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Transition pathways in participatory plant breeding programs: a farm-level network analysis

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Abstract – According to the literature on regime transition, niches are sources of innovation that may lead to the transformation of the dominant regime, if processes at other level of the system – the landscape and the mainstream regime - are supportive. A focus on actors involved in the transition process and the analysis of their specific role in knowledge networks can help assessing the robustness of a specific niche and its growth potential. Knowledge systems, and in particular the dynamics of local and expert knowledge, have in fact a key role in innovation models. Different trajectories characterize the transition process, leading to different results: from co-optation and gain in efficiency of the mainstream regime to its radical transformation. Our assumption is that leading actors in the farms' knowledge networks will influence a specific transition trajectory, shaping its direction and transformative potential.
Keywords – Actor network theory, Innovation, Ego networks, Transition trajectories.

INTRODUCTION

The capacity of an individual firm to develop innovation is strictly linked to its participation to local, national and international networks at institutional or civil society levels. At the same time the significance of social movements action is linked to the capacity to be root-based and to have a continuous strong dialectics with local networks and key stakeholders. The actor network theory developed in the 80s by Callon and Latour claims that power relations in society shape local context and local power relations determine the context. The potential to contribute in the process of scaling up from niche to regime of individual actors and practices can be related to the network of relationships in which individual actors are embedded. When considering scaling up, though, the growth in size of the network is not sufficient. The continuous tension and dialogue between networks of individual actors of niches and regimes define the way the translation from niche to regime can be developed. The visualization of an actor through the network of his relationships can contribute to understand the actor position in its trajectory from niche to regime. In addition the analysis of the role of different actors in the individual actor network can give information about the possibility to develop a learning process allowing to transform the regime. This work examines how the structure of the relational network influences the trajectory of individual farmers. It integrates transition theory with actor network theory and ego-

network analysis to conduct an in-depth case studies analysis.

METHODS

We utilize tools drawn from Social Network Analysis to investigate the knowledge networks of six innovative organic farms involved in participatory plant breeding programs in Italy, Portugal and France. The farmers and their relational networks are the unit of analysis. The focus is on farmers' perception of their relational networks as the research goal is to understand how the surrounding environment influences farmers' behaviors in term of innovation strategy.

Relational data were collected integrating personal network research design defined by Borgatti (2009) with participatory mapping exercise. The main name interrelated question has been to define the actors the farmers *exchange knowledge with*. The name interpreter question included 8 attributes, we will focus here on two of them: the one related to the multilevel perspective of transition theory and the one related to the role of actors in contributing to the functioning of the farming system.

Finally, betweenness centrality measurements have been used to identify who are the actors in key position in each farmer knowledge network. Three main trajectories were identified on the basis of the analysis of farms' knowledge networks, and the position of each farm was analysed taking into account the dynamic nature of the transition process.
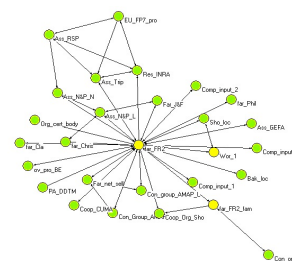
RESULTS

Fig. 1 knowledge network of farmer FR1 with internal and external actors

The first interesting result of this work is the different perception of the interviewed farmer on who are the actors directly contributing to the functioning of the system. This perception range from the idea that the only relevant actor is the farmer itself (Fig.1), (and sometime his family – fig.2), to the idea that all the actors exchanging knowledge with the farmer itself have an internal role in the farming system (Fig.2-4). In a case (IT2) the farmer includes the consumers an the short food supply chain market

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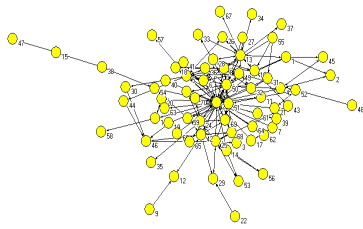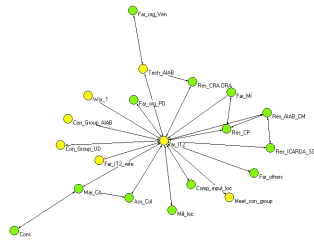channels in the direct funtioning of his farming system.

