Research Article

Indian Journal of Extension Education
Vol. 59, No. 1 (January–March), 2023, (1-6)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Social Network to Accelerate Agricultural Technology Adoption: Evidence from *Hambanthota* District, Sri Lanka

K. N. Nadeeshani Silva

Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka
Email id: nadeeds@gmail.com

ARTICLE INFO

Keywords: Agriculture extension, Agriculture instructors, Contact farmers, Social network, Technology adoption

http://doi.org/10.48165/IJEE.2023.59101

Conflict of Interest: None

ABSTRACT

Information links among the actors of social networks have a vital effect on the diffusion of knowledge from person to person and subsequently accelerate the adoption process. Poor information links led to the inefficiency of technology transfer and adoption by rural farmers in developing countries. Concerning the importance of information links of a social network on technology adoption, the study intended to explore the social network impact on the agricultural knowledge transferring process as an alternative extension approach over traditional extension practices. The 72 extension officers working in the Hambantota district were purposefully selected to collect primary data on information and knowledge network. Extension officers were identified as the key node of the information network. The role of contact farmers was prominent in paddy farming in Sri Lanka as they provided the interconnection between extension officers and farmers by sharing information. The study found that all the actors in the network similarly influenced each other and were well-connected. Further, the contact farmers' approach can be successfully applied as a cost-effective extension tool in developing countries while progressing technology adoption among farmers.

INTRODUCTION

The long-term economic growth of any country heavily depends on the technological progress of the country. Particularly in developing countries, agriculture productivity can be improved through the adoption of new technologies should play a major role in income growth (Todo et al., 2015). According to Foster and Rosenzweig (2010), social learning from neighbours has been the principal determinant of technology adaptation in developing countries. Similarly, farmers directly learn from the agricultural knowledge flow. Anyhow, literature does not always support the positive impact of social learning on agricultural technology adaptation (Duflo et al., 2004; Bandiera & Rasul, 2006). In addition to the information link, the network structure also has impacted knowledge diffusion. Based on Burt (1992) as cited by Todo et al., (2015), "external ties" or "Bridging ties" connect the separate networks together and enhance the information flows among the network while promoting innovation. Similarly, "strong ties", such as ties between individuals who interact frequently or "ties with mutual trust", facilitate a more efficient for flowing information and knowledge within and among social networks than "weak ties" (Todo et al., 2015).

During the past few decades, the role of extension services, technology, and information transfer processes has been eventually evaluated in support of agriculture sector development. However, extension policies and approaches have not footsteps with these transitions of technology transfer approaches (Swanson, 1997). The public extension system more often focuses on the system-based knowledge-intensive and sustainable technologies that the private sector is unable to provide poor and marginalized rural farmers. More sustainable and systems-based technologies such as integrated pest management (IPM), natural resource management (NRM) are "knowledge-intensive technologies". Farmers need

Received 19-11-2022; Accepted 21-12-2022

comparatively higher technical and management skills to adapt to those technologies. In this context, the close and interactive farmer-extension workers' linkages have been considered as the principal need for the information and knowledge flow (Swanson, 1997).

Many developing countries are confronted with the issues of the poor working relationship between national agricultural research and extension organizations, and also with different categories of farmers and farm organizations. By understanding farmers' access and use of agricultural information, their linkages and actor matrix has the capacity to better target farmers (Nain et al., 2017; Panda et al., 2019). This has been one of the most difficult institutional problems when addressing the national-level agricultural issues in Sri Lanka. Recent research studies have extensively analyzed the impact of learning on technology adoption in agriculture technologies. Further, it has been observed that the extension delivery has not been effective enough in many developing countries, especially with regard to the new technological programme and relevant farmer training programmes also coordinated without the proper guidance of the agricultural extension services (Swanson, 1997).

METHODOLOGY

The agricultural extension system in Sri Lanka seems well organized and governed under main two administrative divisions in each District; provincial and interprovincial extension. In this study, the agricultural extension services in the context of Paddy cultivation were analyzed based on the importance of paddy farming in Sri Lanka. The targeted group was Agriculture instructors (AI) or Agriculture Extension officers, who bridge the gap between the research officers and farmers. The study focused on the paddy farming system as a particular agricultural crop and observed two major paddy farming technologies. According to the local agricultural extension agents, two major agricultural technological programmes were selected for data collection: *Yaya* 2 programme and FFS programme for paddy farmers.

