Innovation networking within Producer Groups (PGs): The case of two PGs in Ierapetra, Crete.

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Abstract

The current paper aims at exploring innovation networking practices among the members of two Producer Groups (PGs) in Ierapetra area, Crete. Results show that the first PG's members are better incorporated in the PG's innovation network(s) as well as that its leaders are conceived of as innovators. On the contrary, the innovation network of the second PG is highly fragmented and dependent on the leaders of the first PG. These results have implications in terms of the PGs' innovation capacity as well as of extension work, especially with a view to current developments in both Greece and the EU.

Key words*: Producer Groups, networks, social networks analysis, innovation, Greece.*

Introduction

Under the dominant globalization conditions within which the agrifood system currently operates the only way for farmers to exert some influence is through their organisation. Producer groups (PGs) play a crucial role in the management and development of the rural space and constitute a major tool for the incorporation of small farmers in the agrifood chain (El Dahr 2012). Producer groups can play a major role in and/or initiate development processes (World Bank 2007) though the undertaking of collective actions addressing poverty alleviation, the sustainable utilization of natural resources, rural development and competitiveness, etc. (Bosc et al. 2002).

PGs are social networks. Networks, in general, have attracted increased interest from quite a number of disciplines (see, Provan et al. 2007). According to Dredge (2006) networks are sets of formal and informal relationships between (heterogeneous) actors that shape collaborative action. Network theory, in short, implies that actors are not isolated but connected to others, i.e. that there is some 'connectedness' between actors which may both facilitate and constrain their actions. Particularly the term social network concerns a social structure which comprises nodes representing actors and their interconnections (see, inter alia, Christakis and Fowler 2009). Chtouris (2004) maintains that networks refer to multidimensional systems of human communication shaping practices and identities. Hill (2002) underlines that networks are characterised by systematic cooperation, on a non-hierarchical basis, around common topics or problems, with cooperation being founded on trust and commitment.

A social network thus concerns a populace of actors (individuals and/or organizations) who act, intervene, exchange and take decisions. In this sense, such groupings provide the appropriate framework (interactive structure) which allows for the definition and redefinition of their members' interpretative frameworks and supports the process of structuring and empowering their identity, and maybe of political conscience (Passy 2003). The actors assimilate the multiple interactions, elaborate them, give meaning and finally shape their perceptions and preferences (Watts 2003); it follows that the actors' individual decisions and actions are shaped, at least partially, by the interactions between the actors/network members and, in turn, may lead in the undertaking of collective action (Oliver and Myers 2003).

In general, networks are not limited to (tangible) resources' coordination and actors' collaboration; they evolve to (collective) learning processes and open wider 'windows of opportunity' for the generation of innovations (Dredge 2006; Zach 2012). Research in the rural space has shown the importance of networks for communication and information seeking (Chiffoleau 2005; Isaac et al. 2007); particularly as far as PGs are concerned, Blokland and Gouët (2007) have shown that they are an effective communication tool owing to their extended social networks and the multiple linkages of their membership with other actors and/or collectivities at various levels. Additionally, Matuschke (2008) has argued for the importance of social networks in farmers' learning, especially through peer-to-peer communication processes. According to Darre (1996), farmers define the local norms on specific matters and the alternatives deemed possible through discussion networks (for dialogue networks see, Darr and Pretzsch 2008; Van der Broeck and Dercon 2011). Networks are spaces where information is negotiated and actors attempt to enroll others in innovations and spaces where (new) knowledge/innovation is co-produced (Leeuwis and van de Ban 2004). Finally, the use of social network analysis has been shown to allow for the identification of (opportunities for) cooperation within PGs (Faysse et al. 2012).

