Chapter 12

Knowledge Creation, Growth, and Transfer within Industrial Networks of Practices:
The Role of Absorptive Capacity and Direct Centrality

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ABSTRACT

In this chapter we test the hypothesis that uneven links distributions and uneven absorptive capacity between an industrial cluster members provide some kind of competitive advantages. Through an agent-based model has been built and calibrated on real data taken from an aerospace industrial cluster, that hypothesis is contrasted against the normal, the uniform, and the U-shaped distribution. The focus of the model is on knowledge variables, agents' learning capacities, and structural variables, like firms size and proximity. Physical production is not considered, excepted for its degree of complexity, which determines also the degree of knowledge complexity. This work shows that, actually, the best performance in terms of cluster knowledge creation, growth and diffusion is obtained when firms connectedness and absorptive capacity are distributed in a scale-free way. More generally, the more unbalanced are these two variables (especially absorptive capacity), the better is knowledge performance. These results are rather robust, and obtained while keeping all other variables very balanced at the beginning of each simulation.

INTRODUCTION

What appeared more and more evident during the last two decades is that, given its tremendous complexity and methodological heterogeneity, it is very hard to find clear, sound and convergent results from

empirical studies on knowledge transfer, industrial clusters and innovation networks, often reciprocally incomparable and theoretically inconclusive. To face with these limitations agent-based simulation modelling (ABSM) are diffusing (Carley, 2009; Davis *et al.*, 2007; Gilbert, 2008; Gilbert & Terna, 2000; Gilbert & Troitzsch, 2005; Harrison *et al.*, 2007; Tesfatsion & Judd, 2006; Uhrmacher & Weyns, 2009), with the hope to build strong and comparable results. When these models are not too abstract, and especially if its parameters are calibrated - inspired by and set up - with real data, results of virtual experiments can dramatically improve and increase our scientific knowledge. This paper adopts this methodological perspective by building KNOWTIC, an agent-based model on knowledge creation, growth, and transfer of industrial clusters (IC).

According to various scholars (Arikan, 2009; Lorenzen & Maskell, 2004; Maskell, 2001; Tallman *et al.*, 2004), the need to build, enhance, and exploit collective knowledge is supposed to be one of IC major drivers. The process of collective knowledge formation occurs through recursive and (mostly) self-organizing mechanisms (Biggiero, 2001, 2006), that is, grounding on largely spontaneous bottom-up forces. After one or more forms of proximity have been established (Boschma, 2005), knowledge creation and transfer (Ernst, 2002) is enabled. Indeed, this picture requires a number of other favourable conditions to occur, and their exploration is just at the beginning. In fact, many IC decline and fail, and many of them loose identity, structure, social cohesion, and competitive advantages. Moreover, nobody knows how many IC could have been formed but never born. In this paper we do not investigate such contextual conditions, and assume that an IC already exists.

The focus is on the way that tacit and explicit knowledge circulates and grows, and how knowledge is employed in collaborative and non-collaborative activities, depending on agents' collaborative propensity, learning attitude, imitation or innovation choice, research expenditure, geographical proximity, size, and a number of other variables whose discussion is succinctly made in the third section. *The core research issue concerns if and how the specific distribution of firms' absorptive capacity (ABC) and connectedness (Dc) influence an IC knowledge performance*. To this aim, a normal distribution of these two variables is benchmarked, ceteris paribus, against a uniform, a U-shaped, and a power-law distribution.

Theoretical supports to our KNOWTIC Model are the following two: the research stream viewing ICs as cognitive systems (Belussi & Gottardi, 2000; Camuffo & Grandinetti, 2011), and the research stream of communities and networks of practices (Agterberg *et al.*, 2010; Anderson *et al.*, 2010; Lave & Wenger, 1991; Wenger 1998), which are combined with the knowledge networks literature (Kreis-Hoyer & Grünberg, 2002; Hildreth & Kimble, 2004; Sammarra & Biggiero, 2008) to ground IC knowledge creation and growth on the firms' micro-level. These theoretical backgrounds are summarized in next section, while the model structure is outlined in section three. Agents' autonomy, cognition, behaviour, and decision making processes are described in the next section, followed by the description of virtual experiments. In section six the main results are evidenced, and then discussed and compared with current literature. In extreme synthesis, the analysis indicates clearly that, ceteris paribus, ABC and Dc nonlinear distributions influence significantly knowledge performance, and the former more than the latter.

THEORETICAL BACKGROUND

We assume the knowledge-based theory of IC formation and evolution (Arikan, 2009; Lorenzen & Maskell, 2004; Maskell, 2001; Tallman *et al.*, 2004). Notwithstanding the variety between and within ICs (Belussi *et al.*, 2003; Belussi & Sammarra, 2005, 2010; Giuliani *et al.*, 2005; Karlsson *et al.*, 2005;

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