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BioEnergy Brazilian Program (BIOEN) Innovation Networks

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Introduction

This article investigates the *ex ante* appropriability pattern for the Brazilian BIOEN – BioEnergy Program, a multidisciplinary ethanol sugar-cane project, from its economic issues, assets management and social network formation together with scientific and technical perspectives.

The objetives of BIOEN are:

- To search and selection of technological trajectories of plant varieties;
- To define patterns of market interests;

To develop a network tool which can be accessed by R&D Brazilian institutions in order to protect efficiently the technological results of the BIOEN and to identify strategic behaviors of technology appropriation.

Networks of patent citation are used for technological foresight of ethanol research and development scenarios building.

The project's goal is the formulation of an organizational design: a) analysis of the demands due to intellectual property of technologies, supplies and genetic material that can create risk situations for the continuity of the program itself; b) preparatory analysis of business plans and economic exploration 'models', from intermediate products and supplies to final products. It includes an incentive system, and scenarios of partnership formation, from the formation of networks that identify patent families, networks of quotations on intellectual property attribution and appropriability pattern in plant biotechnology; c) *ex-ante* impact evaluation for the formulation of business plans based on the research results.

Knowledge communication, which supports the discussion of technology networks and links it with questions of merit and approval (Dal Poz, 2007; Cowan & Jonard, 2007), appears in the simplified form of a division between integrated and unintegrated research structures which, besides defining a rule for sharing of gains (alpha percentage not dependent on the amount of total revenue earned), involves a variable relating to knowledge transmission from the research unit (creator of the invention or new knowledge) to a firm that intends to develop it in a second stage. Two conclusions are obtained: (a) an integrated structure facilitates knowledge diffusion by reducing the percentage to be paid to the research unit to a compatible incentive; and (b) if an unintegrated structure persists, a system of intellectual property is required to avoid the dissipation of earnings determined by ex post competition. Raised by Aghion & Howitt (1998), remits us to the system failure represented by the Brazilian patent regime, which does not recognise gene patents, a matter of paramount importance to BIOEN.

The indication given by Aghion & Tirole (1995) that integrated units are more conservative corroborates the correctness of the BIOEN strategy while at the same time extending the technology paradigm from applied molecular biology to bioenergy and increasing the scope to negotiate technology with economic agents.

Methodology

Networks of innovation approach will be used to foresight BIOEN potential intellectual property pattern. R&D technologies involve techniques of biological markers, viral vectors for introduction or genetic engineering (Dal Poz,2006).

According to literature on industrial ensembles, the actors interests in the assets based on technology result on the building of innovation networks.

This paper deconstructs the technological content of IP aspects for innovative arrangements of BIOEN, in order to understand its technological dynamics. The methodology is based on forward citations that a patent receives, which are indicators of innovative strength on markets based on technology. Highly cited patents are proxies for technological market values.

According to Hall *et al.* (2001), patents may be considered as reliable sources of innovation studies and technical change. Sampat and Ziedonis (2002) show the economic and technological importance of such analysis. Trajtenberg (1990) and Jaffe & Trajtemberg (2002) claims that the measurement of forward citations received by a patent is an innovation indicator.

Odysseýs Patent Computacional System[1] for Information Retrieval is used for forward citation search, selections and aggregation data from the *United States Patent and Trade Office* (USPTO),identifying networks by algebric indicators.

Findings

Preliminary results concerning a lexical query composed by combinational BIOEN R&D areas and International Patent Classification areas (C07h21 and C12N at "title", "abstract" and "claims"), from 1976 till now, from BIOEN R&D areas:

A - Biomass Research

B - Ethanol Industrial Technologies and Processing Research

C – Alcoholchemistry and Biorefineries

The citation networks (Figures 1, 2and 3) – from a macro structural analythical approach - shows that the "sugar cane R&D process" and "ethanol, bioethanol and biomass" technological themes are emergent market enterprises.

The article has reached a clear scenario about international enterprises which may be technological market players at ethanol business.