The main objective of the research was to explore the social network impact on the agricultural knowledge-transferring process. In addition, the other selective decisive factor of making an information link was analysed. Further, the study focused on the factors that affect effective information networks at the village level. *Hambanthota* District in the Southern province of Sri Lanka was selected purposefully as a study area since this province has immense potential to develop the agriculture sector as it is the largest paddy-producing district in the southern province. AI officers working in provincial and inter-provincial extension systems in the district were purposefully selected for primary data collection. The total sample size was 72 out of 92 of the total AI officers in the district. An interview was scheduled by considering the objectives of the study. Data collection was done through a personal interview method using a semi-structured questionnaire. Data analysis was done using the basic descriptive analytical tool and social network analysis tool using UCINET 19.

RESULTS AND DISCUSSION

Type of information link between farmers - extension officers in a social network

Agricultural technologies transferred through extension officers vary according to the nature of the technologies used by farmers in the area. Following the secondary data review, five major types of technologies identified as the most common types of information shared with the paddy farmers in Sri Lanka. Therefore, those 5 types of information were used in the questionnaire. Any new technological information issued by the department of agriculture will transfer to the farmer through AI officers in the area. In particular, technological information on new varieties, fertilizer application, paddy seed production in the field, etc., is transferred through AI officers in the *Hambathota* Districts. In addition, technological solutions for field-level issues will be given by an AI officer when farmers directly contact the officer regarding their specific field-level issues. Further, information on subsidies and market information is also transferred to farmers via AI officers in the area. Particularly, paddy farmers in Sri Lanka are given fertilizer subsidies for paddy cultivation through the agrarian service centers where AI officers have officially worked in the area. At the beginning of every cultivation season, farmers need to do a few land pre-preparation practices in order to get fertilizer subsidies.

Further, after the paddy harvesting, the paddy purchasing mechanism and market information also will be given to the farmers through AI officers in the area. Another major type of link with farmers by AI officers is to give technical and educational training. Department of Agriculture delivered some technical training and educational programmes for the farmers regarding farming practices, post-harvest technologies, skill and capacity development programme etc. Particularly, two major technological programmes were used to analyze farmer adaptability to the technologies. Based on the above research findings, AI officers mainly visit farmers to assist them with field-level problem issues. Paddy farmers are frequently confronted with different types of pest and disease outbreaks, farming issues, and post-harvest issues during their cultivation season. Therefore, farmers need frequent assistance from AI officers to get solutions for their field-level issues. In addition, farmers get compulsory seasonal training every week from the AI officers. Farmer field school (FFS) from the beginning of the cultivation season to the end of the season is conducting in every week with all farmers in the area. Through this FFS programme, farmers get opportunities to learn new technologies, solve their field-level issues, and share knowledge with other actors in the network.

Knowledge and information network with other stakeholders

The information and knowledge network with other actors of the clusters; farmers, Agriculture research officers (ROs), Village level Agriculture extension officers (KPNS), and other AIs) in other areas were measured. Table 1 shows the different perceptions regarding the knowledge and information network with other actors in the agriculture sector. Seven dimensions were used to analyze the knowledge and information linkages with other actors of the network. After the factor loading of the main seven variables, four variables were significant for the measure of external linkages of the stakeholders. The information linkages with the other actors of the social network were measured using a 0/1 scale. Based on Table 1 almost all the scales used to analyse the knowledge and information link with all stakeholders show slightly skewed (which means closer to or below 1) from their respective means. Therefore,

Table 1. Descriptive measures of data

S.No.	Variables	Mean	Std. Dev.	Skewness
1.	Frequent contact with research officers	-0.100	0.711	-1.081
2.	Participate in knowledge update meetings with research officers at least once a month	-0.300	1.118	0.645
3.	Attend compulsory technical training and awareness programme done by the research station	0.066	1.201	0.375
4.	Always contact ROs to solve field-level issues	0.333	1.028	-0.128
5.	Discuss with other AIs in other regions regarding issues and information	0.333	1.493	-0.419
6.	Always approach farmers via *KPNS**s	0.433	0.773	-0.001
7.	Work collaboratively with *KPNS*s in the knowledge/information-sharing process	0.800	0.610	0.117