The role of networks has been indeed underlined in innovation literature (Rogers 1995). Especially, the new, systemic approaches to innovation co-generation, dissemination and use (Agricultural (Knowledge and) Innovation Systems – A(K)IS) stress the importance of networks, as social processes encouraging the sharing of knowledge and preconditions for innovation, with particular attention given to (social) co-ordination and (process) 'facilitators/ brokers' (see, Cristóvão et al 2012; Klerkx et al. 2012; Koutsouris 2014). In general, networking, knowledge co-creation and collaboration are becoming increasingly popular across EU Member-States as means to stimulate innovation. The European Innovation Partnership, (EIP) has a become a focal point of EU innovation policy under the "Europe 2020" strategy that focusses on partnerships and 'bottom up initiatives' in "Operational Groups" (comprising of a wide variety of actors such as farmers, researchers, extensionists, businesses, etc.) that will be connected to it (EU-SCAR 2012, 2014).

Given the dearth of relevant research as well as the outstanding role of innovation, on the one hand, as a transversal theme, in the new CAP (2014-2020; R. 1305/2013) and, on the other hand, in the overcoming of the current crisis of the Greek economy, the current piece of work aims at exploring the innovation networks within two Greek PGs in the Ierapetra area, Lasithi Prefecture, Crete. The exploration of innovation networks within organised groups, such as PGs, can provide evidence on the capability of farmers in engaging in innovation transfer (and adoption) and/or co-production, thus to point to measures deemed necessary in enhancing innovation networks, especially as far as extension intervention is concerned.

Methodology

Field research on a number of (networking) topics in two PGs in the Ierapetra area, Lasithi Prefecture, Crete was carried out in 2013. Both PGs are occupied in horticulture, were officially recognized in 2010, carry out business plans and implement Integrated Farming (IF). Research was carried out through questionnaire-based interviews with the PGs' membership; the first PG has 26 and the second one 21 members. Specifically as far as the topic dealt with in this paper is concerned, farmers were asked to name farmers with whom they discussed innovations which had not yet been adopted by the PG's membership; in the same way, hydroponics and new hybrids were identified by the farmers of both PGs as the most important innovations at the time of the research.

Given the focus of the present paper on networks, Social Network Analysis (SNA) was employed. SNA is a set of methods specifically geared towards the exploration of the structure of connections of the actors i.e. of the relational aspects of structures (Scott and Carrington 2011). Research results are thus illustrated through graphs comprising a number of nodes (dots or vertices) connected by ties, i.e. joined by links, taking the form of either (undirected) lines or arrows in the case they show a certain direction (Martino and Spoto 2006). Additionally, node metrics (centrality measures) were used allowing for the exploration of social influence and power within networks (Borgatti et al. 2008).

Centrality is a measure showing a node's/ actor's structural importance; it is a composite indicator comprising four partial indicators: degree, betweenness, closeness and eigenvector. Degree centrality shows how well connected a node is and the direct influence of a node on what is flowing through the network. The higher a node's value the more distinguished the node is. Closeness centrality shows the extent to which a node is close (or far) from all other nodes and represents the expected time (how long) until arrival for given node of whatever is flowing in the network. Nodes closer to all others (i.e. scoring low) are important as they communicate easier and quicker with them. Betweenness centrality, showing how often a node lies along the shortest path between two other nodes, is an index of potential gatekeeping, brokering, controlling the flow as well as of liaising otherwise separate parts of the network. A node has a high score when it controls the flow of information between other nodes. Finally, eigenvector centrality measures the number and quality of ties and is an indicator of popularity and power; a node has a high score if connected to many nodes that are themselves well connected.

SPSS v. 17.0 was used for the data analysis and NetDraw v. 2.127 for the network analysis (see Borgatti 2002; Borgatti et al. 2008; Clark 2006).