From BIOEN's micro-aspects of technological capacity building, other broader considerations about the innovation dynamics and about the holes of the different clusters, hubs and connectors will be found.

[1] Developted by a institutional partnership among the authors of this paper for the BIOEN Project.

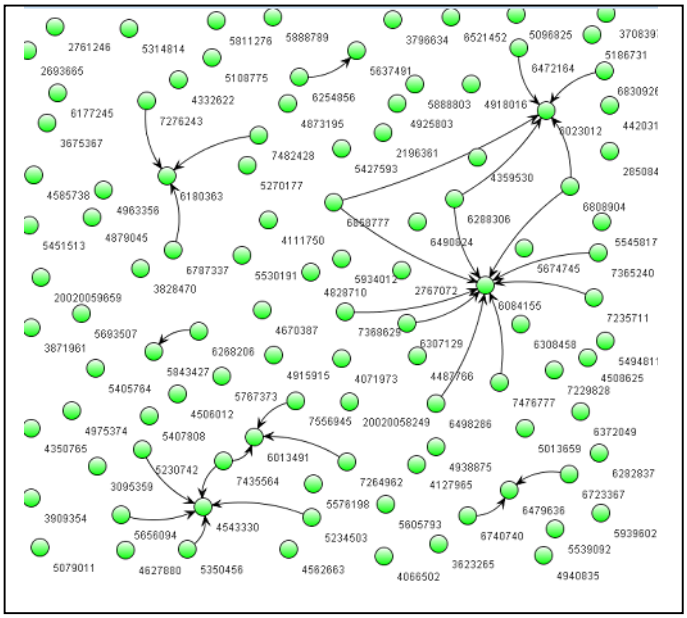

Figure 1 – Network of citations: IPC = C12N and Abstract = cane

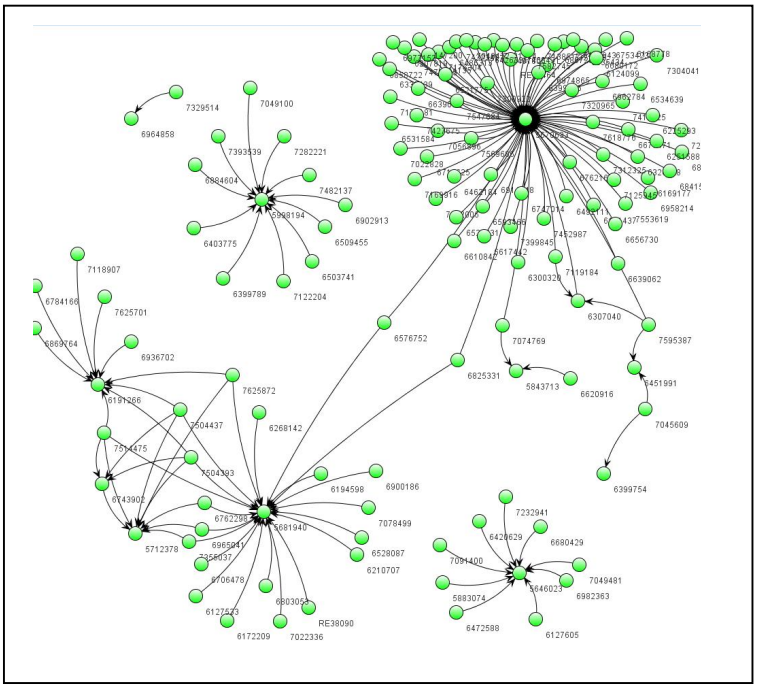

Figure 2 – Network of citation: IPC=C07h21 and Abstract= sugar

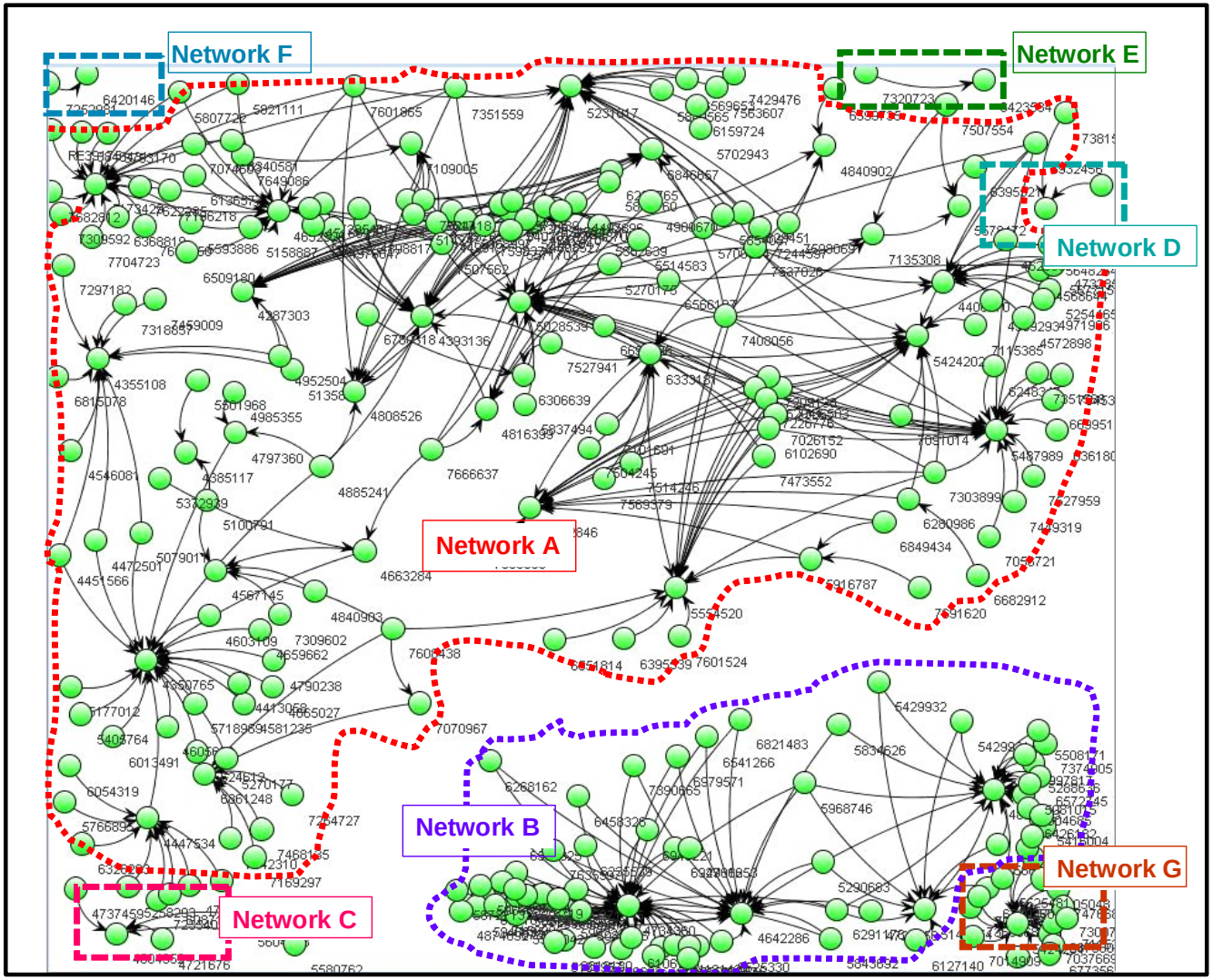

Figure 3 - Ethanol or Bioethanol network of citations – patents from United States Patent and Trade Office (USPTO), 1976-2010; C12N and C07h21 IPC Classes.

Contributions and implications

This paper colaborates for the perception of technological opportunities and for formulating problems that result in innovations, via what are known as "focusing devices" (Marengo e Dosi, 2000). These are defined on the basis of a systematic application of technical and scientific knowledge by agents who compete in a context of selective market processes. These processes take different trajectories and generate different patterns of technology diffusion within firms, between firms, among firms in the same industry, and between industries and sectors.

References

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