RO-Research officers, *KPNS- a local name used for village-level extension officers

it concludes that the scale used to analyze information linked by the network was normally distributed. AI officer in *Hambanthota* districts had regular attendance and meeting at the district's research station for the technical training and awareness programme. Therefore, AI officers in the district were updated with their knowledge and information, thus updated information will be shared with the field-level farmers. Further, the communication link with the Research officers (RO) shows a significant role to solve field-level issues. Moreover, the knowledge link with other AIs was also significant. In addition, AI officers more frequently approach farmers through the village-level officers named as *Krushi paryeshana niladhari sahayaka (KPNS).*

A social network was drawn using the information link of AI officers with other actors in the agriculture sector. Research officers, the other AIs of the districts, the village-level agriculture officers (AOs), and ten contact farmers were selected to construct a social network for each administrative division of the districts: Provincial agricultural extension officers and Interprovincial agricultural extension officers. Following figures 01 and 02 show the social network for each provincial and interprovincial actor of the agriculture information system. Figure 1 shows the overall network of the AIs with the contact farmers, research officers, and other actors.

Table 2 summarized graph theoretical analysis of the network structure; 'In-degree', 'out-degree' and 'Betweenness'. They were scaled to range from a minimum of zero to a maximum of 100 (Wasserman and Faust, 1994). Further, the graph which has a high number of connected firms implied the generally well-established linkages among actors of the network. The "In-degree" measure the extent to which one or two members were dominating a network by influencing others. A "low value" indicated the "decentralized" network, implying that actors in a network were relatively equal in their influence; each actor was influencing a similar number of others. A "high value" indicated the centralized network implying that one or two individuals dominated the network and were influencing most actors in the network

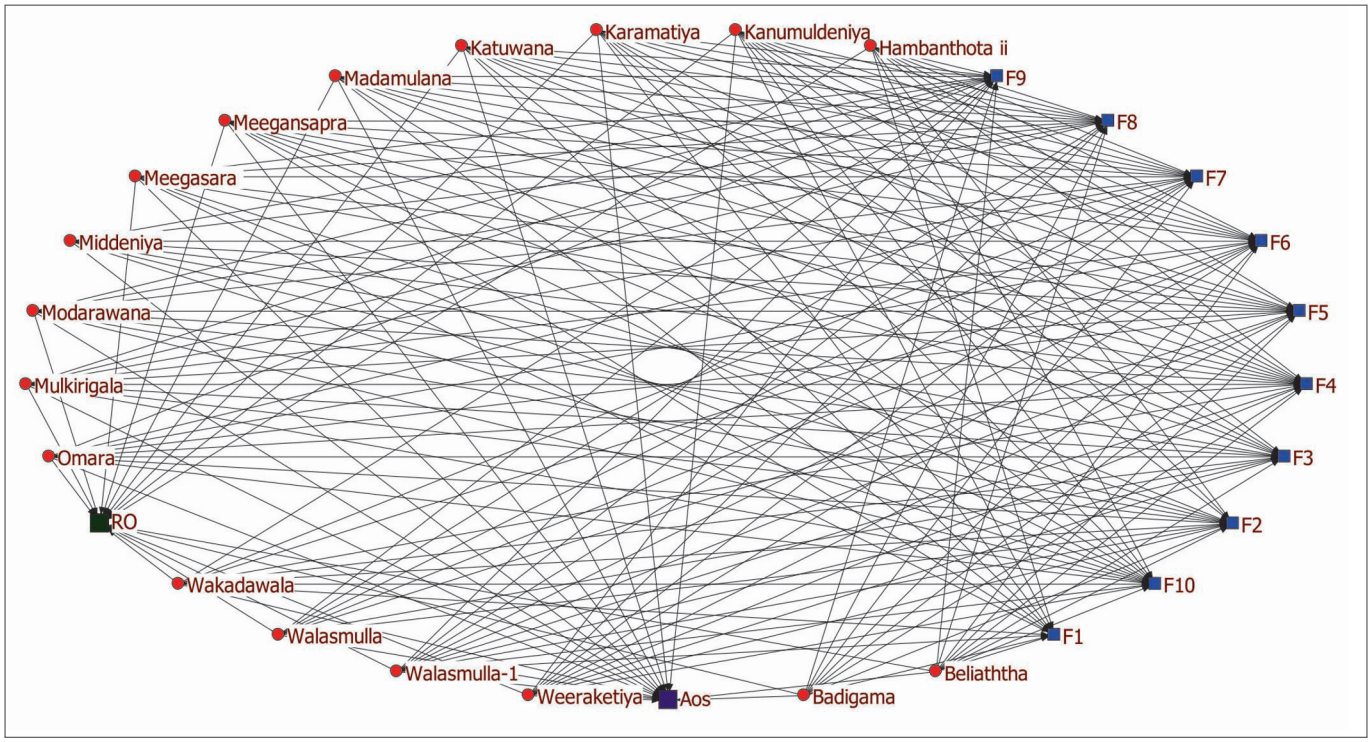

Figure 1. Interprovincial overall link with Research officers (ROs), Agriculture assistant Officers at the village level (AOs), and selected farmers. (Output of Ucinet software)

