



Tropentag 2016, Vienna, Austria
September 18-21, 2016

Conference on International Research on Food Security, Natural Resource
Management and Rural Development
organised by the University of Natural Resources and Life Sciences
(BOKU Vienna), Austria

Networking, information and technology adoption: A Social Network Analysis of Colombian small/medium scale cattle producers

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Abstract

Social networks are an important strategy in helping people to cope with challenging conditions such as a lack of basic services or inputs. The worse the conditions are and the more difficulties exist in the access to resources, the more likely people will protect themselves by forming social networks. In many cases, social networks replace formal services and input providers, relying on the delivery of informal financial services, extension services and problem solving assistance. Small and medium scale cattle producers in Colombia face difficult conditions, which not only comprise climate change related production constraints, market or credit access, but also the access to technical information (e.g., feeds, animal production, marketing).

In this paper, an analysis was carried out in order to understand how social networks function as assets for small and medium scale cattle producers in the Colombian Cauca Department. Precisely, the authors tested the hypothesis that a strong social network has a positive influence on the adoption of improved forages in cattle production. Data was obtained in October 2015 through 308 semi-structured questionnaires with randomly selected small and medium scale cattle producers and was analyzed for network density and actor centrality by applying the UCINET software.

To test the hypothesis, correlation analyses were conducted. Results indicate that cattle producers with a higher centrality degree show significantly higher adoption levels of improved forages, access to information and technical knowledge. The access to information has a positive and significant relation to the technical knowledge level and the latter to the adoption level. Producers who are members of an association, are more likely to adopt improved forages, especially those with a leading position within the association.

Keywords: Access to information, social network analysis, technology adoption, tropical forages.

Introduction

When governments and markets do not provide optimal conditions for smallholders, behavior of households and livelihood strategies tend to rely more on social networks, which are considered reliable and powerful channels for social learning, collective action, and the exchange of information and resources (World Bank, 2008).

According to Ramirez (2013), participation in producers' associations influences agriculture technology adoption and plays an important role in knowledge transfer. For Spielman *et al.* (2010), Social Network Analysis is critical for the application of innovation systems theory, as findings suggest that policies should be oriented to promote participation of all stakeholders in the network. Pali *et al.* (2013) identified the influence of centrality measurements as well as other socioeconomic variables on knowledge transfer and technology adoption, suggesting also that the producer knowledge level is critical to promote adoption programs.

Difficult conditions in the access to resources, as well as the lack of knowledge and information related to changing climate conditions, have resulted in the reduction of cattle feed availability for smallholders in the Colombian Cauca Department (Calle, 2015) leading to challenging conditions for the producers, especially in dry seasons. Improved forages due to their numerous benefits, such as drought resistance and higher productivity, can play an important role in overcoming seasonal feed shortages but adoption levels in Colombia are still low.

This study aims to identify the general structure of interactions among cattle producers in Cauca, Colombia and to determine the influence of being connected to this social network on the adoption of improved forages as a way to strengthen the cattle value chain in the region.

Material and Methods

This study is part of the research program “*Development and implementation of forage resources for sustainable bovine production systems in the Cauca department, Colombia*” between the International Center for Tropical Agriculture (CIAT) and the Colombian Cauca University.

Data was collected through semi-structured surveys applied to 308 farmers from the southern Cauca Department (Patía and Mercaderes municipalities). For the identification of local farmers, we used databases of local farmer associations and applied a snow-ball sampling method for reaching a wider sample and including non-associated farmers.

As influencing variables on the adoption rate of improved forages, we assumed network centrality of producers, the producers' knowledge of climate change and improved forages, the producers' role in their associations (regular members vs. administrative/leading members), and producer size.

Social Network Analysis (SNA)

Ucinet 6.531 was used to obtain the *Centrality degree* of producers, and Netdraw 2.160 to create the network figure. Connections are based on collaboration among producers, sharing information or resources on several topics related to livestock production.

Correlation analysis

The indicator *technical knowledge* has three components: knowledge of climate change and improved forages, knowledge of cultural practices, and awareness of productive models in the region; all measured on a scale from 1 to 5. The indicator *access to information* is based on the number of sources consulted for technical assistance. The *adoption level* was calculated dividing the farm area under improved forages used for cattle production by the total farm area used for cattle production.

