

Searching for the optimal structure for innovation networks

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Abstract

In this paper we provide an Agent based model with the purpose of analyzing the impact of the structure of the firms' network on the technological and economic performance of their industry. In our model, firms connected in a network exchange knowledge allowing them to improve their R&D process, which in turn impacts the industrial performance, and technical progress. In the extant theoretical literature it is indeed not very clear how knowledge flows impact the R&D process of the firms, and we aim to better understand this process. A first contribution of this paper is to open this black box and provide a detailed modelization of this mechanism. Opening this black box is important since not all knowledge is useful for a firm. We consequently assume that knowledge generated by firms on the same trajectory as the firm are relevant for her incremental innovations, while the diversity of this knowledge is the important dimension for radical innovations.

Furthermore, we model a competitive environment for the firms where we can compare different network structures from their consequences on the performance of the industry our objective is to determine if some structures are more favorable to technical progress and industrial performance. Using a simple industrial dynamics model inspired by Nelson & Winter (1982) and Jonard & Yildizoglu (1999), we compare the global performance corresponding to some canonical network structures: closed lattice, random networks with different connection probabilities, small world, and scale-free networks. In the relevant network structures, we also analyze the role of the firms' localization in the network on their individual performance.

Taken together these elements provide a more realistic model of the functioning of an innovation network and hence allow a better understanding of the link between network structure and firm performance.