña K'awa Chico	C1[c]	0.282	58.52
(n=48)	C2[d]	0.048	27.94
2. Villa 2 de Agosto	C1	0.250	61.28
(n=20)	C2	0.066	23.64
3. Aranjuez	C1	0.250	33.33
(n=12)	C2	0.106	38.89

[a] When there is a tie from i to j, and also from j to h, then there is also a tie from i to h
[b] Based on the grading of: fertilization, pruning, irrigation, Integrated pest management (IPM) marketing of peaches
[c] Communication regarding traditional knowledge of peach production
[d] Communication regarding innovation in peach production

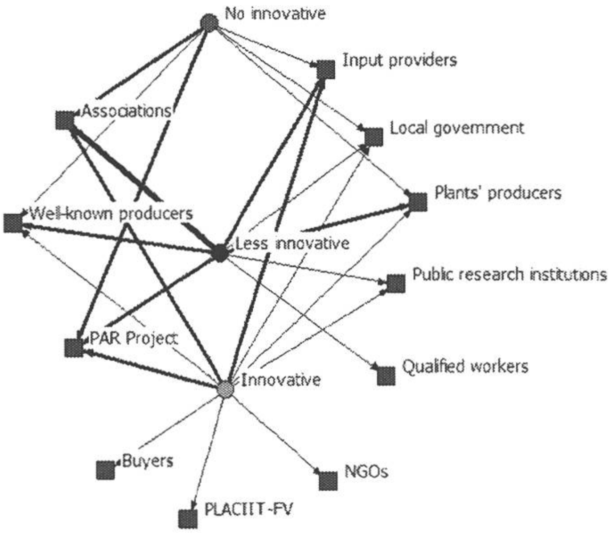
Regarding communication on innovation (farmer level), the communities with one or few actors in the center of the networks were less innovative than the one with many central actors.

The visualization of the networks with NetDraw and the qualitative data from UCINET 6 allowed us to see who is who in each community. Those networks are very particular for each community and the type of communication, but the main focus is that we could see the farmers who are opinion leaders, who can act as bridges, who are not interacting. The same for farmers-agent's networks. This kind of information is important to make the best out of a given structure in order to foster innovation.

3.2.2 Patterns of farmers-farmers networks

About farmers-agents' networks, input providers and qualified workers are very influencing agents, but they are not included in the PLACIIT-FV[5] of the PIC's[6] fruit project. Figure 3 shows how interaction that farmers maintain with change agents may influence in their innovativeness. Another relevant aspect is the important role of a new institution, called PAR Project, which is working separately, not interacting with the PIC project and the other stakeholders of the peach value chain. Moreover, the Chi-squared test showed that the number of change agents with whom a farmer interact influences in their innovativeness (X-squared=10.0391, df=4, p-value=0.0397)

Figure 3: Average interaction of types of innovators with change agents regarding peach production and marketing. Community Waña K'awa Chico. Note: All change agents from the interaction networks: C1 (production), C2 (innovations), C3 (marketing) and C4 (organizational issues) taken into account. Dots = farmers; squares = change agents. Red = Quartile Q75 (Innovative); black = Q50 (Less innovative); blue = Q25 (No innovative). Tie strength is proportional to the frequency of communication: 0 farmers = no line, 1 to 6 farmers = thick 1, 7 to 14 farmers = thick 2, ≥14 farmers = thick 3. Classification of farmers based on the continuous variable innovativeness on peach production and marketing.



5 Plataforma de Coordinación Interinstitucional Frutas del Valle. Platform conformed by different stakeholders of the regional peach value chain

6 Programa de Innovación Continua / Program of continuous innovation

Discussion

We could not prove our first hypothesis, that the communication among farmers influences their decision to innovate. One of the problems that might have affected the results of our models in trying to prove this hypothesis, is that we used the communities as parameters to set the boundaries. We didn't study whole individual networks because of time and logistics, but this would have been the optimal to do because farmers go beyond their geographical boundaries to get information and interact with other farmers and agents. Additionally, we evaluated only farmers-farmers' networks in the models. And we know that farmers' decision to innovate is based on a set of interactions not only with their peers, but also with change agents. This vertical interaction, which we did not include in the models, is an important source of information and a success factor when fostering innovation. Another aspect is that in Waña K'awa Chico, the main leader died a couple of months before the realization of this study and this affected the structure of the networks in that community and of course, the qualitative data that we used.

Concerning the second hypothesis, we proved that those farmers who have a kind of contractual arrangement tend to innovate more. We do not talk about written contracts, but about spoken agreements. Those farmers who have better marketing channels normally have products of better quality. They even have a different package. Improving the marketing channels of the farmers is an important solution for one of their main problems, the seasonality of the production which concentrates from February until the middle of March. The increased offer leads to low prices and this discourages the farmers.

Regarding the third hypothesis, we proved that those farmers whose income is higher tend to be more innovative. Here, another topic of discussion is the endogeneity of the model regarding the variable *Log Income 2010*. For this, it was not possible to do a time lag with respect to prior years. First, because most of the farmers do not register their costs and income. Second, because of the confidentiality of this data.