Results and Discussion

Sample description

Producers were classified by size according to the number of animals they own (Fedegan 2014): 85.99% of them are smallholders, 13.36% are medium scale producers, and 0.65% are large scale producers. 74.26% are men.

Adoption level, membership in associations, and technical knowledge

40.7% of the producers use improved forages with an average *adoption level* of 30.81% within the area dedicated to livestock production. 4.8% of producers have a 100% *adoption level* and 20.8% have an *adoption level* between 50 and 99%. 42.34% have access to information from technical assistance providers. 54.39% of the producers are *members in associations*, 82.03% have a *role in associations* as regular members and 17.96% in an administrative/leading function. 70.68% obtained a score between 2 and 4 in the *technical knowledge* indicator.

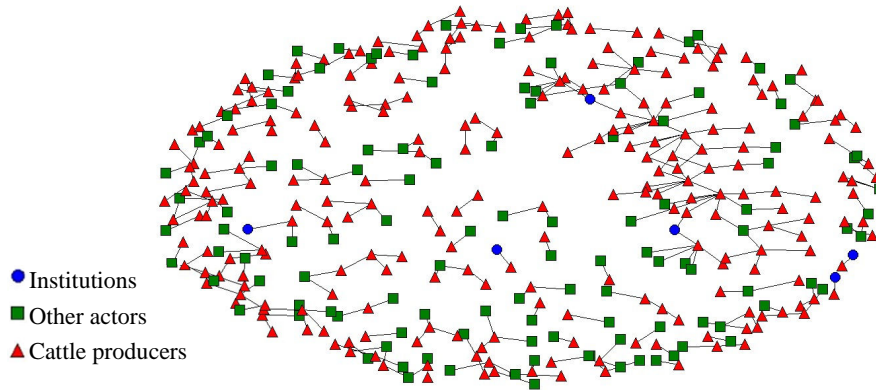


Figure 1 Undirected Social Network of cattle producers in the Southern Cauca Department, Colombia
* Isolates are not shown.

The cattle producer network is formed by 134 out of 17,822 possible connections (a scenario where everyone is connected to everyone), meaning a network density of 0.75%. This indicator is useful to know if a network is reaching its full potential of connections, although a low number does not necessarily mean that a network is not an influential element within a community (Figure 1).

The *centrality degree* indicator shows a positive and significant relation to the *adoption level* of improved forages and to the *information access* and *technical knowledge* indicators that also show to influence the *adoption level*. The mean difference test shows a significant difference between *adoption level* and *role in a producer association*, meaning that producers with an administrative/leading role in a producers’ association have significantly higher adoption rates than regular members and non-members ($p < 0.05$) (Figure 2).