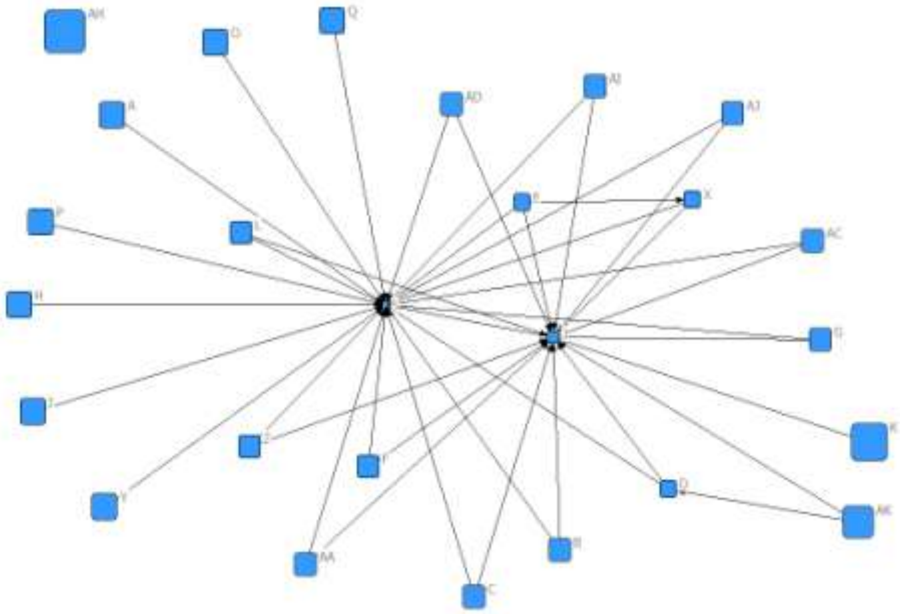
Results

In this section selective sociograms concerning innovativeness in the two target-PGs are presented.

First PG (PG A)

The innovation network of the PG A comprises 26 actors, all members of the PG.

Degree centrality reveals that two nodes (persons) hold distinguished positions in the innovation network (in terms of connectedness and influence) and, thus, can be considered as innovators. The first one (S) is the vice-president of the PG (degree centrality: 22) and the second one (J) is the PG's president (degree centrality: 17). The rest of the PG's members have low scores (max. 3) and quite some only pointed to others as innovators without been pointed by others. One producer (AH) is isolated (degree centrality: 0); s/he was neither considered as innovator nor pointed to someone else as being an innovator.

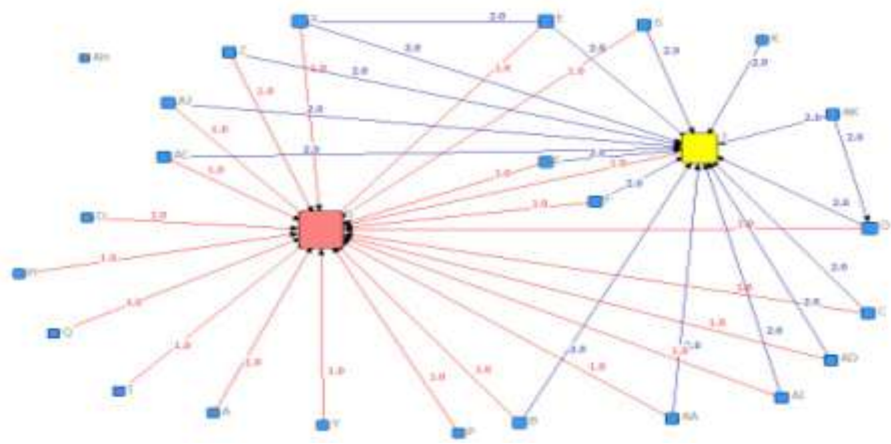


***Sociogram A1**: Closeness centrality (PG A)*

Sociogram A1 shows that the most important nodes of the network, i.e. those with the lowest distance, implying in turn the easiness and (high) speed of communication, are S (closeness centrality: 80) and J (closeness centrality: 85). The rest of the nodes show closeness centrality between 80 and 108 while node AH has the maximum value (702) and is isolated.

As far as betwenness centrality is concerned it shows similar results with closeness centrality: the nodes S (betweenness: 185) and J (betweenness: 85) are the gatekeepers and brokers of innovations and thus control the flow of relevant information, including mediation between otherwise separate nodes of the network. All others but D (betweenness: 4) score 0 and do not exert any control. Additionally, the exploration of the quality of ties shows that S (eigenvector: 0.544) and J (eigenvector: 0.487) display the best results with all others scoring between 0.193 and 0 (AH); therefore S and J are the most popular nodes of the network.

