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Knowledge transfer in an innovation simulation model

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Abstract

To understand the development of innovation processes in these knowledge-driven economies, one needs to focus on underlying processes of creating and sharing new knowledge. In this paper, an evolutionary simulation model is used to achieve some insights into these innovation processes. The model is based on the one hand on rules about market performance, investments and R&D strategies, and on the other hand on a model concerning knowledge creation (the ability of firms to create knowledge through intramural R&D efforts and the ability to discover and absorb new developments from basic academic research and competitors) and knowledge transfer based on an exponentially expanding pool of (not necessarily new) knowledge of innovations in the own sector, but also from external sources. It is demonstrated that the imitative firm can be economically more successful but this strategy may prove to be superior only after a long time span.

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1. Innovation and knowledge

1.1. Theoretical background

This work is based on basic ideas of evolutionary economics. In this theory, the model of an economy is represented by heterogeneous companies interacting under several rules with the assumption of

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bounded rationality. The single entities in these economies are bounded in their ability to evaluate different complex alternatives. Companies evolve in different ways and are therefore described as a heterogeneous group with their own evolving histories.

Evolutionary scholars studying innovation and processes of change have stressed the need of economic models that draw on empirical reality rather than on its abstract and logical examination. Models proposed by Malerba et al. [1] build upon the verbal logic that explains an economic process using causal arguments and the descriptive explanations that reproduce empirical reality. In other words: “in most of the cases it reflects what the analyst believes is really going on” ([1], p. 4). This type of model building requires firstly an accurate understanding of the variables and mechanisms supporting the causal arguments based on empirical experience. In order to be successful, the empirical research community has to accept the models as representing an accurate version of the empirical reality and, at the same time, the logic of the formal model has to be understandable for good management practices [2].

For this paper it is essential that firms can follow divergent strategies. This means different rules make up their behaviour. Biological evolution and also evolutionary theory include selection processes which are also part of the presented model. Companies may be driven out of the market under pressure of intense competition. One result of these evolutionary variation and selection processes is the emergence of new technologies. Different strategies and decisions in different market situations lead to new techniques and, for producing companies, to a new level of productivity. This paper attempts to model these aspects as well as the variation of companies by considering their actual knowledge as a driver for new business opportunities.

Thus this paper is in some way similar to March [3] and March et al. [4] and in a different way comparable with Péli's and Nooteboom's [5] simulation model where also use is made of a two-dimensional knowledge space in which actors move.

1.2. Knowledge

Companies rely on their ability to create new techniques or to improve their business processes in order to succeed in the market. This ability is based on the knowledge within the company represented as the individual knowledge of every employee [6] and the culture within the organization [7,8]. The organization structure, the culture and the people determine the way a company does business and thus the company's knowledge. Different approaches deal with knowledge representation and knowledge transfer within a company. A basic result in this field of research is the unease of spreading or reusing knowledge as a basis for innovation. This applies not only to diffusion processes within organizations, but is even more important on an inter-organizational level. The concept of “cognitive distance” has been developed to deal with this problem. Companies which do not already share any knowledge about markets or technologies must make great efforts to communicate and to exchange new ideas [4]. Spill-over effects as an unwanted form of sharing knowledge between different organizations are facilitated by having the same historical background or a kind of “cultural” closeness [9]. Under the aspect of an evolving company as part of an evolutionary economy, bounded rationality and cognitive distance lead to a determined development of their knowledge assets. Organizations stay in their “track” as a result of these constraints and the development is specified as path-dependent. This does not warrant successful decisions “while coping with surprises in the unfolding of history” [4].

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