Fig. 2 knowledge network of farmer IT1 with internal and external actors

Fig. 3 knowledge network of farmer IT2 with internal and external actors

Case studies of this work represent niche actors, as they are innovative farmers directly involved in EU research projects. Most of them have both niche and regime actors in their networks, giving an indication of their involvment in the continuous dialogue between niche and regime. However, often regime actors are researchers working in public institution. This indicates a low direct exchange of some niche actors with regime ones. At the same time, there is one case study that have all regime actors in his network and this underline how dialogue between organic farmers in the regime and the organic root based movement can be completely absent, avoiding the transfer of value and principles of organic farmers.
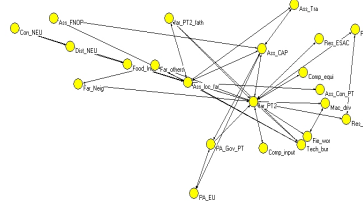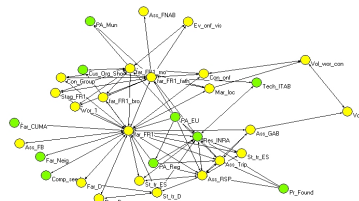

Fig. 4 knowledge network of farmer PT2 with internal and external actors

Looking at key actors in farmers' knowledge networks the type of actors with higher value of betweenness centrality in the six farmers knowledge network range from organic no certified farmers to researchers and technicians, to consumers and farmers unions. Farmers with different actors in key position of their knowledge networks are likely to follow different trajectories in innovation development.

Fig. 5 knowledge network of farmer FR1 with internal and external actors

The static analysis of the ego networks of the six case studies has been integrated with the dynamic analysis of micro transition at farm level with the aim of understanding individual trajectories. Three possible trajectories resulted from the analysis of the six farmers: value driven, quality driven, policy driven. Each trajectory has a different vision of innovation and plant breeding experiment at farm level that results in a different potential to contribute in the process of scale up from niche to regime.

Value driven farmers have an enthusiastic approach to radical innovations, however on farm trials are one of the highly diversified activities of their farm and often their management is researcher driven. This type of farmers have an high flexibility in experimenting novelties due to their low attention to external rules, however their farming system have a unique equilibrium strongly based on personal motivation. They have an high potential in developing novelties but a low potential to influence the landscape and stabilize niches. Value driven farmers represent break trajectories with mainstream regime.

Quality driven farmers follow the agroecology paradigm of innovation, based on strong consideration of existing knowledge. These farmers have the capacity to involve other farmers in their innovation process to share traditional knowledge. The presence of breeding trials on the farm is integrated in a collective process of innovation development, where different actors co-create knowledge to increase the quality of their production. The structure of their knowledge network encourage the stabilization of niches and have a large potential to scale up and influence the decision making process as best practices. Other experiences take inspiration from those farmers and they have the possibility to contribute in the reconfiguration of the system.

Finally, policy driven farmers follows the dominant innovation paradigm (KBBE) and works with a gradual introduction of incremental innovation in their farming system. Investments in research and innovation aim at reducing the use of chemicals as required by the EU policies. They could catch up innovation from niches and adapt them to the regime, developing symbiotic trajectories with the dominant regime.

Conclusions

Innovative farmers have a twofold role in knowledge management: they should increase density of their network to develop shared meanings but they should also look at external knowledge to encourage the learning process. The focus on the relational aspect and the analysis of farmers' knowledge network allowed understanding the direction of their transition pathways. The study of actors' structure in the farmers' ego networks and the use of participatory approach in data collection provided interesting information on the logic underpinning farmers' decision-making process. In urban areas, where social relations are more complex and dense, the application of this approach could give interesting results to better understand the relation between agriculture and urban actors. Further research can be developed to improve the methodology used in this work, however this work may highlight how micro economic studies could be integrated with the analysis of knowledge networks to better understand individual decision making process.