Furthermore, the topics of innovations according to the PG members are: hydroponics (red arrows; 1.0) and new hybrids (black arrows; 2.0). As shown in sociogram A2, farmers communicate with S for the first topic and with J for the second one; very few



Sociogram A2: *Topic of communication with innovators (PG A)*

other connections (AK with D; E with X) are observed. Eight nodes are relatively isolated as they only communicate with only one other farmer; additionally, one farmer (AH) is entirely isolated. Node S, the PG's vice-president, has already implemented hydroponics; additionally for the same topic J communicates with S.

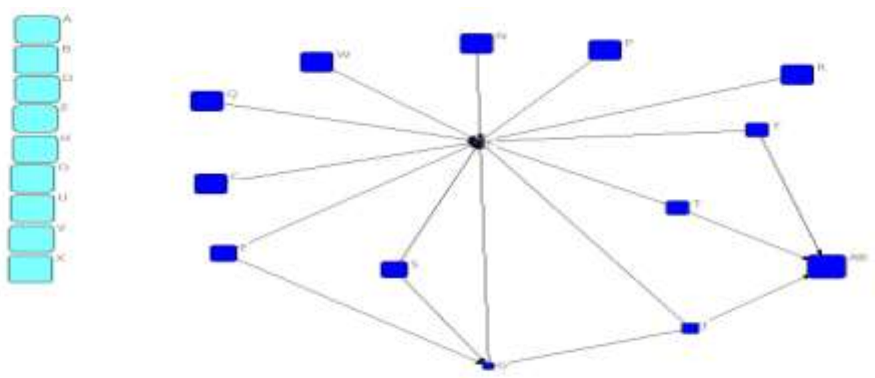
Further analysis shows that the PG's president communicates with the PG's technical advisor (agronomist) for new hybrids as well as with 3 agronomists for information on certification, marketing and programmes to finance the PG's activities, respectively.

Second PG (PG B)

The innovation network of PG B comprises 23 members out of which 21 are members of the concerned PG (PG B) plus 2 members of PG A.

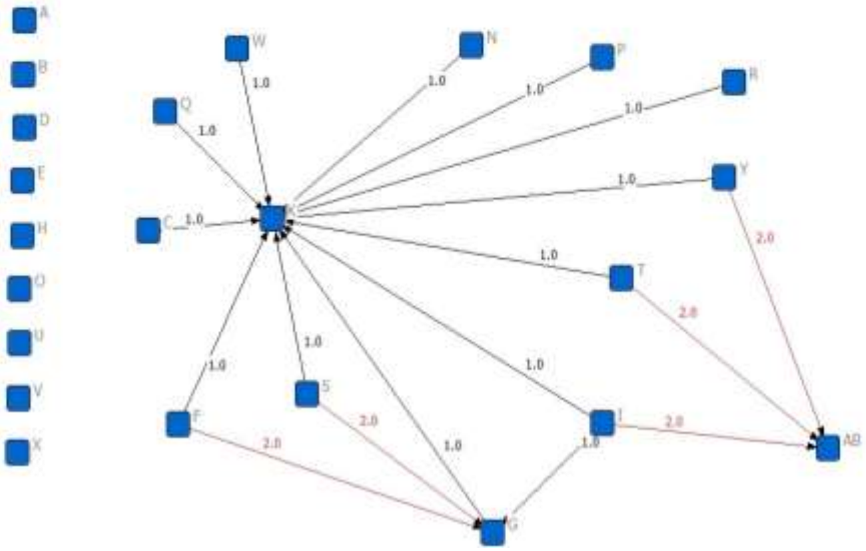
Degree centrality reveals that one node (K) is distinguished (in terms of connectedness and influence) within the second PG's (PG B) innovation network. K (degree centrality: 12) is the vice-president of PG A, followed in importance by the node/actor G (degree centrality: 4), a member of the PG under examination (PG B). The rest of the nodes score 3 (I and AB) or less, with nine nodes scoring 0.

