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Role of Entrepreneurial Support for Networking in Innovation Ecosystems: An Agent Based Approach

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ABSTRACT

Entrepreneurial support organizations are among the most successful approaches for economic growth. There are multiple dimensions of entrepreneurial support activities such as resource provision, funding or networking support. In this paper, we present an approach for the assessment and analysis of entrepreneurial support for networking and its effects on global innovation ecosystems. The innovation ecosystem in our approach is modeled as a complex adaptive network by using an agent-based modeling methodology with a focus on entrepreneurial support organizations. A portion of the economic entities in this ecosystem is provided with entrepreneurial support of different types to assess their effects. The results highlight the positive impact of networking support on the innovation ecosystem.

1 INTRODUCTION

Agent-based modeling (ABM) of micro-economic behavior has been recognized as an important tool that allows for the emergence of macro-economic phenomena. ABM provides a sand-box for experimentation with possible policy changes (Axtell 2007). We utilize ABM to model the innovation ecosystem as a complex adaptive system with heterogeneous agents (Garibay et al. 2015). The model improves the understanding and assessment of the dynamics within the large cluster of economic entities. This is advantageous for the national economic well-being as it provides a synthetic environment to test economic policy decisions such as entrepreneurial support (Bergek and Norrman 2008).

Entrepreneurial support, vital to new organizations, provides the necessary business support for these companies to grow and survive in a competitive economic environment by providing resources, monetary assistance and specialized business skills training such as networking and entrepreneurship skills. This study assess networking support via our innovation ecosystem model and its impact on general economy.

2 THE MODEL

We model economic entities as Adaptive Resource Transformer (ART) agents to form an innovation ecosystem. An ART has the following objectives: harvest, produce, trade and reproduce. If an ART is unable to carry out these processes it "dies." ARTs exist within an *environment* of resources and continuously harvest off of this environment, which is a stochastic process governed by the agent's fitness. Fitness is determined by the *energy* of an ART, which is the sum of its resource quantity, product quantity and wealth.

The production is the main objective of an ART and is governed by its transformation rule $r_i \rightarrow r_j$, where: r_i and r_j are its resource type and product type, respectively. Transformation rules are randomly initialized and are then inherited into child ARTs via reproduction. During one simulation step, an ART converts all its input resources into products. Additionally, ARTs seek *trade partners* within its vision radius v_i to purchase further resources. A viable trade partner (seller) j would have the same output product type r_j as the input resources type of the buying agent i and also present the lowest price of r_j out of

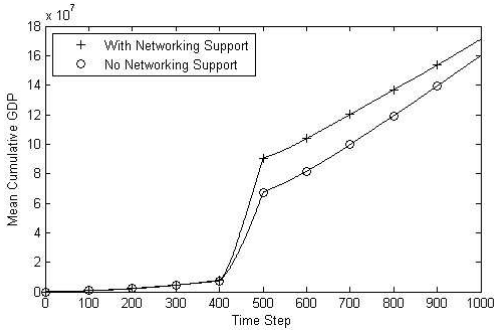

Figure 1: Mean cumulative GDP over time

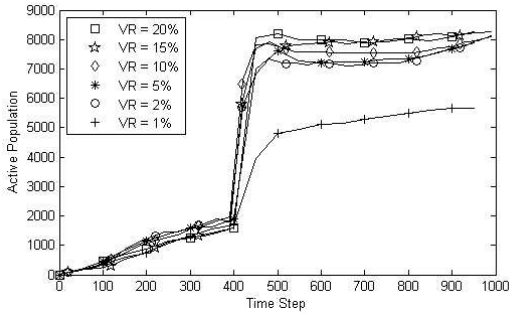

Figure 2: Active population over time

other visible sellers. The agent then attempts to move to the closest location near its trade partner and performs the trade. An agent reproduces by creating a child agent with a mutated version of the parent's transformation rule. The reproduction is a stochastic process based on the ART's fitness.

We use our model to simulate the process of entrepreneurial support by providing selected firms with resources, money and networking range during a *support period*. The support process consists of two major phases: 1) selection and 2) business assistance. Our ongoing experiments revealed that selection of youngest agents provided the best improvement in GDP in the overall economy (over selection of best performing, worst performing, oldest agents and the combinations of these selection types). Hence, the youngest ARTs in the population are selected for entrepreneurial support in this study.

Entrepreneurial assistance is provided in the form of additional resources, money and networking to selected ARTs. Networking assistance is represented as an improvement of the vision radius of the agent during the support period. The ART is expected to gain a larger window into the ecosystem as vision radius is increased and potentially identify better trade partners. However, macro-economic effects of this change are not as straightforward and they are explored in this study.

3 OBSERVATIONS

The changes in the macro-economic measurements of the economic system were compared for different cases of entrepreneurial support in the model. Fig. 1 shows the mean GDP in the simulated innovation ecosystem where there is a resource support from time step 400 to 500 for the cases with and without networking support. The result shows that the networking assistance improved the economy's mean GDP during the support period.

In the second set of simulations, the population of the agents is observed over time with networking and resource support in the support period. Fig. 2 demonstrates a pattern in the active population as the degree of networking support was increased. As the vision radius was improved from 1% to 2%, there was a significant increase in the active population, which was measured as the number of agents engaged in trade. However, the effect was relatively less significant when the radius is increased more (up to 20%). The simulation showed a massive burst in population for higher level of networking assistance, indicating that more agents had high fitness values allowing them to add new ARTs to the environment faster.

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