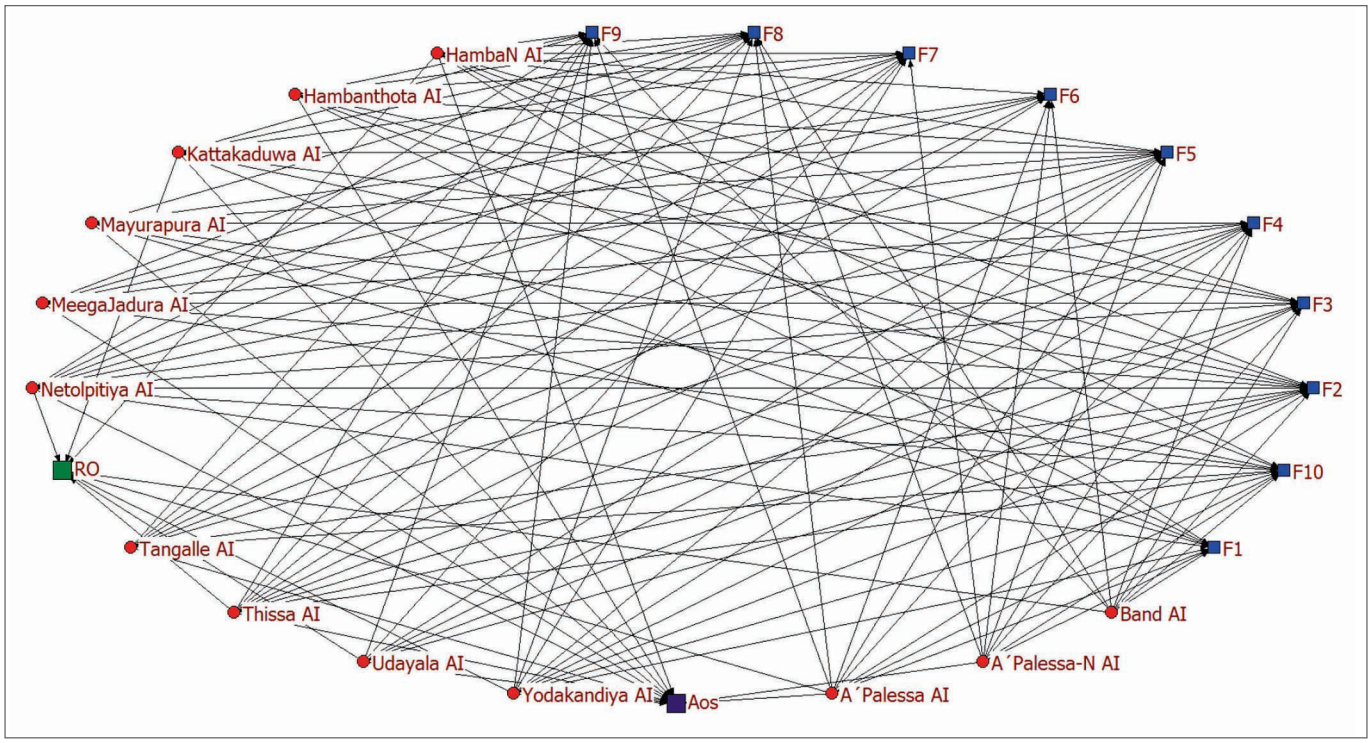

Figure 2. Provincial overall link with Research officers (ROs), Agriculture Officers (AOs), and selected farmers (Output of Ucinet software)

Table 2. Properties of provincial and interprovincial network

	Provincial	Interprovincial
Density	0.846	0.882
No of ties	132.000	240.000
Average degree	10.154	14.148
Average Distance	1.000	1.100
Out-degree centrality	0.167	0.125
In-degree centrality	0.167	0.0586
Betweenness	1.0864	1.882

(Wasserman & Faust, 1994). The "centralization", is the "out-degree" measure which reflected the extent to which a number of members of a network were being influenced by others in the network. "Betweenness centrality" is an indicator of a node's centrality in a network. "Network density" measured the number of interactions between people in a network people as a percentage of the maximum possible number of interactions (Wasserman & Faust, 1994). The higher the percentage the denser the network, and the more the actors in the network were interacting with each other. The average distance was calculated to reach every actor in the network.