Sociogram B1 shows that the most important nodes of the network, i.e. those with the lowest distance, implying in turn the easiness and (high) speed of communication, are K (closeness: 254) and G (closeness: 262). The rest of the nodes score between 254



***Sociogram B1**: Closeness Centrality (PG B)* and 271, with the aforementioned nine nodes (A, B, D, E, H, O, U, V and X) being entirely isolated (closeness: 552).

As far as betwenness centrality is concerned the results are similar to those of closeness centrality. K (betwenness centrality: 67.5) is the sole gatekeeper and broker of innovations and thus controls the flow of relevant information, including mediation between otherwise separate nodes of the network. All other actors score at most 4.33 (node I), with G scoring 2 and the aforementioned nine actors being again isolated. Additionally, the exploration of the quality of ties shows that K (eigenvector: 0.631), G (eigenvector: 0.358) as well as I (the PG's vice-president; eigenvector: 0.293) display the best scores as far as the quality of their ties is concerned; therefore they are the most popular nodes of the network. All other nodes score between 0.173 and 0 (the latter concerning once more the nine isolated actors).



***Sociogram B2**: Topic of communication with innovators (PG B)*

The topics of innovation within the second PG are hydroponics (1.0) and new hybrids (2.0). As shown in sociogram B2 the members of the network communicate with K and G on hydroponics (black arrows; 1.0) and with AB, the president of PG A, on new hybrids (red arrows; 2.0). K (the vice-president of PG A) and G (member of PG B) use hydroponics in their greenhouses; G is in contact with K for hydroponics (but not with AB for hybrids). Six nodes are relatively isolated as they only communicate with one other farmer while the nine farmers, earlier identified, remain entirely isolated.

Further analysis reveals that the PG's vice-president (I) is important for the PG's membership in providing them with information on marketing and programmes to finance the PG's activities and one member (G) for information concerning irrigation and hybrids. Additionally, the PG's vice-president communicates with 3 agronomists for information on certification, irrigation, hybrids and programmes as well as with the president of PG A for new hybrids and programmes. The president's (Y) role is again marginal.

Conclusions

The analysis of the innovation network in the first PG (PG A) shows that two of its members are of major importance: its vice-president (S) and president (J) respectively. Only one farmer (AH) appears to be isolated. The PG's members identify the vice-president as an innovator on hydroponics and thus communicate with him, including the PG's president (J). It should be noted that the PG's vice-president (S) is the only one who implements hydroponics within PG A. Additionally, the PG's members identify their president (J) as an innovator on new hybrids. In sum, the vice-president (S) and the president (J) are the dominant nodes within the PG's (PG A) innovation network; in parallel, most of the PG's members are incorporated in the network(s).

In the innovation network of the second PG (PG B) the major actors are chiefly the vice-president of PG A (K) and secondly a member of PG B (G). The PG's members communicate with the aforementioned two actors (K and G) on hydroponics, given that they are the only ones who use hydroponics in their farms. Furthermore, the PG's (PG B) members communicate with the president of PG A (AB) on new hybrids. The president and vice-president of PG B (Y and I, respectively) play a minor role within the innovation network of their PG; the vice-president appears to be quite popular within the PG, albeit mostly as far as information provision not strongly related to the innovations pointed to by the PG's membership is concerned. Moreover, nine of the PG's members are isolated, with another six members not fully incorporated in the PG's innovation network(s).

Therefore, the second PG's (PG B) innovation network(s) appears to be 'weaker' as compared to the first one (PG A). According to our field research this owes to the quite large number of its members who are isolated and the highly fragmented network(s), the lack of innovators and the 'dependence' upon the president and the vise-president of PG A, the minor role played by its own president and, to a lesser degree, the vice-president in the innovation network(s) as well as the lack of technical advisor (contracted agronomist).