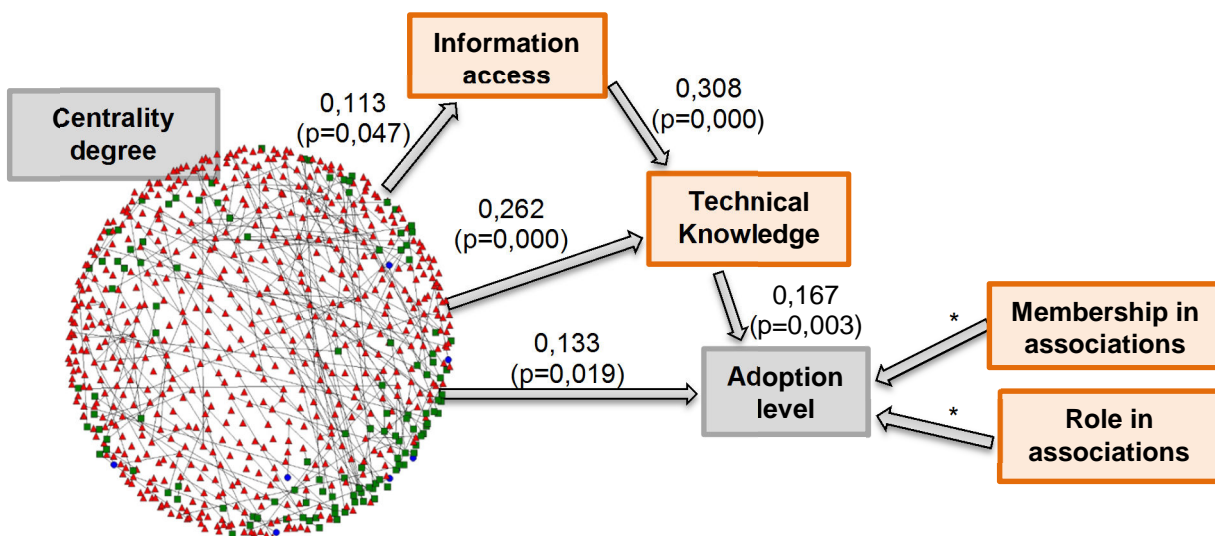


Figure 2 Influence diagram based on correlation analyses between indicators

Conclusions and Outlook

The results of this study can be a useful input for strengthening and developing the cattle value chain in the region, allowing policy makers, researchers, extension services and other relevant stakeholders to identify potential opportunities for intervention and support at producer level.

Cattle producers with a higher *centrality degree* as well as (administrative/leading) *members in associations* could play an important role in the dissemination of improved forages and other agricultural technologies, and facilitate the diffusion process within their communities. The *centrality degree* could be used to select producers for extension programs, for example for the establishment of demonstration plots or to be trained as trainers for their community, facilitating the visibility and reach of new technologies such as improved forages.

Since the *adoption level* is higher among producers with more *access to information*, it is recommended to strengthen the implementation of training and extension programs as a critical element for the promotion of innovations and innovation strategies in cattle production. A successfully applied methodology in Nicaragua are Farmer Field Schools, an extension model where producers train other producers supported by institutions, and according to FAO (2005), it is one of the most effective ways to improve conditions of rural families.

Overall, we can conclude that social networking among producers can help to facilitate technology uptake and diffusion and hence contribute to sector development. For the case of improved forages, recognizing and collaborating with such networks can create opportunities for overcoming seasonal feed shortages.

Acknowledgements

This work was funded by the Sistema General de Regalías, Colombia. We acknowledge the support of the Cauca Regional Government, and the local producer associations COAGROUSUARIOS and ASOGAMER.

References

- CALLE, Z., MURGUEITIO, E., AND CAICEDO, J.M. (2015). Como enfrentar la sequía y la degradación extrema de las tierras. Carta Fedegán 151:62-69. Retrieved from: <https://goo.gl/LG7j44>
- FAO. (2005). Las Escuelas de Campo para Agricultores (ECAs) en el PESA-Nicaragua: Una experiencia participativa de extensión para contribuir a la seguridad alimentaria y nutricional en Nicaragua. Food and Agriculture Organization, Rome, Italy. Retrieved from: www.fao.org/3/a-au004s.pdf
- FEDEGAN. 2014. Plan de desarrollo ganadero 2014-2019: Por una ganadería moderna, sostenible y solidaria. Federación Colombiana de Ganaderos. Retrieved from: <https://goo.gl/9dq1qS>
- HOANG, L. A., CASTELLA, J-C., AND NOVOSAD, P. (2006). Social Networks and information Access: Implications for agricultural extension in a rice farming community in northern Vietnam. *Agriculture and Human Values* 23(4):513-527. doi: 10.1007/s10460-006-9013-5
- PALI, P.N., ZAIBET, L., MBURU, S.K., NDIWA, N., AND RWARE, H.I. (2003). The potential influence of social networks on the adoption of breeding strategies. *Livestock Research for Rural Development* 25(5), Article #89. Retrieved from: www.lrrd.org/lrrd25/5/pali25089.htm
- RAMIREZ, A. (2013). The influence of social networks on agricultural technology adoption. *Procedia - Social and Behavioral Sciences* 79(6):101-116.
- RAO, I., PETERS, M., CASTRO, A., SCHULTZE-KRAFT, R., WHITE, D., FISHER, M., MILES, J.,...RUDEL, T. (2015). LivestockPlus – The sustainable intensification of forage-based agricultural systems to improve livelihoods and ecosystem services in the tropics. *Tropical Grasslands-Forrajes Tropicales* 3(2):59-82. doi: 10.17138/TGFT(3)59-82
- SPIELMAN, D.J., DAVIS, K., NEGASH, M., AND AYELE, G. (2010). Rural innovation systems and networks: findings from a study of Ethiopian smallholders. *Agriculture and human values* 28(2), 195-212. doi: 10.1007/s10460-010-9273-y
- WORLD BANK. (2008). World Development Report 2008, Agriculture for Development, Washington D.C., The World Bank.