A preliminary analysis of knowledge transfer: the case of structural composite material in aeronautics

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With increasing technological complexity firms are no longer able to innovate on their own. The expertise needed for new technologies cannot be held within the boundaries of a single firm. Firms hence tend to cooperate in order to access knowledge they do not master themselves.
In this paper we use patent and publication data on the topic of Structural Composite Materials (SCM) in aeronautics between 1980 and 2013. From this data we extract collaborations which allow us to generate a network. Our aim is to explain the evolution of the structure of this network and analyze how the firms in the aeronautics sector organize themselves to absorb a new technology.

CSM were first developed by chemists in the early 20th century and have since been used in sport equipment and the automotive industry. It caught the attention of civil aircraft manufacturers during the late 70's. During this period programs focusing on the optimization of energy consumption were launched. The aim of these programs was to exploit composite materials to increase energy efficiency. This makes it the perfect candidate for a study to analyze how a network structures itself to absorb an existing technology and adapt it for its proper needs.

An aircraft is a multi-technological product, this implies that it is build from different technologies. The introduction of a new technology such as SCM can only be achieved if all firms in the production chain will adapt to the integration of the new technology. Integrating SCM in the aerospace industry hence implies a thorough understanding of the core and linkage technologies (Prencipe, 1997) by all the actors implicated in aeronautical programs. We argue that the overall structure of the network can be explained by the technological clusters inside the network.
In addition to these factors we argue that a correlation exists between the overall structure of the network and the technology life-cycle. When the technology matures the structure of the network stabilizes while the structure of the network presented a high variation in its indicators at the early stage of development of the technology. Overall the network indicators stabilize while firms move from the exploration stage to the exploitation stage.

On a micro and meso-level conclusion are more complex, the structure of clusters can only be explained by looking more closely at the patents and the technologies of the firms. As has now been well established within innovation economics, patents do not imply valuable innovations. We hence enrich our network with technological trajectories (Epicoco, Oltra and Saint Jean 2014). These trajectories allow us to determine which patents are the most valuable in terms of citations and have opened up a path to new innovations. We aim at showing a link between the position of firms in a network and the importance of their patent portfolio within the sector.

Keywords: Dynamic Social Network Analysis, Main path algorithm, inventive trajectory, structural composite materials, aeronautics, patents, scientific publications

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