These results are important in terms of extension intervention/ innovation communication. In this respect, it is shown that, although farmers' groups/ organisations can support innovations as a space of exchange to disseminate know-how, the formation of innovation networks depends on the innovation under consideration (for example, hydroponics and/or new hybrids). Such diverse networks leading to peer-to-peer learning and potentially to innovation adoption should be thus taken into account when designing activities supporting learning and innovation dissemination. Furthermore, although it is common in extension work to involve actors who are sought after for advice it should be pointed out that, as shown in the cases examined here, the latter do not necessarily concern the organization's (PG's) leadership; instead, they may be farmers located in other organisations/ networks and/or areas, advisors/agronomists (either formally contracted or free lancers), etc.

In this respect, network analysis allows for the identification of the central nodes and ensembles operating within a group/ organisation which facilitate the dissemination of innovations. On the other hand, it allows for the identification of the stumbling blocks, including isolated actors or fragments (which rescind the notion and the existence of a network), and thus for the undertaking of efforts towards the (re)establishment of cooperation/ networking between the members as well as farmers' capacity-building.

Finally, with respect to the guidelines of the new CAP (2014-2020) stressing the importance of the generation, dissemination and use of innovations through operational groups, and the need for innovatory actions to support the country's exodus from the current crisis, the current piece of work raises a number of questions. These concern the capacity of, more or less, formal collectivities, let alone individual farmers who do not participate in any collective scheme, on the one hand, to engage in peer-to-peer learning and uptake innovations and, on the other hand, to become actively involved in innovation co-creation, unless an extern actor (extensionist/ advisor in the role of facilitator/ broker) undertakes their coordination and support. This, in turn, raises the crucial question of whether extensionists/ agronomists have the skills to undertake (or, instead, training opportunities to learn) new roles (group facilitation; innovation brokerage; farmers' capacity-building), that is, to act beyond the transfer of technology and know-how to farmers - denoting the 'business as usual' motto (see, Koutsouris 2014).

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References

Blokland, K. & Gouet, C. (2007). The Farmers' Organisation: Route to Economic Development. In Ton, G., Bijman, J. and Oorthuizen, J. (eds.), *Producer Organizations and Market Chains: Facilitating Trajectories of Change in Developing Countries* (pp. 235-249). Wageningen: Wageningen Academic Publishers.

Borgatti, S. P. (2002). *NetDraw Software for Network Visualization*. Lexington: Analytic Technologies.

Borgatti, S.P., Halgin, D. & De Jordy, R. (2008): *An Introduction to UCINET and NetDraw*. NIPS UCINET & NetDraw Workshop, MA: Harvard University.

Bosc, P.M., Eychenne, D., Hussein, K., Losch,, B., Mercoiret M.R., Rondot, P. & Mackintosh-Walker, S. (2002). *Reaching the Rural Poor: The Role of Rural Producers Organisations (RPOs) in the World Bank Rural Development Strategy.* Rural Development Strategy Background Paper 8, Washington D.C.: World Bank.

Chiffoleau, Y. (2005). Learning about Innovation through Networks: The Development of Environment-friendly Viticulture, *Technovation* 25: 1193-1204.

Chisholm, R. F. (1998). *Developing Network Organizations: Learning from Practice and Theory*. New York: Addison Wesley.

Christakis, N. & Fowler, J. (2009): *The Surprising Power of Our Social Networks and How they Shape Our Lives.* New York: Little, Brown and Company.

Chtouris, S. (2004). *Rational symbolic networks*. Athens: Nisos Eds.

Clark L. (2006). *Network Mapping as a Diagnostic Tool.* Centro Internacional de Agricultura Tropical/ CIAT (English translation), La Paz, Bolivia.

Cristóvão, A., Koutsouris, A. & Kügler, M. (2012). Extension Systems and Change Facilitation for Agricultural and Rural Development. In Darnhofer, I., Gibbon, D. and Dedieu, B. (eds.) *Farming Systems Research into the 21st Century: The New Dynamic* (pp. 201-227). Dordrecht: Springer Science.

Darr, D. & Pretzsch, J. (2008). Mechanism of Innovation Diffusion Under Information Abundance and Information Scarcity. The Contribution of Social Networks in Group vs. Individual Extension Approaches in Semiarid Kenya, *The Journal of Agriculture Education and Extension* 14: 231-248

Darre, J. P. (1996). *L' Invention Des Pratiques Dans l' Agriculture. Vulgarisation et Production Locale de Connaissance.* Paris: Karthala.