About communication patterns, we saw that farmers are not actively exchanging information about innovation on peach production. The networks have the potential for the information to flow but this information is being «consumed» by some people and not passed to others. It is important to foster innovation by identifying opinion leaders and working with them so that the information can spread easily. Regarding farmers-agents' networks, it is important to work together with agents who are influencing (eg. PAR Project, qualified workers, input providers), because not cooperating with them could mean that it is not possible to reach as many farmers as possible or that farmers receive different and/or contradictory information.

Innovation at an early stage

A further analysis of the type of innovations available in the value chain reveals that many of them did not yet contribute to substantial increases in production and income. One may argue that -for this particular case- the available innovations were simply not substantial enough to measure the effect of networking on innovativeness.

Conclusions and Policy Implications

Development projects may note that it is important to consider and improve social interactions when fostering innovation. They may be advised, for example, to strengthen producers associations in a way that they promote communication about relevant information for innovation and marketing opportunities. This, however, may only be effective if ideas and solutions are present inside the farming community and among development agents in order to bring considerable benefits to the potential innovators. Fostering cooperation among farmers, between farmers and agents and among agents is an important step to do. Additionally, they may be advised to identify bottlenecks for the information flow at the farmer and agent level. Regarding change agents, through this study we could prove empirically who are the most important agents influencing the farmers. Development agencies are recommended to assess those roles and take into account all relevant actors in order to join actions.

Finally we encourage development projects to assess which innovations are relevant for the farmers, distinguishing between innovative and less innovative farmers. In other words, innovations should be targeted in order to bring sustainable changes at the grassroots' level. Assuming that farmers would develop their own solutions is not realistic.

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References

Bandiera, O., Rasul, I., 2006. Social Networks. Technology Adoption in Northern Mozambique. Economic Journal 116 (514): 869–902.

Barret, C.B., 2005. On the Relevance of Identities, Communities, Groups, and Networks to Economics of Poverty Alleviation. In: Barret CB (Ed), The Social Economics of Poverty: on Identities, Communities, Groups, and Networks. Routledge, Oxon, UK, 1–11

Becker, M.H., 1970. Sociometric Location and Innovativeness: Reformulation and Extension of the Diffusion Model. American Sociological Review 35 (2): 267–282.

Darr, D., Pretzsch, J., 2006. The Spread of Innovations within Formal and Informal Farmers Groups: Evidence from Rural Communities of Semi-arid Eastern Africa: Conference on International Agricultural Research for Development, Tropentag, 10 p.

Erickson, B.H., 1988. The Relational Basis of Attitudes. Social In Structures: A network approach, ed. B. Wellman and S.D. Berkowitz. Cambridge University Press, New York, 99–121.

Feder, G., Savastano, S., 2006. The Role of Opinion Leaders in the Diffusion of Knowledge: The Case of Integrated Pest Management. World Devel, No. 34 (7), 1287–1300.

Fetien, A., Belay, T., Mengistu, H., Mamusha, L., 2001. Facilitating Farmer-to-Farmer Communication about Innovation in Tigray. In: Reij, C; Waters-Bayer, A. Farmer Innovation in Africa – A Source of Inspiration for Agricultural Development. Earthscan, London, 185–197.

Foster, D., Rosenzweig, M., 1995. Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture. Journal of Political Economy No. 103, 1176–1209.

Granovetter, M.S., 2005. The Impact of Social Structure on Economics Outcomes. Journal of Economic Perspectives, No. 19 (1), 33–50.

Hartwich, F., Scheidegger, U., 2010. Fostering Innovation Networks: The Missing Piece in Rural Development? Rural Development News No. 1.

Krackhardt, D., 1998. Simmelian Ties: Super Strong and Sticky. In Power and Influence in Organizations, ed. R. Kramer and M. Neale, Thousand Oaks, CA: Sage, 21–38.

Krackhardt, D. 1999. The Ties that Torture: Simmelian Tie Aalysis in Organizations. Research in the Sociology of Organizations 16: 183–210.

Matuschke, I., 2008. Evaluating the Impact of Social Networks in Rural Innovation Systems. International Food Policy Research Institute. Discussion Paper 00816, Washington, DC, 36 p.
Matuschke, I., Qaim,M., 2009. The Impact of Social Networks on Hybrid Seed Adoption in India. Agricultural Economics No. 40 (5), 493–505.

Monge, M., Hartwich, F., Halguin, D., 2008. How Change Agents y Social Capital Influence the Adoption of Innovations among Small Farmers: Evidence from Social Networks in Rural Bolivia. International Food Policy Research Institute. Discussion Paper 00761, Washington, DC, 76 p.

Rogers, E.M., 2003. Diffusion of Innovations: 5. Ed. Free Press, New York, 519 p.

Sparrowe, R.T., Liden R.C., 2005. Two Routes to Influence: Integrating Leader-Member Exchange and Social Network Perspectives. Administrative Science Quarterly 50: 505–535.

Simpson, B.M., Owens, M., 2002. Farmer Field Schools and the Future of Agricultural Extension in Africa. SD dimensions, FAO. www.fao.org/sd/2002/KN0702a_en.htm. Consulted on 12.12.2010

Wasserman, S., Faust K., 2009. Social Network Analysis: Methods and Applications. Cambridge Univ. Press, Cambridge, 825

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