In connection with the social network analysis, the two networks were constructed based on their administrative division; provincial and interprovincial networks. These networks were analyzed using their structural properties such as density, average distance, centrality measures; in-degree, out-degree, and betweenness measures. Both networks show well-connected connectivity and in-degree measures show a low value which indicates the decentralized network. All the actors in both networks are relatively equal in their influence and each actor is influencing a similar number of others. Out-degree measures in both networks also show low value, showing that each network actor tends to influence different network actors. This is also supported by the fact that actors of agricultural knowledge networks act and show influence in a similar manner to each other.

Factors affect to select contact farmers to transfer knowledge and information

In general, the contact farmers are selected by an AI officer in the area to use as the key actors of the social network. Therefore, AI officers are thoroughly concerned with the socio-economic and other certain factors when they select a contact farmer to share knowledge at the community level. Thus, the study focused on the analysis of the factors which, affect the selection of the contact farmer in each GN division. Table 3 shows the significant aspects of the selected variables extracted from the principal component analysis.

Constraints and issues of AIs affect the social network

Furthermore, this study focus on analyzing the constraints and issues associated with constructing social network by AI officers at the community level. In particular, AIs have some field-level and administrative constraints in the knowledge dissemination process. Therefore, the study focused to ascertain these issues and constraints of the AIs based on their perspectives. The descriptive analysis is shown in Table 4.

In connection to the barriers to reaching farmers, the coverage area of each AI officer is a vital factor to disseminate particular information/technology. Therefore, the study shows that each AI officer has his own covering area called Gram Niladhari division

Table 3. Descriptive measures of the data

S.No.	Particulars	Mean	Std. Dev.	Skewness
1	Be a member of a farmer's organization	-0.266	1.574	0.246
2	Consider his educational level	-0.400	1.220	0.238
3	Innovative farmer /wise farmer of the area	0.366	1.351	-0.639
4	Most famous farmers among others	0.100	1.422	-0.341
5	Easiest person to access	-1.23	1.165	1.049
6	The farmer who has a good relationship with us	0.700	1.149	-1.258
7	The farmer who frequently visits us	0.200	1.095	-0.593
8	Select any farmer at the time of giving information	-0.400	1.275	0.614

Table 4. Descriptive statistics of the constraining factors

S.No.	Particulars	Mean	Std. Dev.	Skewness
1	Cover Too Large covering area	0.600	1.101	-0.106
2	Lack of infrastructure facilities to reach farmers	0.066	1.014	-0.352
3	Weak knowledge update and technical training	0.066	1.080	0.562
4	Hierarchical barriers to reaching ROs & other officers	0.100	1.268	-0.199
5	Too much administrative work	0.500	0.820	0.000
6	Poor comm. network with farmer / far. organization	0.000	1.082	-0.174
7	Lack of social recognition for the work	0.033	1.188	-0.332

and it started from the Agrarian centre of each AI division. Each AI officer has an average minimum of 5km to an average maximum of 26 km to cover under their supervision and this is a practical issue for many AI officers as they use public transport services to approach them. In particular, many of the rural areas in Sri Lanka do not have sufficient public transport facilities. Further, each AI officer has to cover average 12 GN divisions under their supervision. According to the AI officers' point of view, they do not get sufficient facilities to cover all the GN divisions. The major constraints were discussed during the interview with the AI officers, particularly, the new technological flow affected by the ineffective hierarchical order of the agricultural sector in Sri Lanka. Particularly, the technological flow from research officers to AI officers was not strong enough to make a strong information link. Moreover, the project and programme which was introduced by the department of agriculture with the assistance of the research station did not appropriate for field-level or farmer needs. Therefore, AI officers confront the different problems of transferring those technologies to farmers. In some cases, the level of acceptance by farmers to the new programme reduces in many orthodox farming practices. The traditional farming system limited the adoption of the new technologies and in many instances; there was not any mechanism to identify real farm needs before introducing new technologies. These barriers make inconsistencies in the knowledge network in Sri Lanka. Further, the use of media by the farming community was very limited and this had negatively impacted the effective use of social media to disseminate knowledge to rural farmers.