Dredge, D. (2006). Policy networks and the local organisation of tourism. *Tourism Management*, 27(5), 269-280.

El Dahr, H. (2012). Producers' organisations and food supply. In CIHEAM (eds.) MediTERRA 2012: *The Mediterranean diet for sustainable regional development* (pp. 247-263.) Paris: Presses de Sciences Po.

EU-SCAR (2014). *Agricultural knowledge and innovation systems towards 2020*. Brussels: Standing Committee on Agricultural Research (SCAR) - Collaborative Working Group AKIS-2.

EU-SCAR (2012). *Agricultural Knowledge and Innovation Systems in Transition - a reflection paper*. Brussels: Standing Committee on Agricultural Research (SCAR) - Collaborative Working Group AKIS.

Faysse, N., Taher Srairi, M. and Errahj. M. (2012). Local Farmers' Organisations: A Space for Peer-to-Peer Learning? The Case of Milk Collection Cooperatives in Morocco, *The Journal of Agricultural Education and Extension* 18: 285-299.

Hill, C. (2002). *Network Literature Review: Conceptualizing and Evaluating Networks.* Calgary: Southern Alberta Child & Youth Health Network, TriAd Research Inc.

Isaac, M.E., Erickson, B.H., Quashie-Sam, S. & Timmer, V.R. (2007). Transfer of knowledge on Agroforestry Management Practices: The Structure of Farmer Advice Networks, *Ecology and Society* 12: 1-13.

Klerkx, L., Van Mierlo, B. & Leeuwis, C. (2012). Evolution of system approaches to agricultural innovations: concepts, analysis and interventions. In Darnhofer, I., Gibbon, D. and Dedieu, B. (eds.) *Farming Systems Research into the 21st Century: The New Dynamic* (pp. 457-483). Dordrecht: Springer Science.

Koutsouris, A. (2014). Exploring the emerging intermediation roles (facilitation and brokerage) in agricultural extension education, *International Journal of Agricultural Extension*, Special Issue: International Conference - Emerging Horizons of Agricultural Extension for Sustainable Rural Development, February 2014: 21-37.

Leeuwis, C. & Van de Ban, A. (2004). *Communication for Rural Innovation. Rethinking Agricultural extension*. Oxford: Blackwell Science.

Martino, F. & Spoto, A. (2006). Social network analysis; A brief theoretical review and further perspectives in the study of Information technology, *Psychology Journal* 4: 53-86.

Matuschke, I. (2008). *Evaluating the Impact of Social Networks in Rural Development Systems: An Overview*. Washington D.C.: International Food Policy Research Institute.

Oliver, P. & Myers, J. (2003). *Networks, Diffusion, and Cycles of Collective Action*. Oxford: Oxford University Press.

Passy, F. (2003). Social Networks Matter. But How? In Diani, M. and McAdam, D. (eds.) *Social Movements and Networks. Relations approaches to Collective actions*. Oxford: Oxford University Press.

Provan, K. G., Fish, A. & Sydow, J. (2007). Interorganizational Networks at the Network Level: A Review of the Empirical Literature on Whole Networks, *Journal of Management* 33: 497-516.

Rogers, E. M. (1995). *Diffusion of innovations.* New York: Free Press.

Scott, J & Carrington, P. C. (eds) (2011) *Handbook of social network analysis*. London: Sage.

Van Der Broeck, K. & Dercon, S. (2011*).* Information Flows and Social Externalities in a Tanzanian Banana Growing Village, *Journal of Development Studies* 47: 231-252.

Watts, D. J. (2003). *Six degrees: The science of a connected age.* New York: WW Norton & Company Inc.

World Bank (2007) World Development Report 2008: *Agriculture for Development.* Washington D.C.: World Bank.

Zach, F. (2012). Partners and Innovation in American Destination Marketing Organizations. *Journal of Travel Research*, 51(4), 412– 425.