CONCLUSION

Agriculture instructors play a vital role in transferring new technology to the farmers and are sufficiently qualified for transferring knowledge and connecting actors of the social network. Moreover, all the actors in both networks are relatively equal in their influence and each actor is influencing a similar number of others. The contact farmers approach was successfully used in Sri Lanka for the paddy development projects funded by the government. Anyhow, many of the important selection criteria such as membership of the farmer organization, experience, education level, and popularity of farmers also have not been given priority in the selection of contact farmers. Among the barriers and constraints of AI officers in the process of effective knowledge and information transfer process, basic infrastructure facilities, the prevailing administrative system and the Hierarchical system of the extension system have limited effective communication among network actors.

REFERENCES

Agbamu, J. U. (2002). Agricultural research-extension farmer linkages in Japan: Policy issues for sustainable agricultural development in developing countries. *International Journal of Social and Policy Issues, 1*, 252-263.

Anand, S., Prakash, S., & Singh, A. K. (2022). Determinants of ICT tools accessibility by farmers in Bihar. *Indian Journal of Extension Education*, *58*(3), 186–189. Retrieved from https://epubs.icar.org.in/index.php/IJEE/article/view/125201

Bandiera, O., & Rasul, I. (2006). Social networks and technology adoption in northern Mozambique. *The Economic Journal*, *116*(514), 869-902.

Biam, K. P., Devi, L. S., Khate, K., Singh, N. U., Paul, P., & Gowda, C. (2022). Information sources, their utilization pattern vis-à-vis Mithun (Bos frontalis) husbandry in Arunachal Pradesh. *Indian Journal of Extension Education*, *58*(3), 14–17. Retrieved from https://epubs.icar.org.in/index.php/IJEE/article/view/125072.

Burt, R. S. (1992). Structural holes: The social structure of competition. Cambridge, MA: Harvard University Press.

Duflo, E., Kremer, M., & Robinson, J. (2004). Understanding technology adoption: Fertilizer in Western Kenya, preliminary results from field experiments. Unpublished manuscript,

Massachusetts Institute of Technology, available at http://sticerd.lse.ac.uk/dps/bpde2004/duflopaper.pdf

Foster, A. D., & Rosenzweig, M. R. (2010). Microeconomics of technology adoption. *Annual Review of Economics*, *2*, 395-424.

Nain, M. S., Singh, R., Mishra, J. R., & Sharma, J. P. (2015). Utilization and linkage with agricultural information sources: a study of Palwal district of Haryana state. *Journal of Community Mobilization and Sustainable Development, 10*(2),152-156.

Panda, S., Modak, S., Devi, Y. L., Das, L., Pal, P. K., & Nain, M. S. (2019). Access and usage of Information and Communication Technology (ICT) to accelerate farmers' income. *Journal of Community Mobilization and Sustainable Development, 14*(1), 200-205.

Sharma, K., Dhaliwal, N. S., Singh, G., & Bishnoi, C. (2020). Assessment of socio-digital approaches for agricultural extension in Shri Muktsar Sahib district of Punjab. *Indian Journal of Extension Education, 56*(3), 60–63. Retrieved from https://epubs.icar.org.in/index.php/IJEE/article/view/106975

Silva, K. N. (2022). Access to and use of agricultural information and technology in a sample of paddy farmers in the Hambantota district of Sri Lanka: a survey. *Sri Lanka Journal of Social Sciences*, *45*(1), 33-44.

Silva, K. N. N. (2020). *The roles of absorptive capacity, technology adoption, and extension services in a local agricultural innovation system in Sri Lanka* (Doctoral dissertation, Hannover: Institutionelles Repositorium der Leibniz Universität Hannover).

Swanson, B. E. (1997). Strengthening research extension farmer linkages, *In:* Swanson, B. E., Bentz, R. P., & Sofranko, A. J. (eds.), Improving Agricultural Extension. A Reference Manual (2nd ed.), pp. 89-107.

Todo, Y., Matous, P., & Mojo, D. (2014). Effects of social network structure on the diffusion and adoption of agricultural technology: Evidence from rural Ethiopia. *Available at SSRN 2447208*.

Ville, A. S. (2013), *Networks of Smallholder Farmer Knowledge Networks to Enhance Innovation and Food Security Policy in the Caribbean Community*, Policy Brief, Institute for the study of international Development, Canadian International Development Agency

Wasserman, S., & Faust, K. (1994), *Social network analysis: Methods and applications*. New York: Cambridge University Press.