

A SPATIAL BASED ANALYSIS OF ROMANIA'S HIGH-TECH INDUSTRY

Abstract

In recent years, increasing attention has been paid to the development of high-tech industries in European countries, and not only, and a lot of researches try to explain their significance in the development of nations. Creating new technologies, applying them to create new products and services, and putting them on the market have become essential in the global race for competitiveness. High-technology industries are key drivers of economic growth, productivity and welfare and are generally a source of high value added.

Technology-intensive enterprises are commonly referred as high-technology (or high-tech) companies. They are vital for a competitive position of a country, because they are associated with innovation and tend to create new markets for products and services, and use resources more efficiently. They are linked to high value-added production and success on foreign markets.

The aim of this paper is to analyse the high-tech industry in Romania, from spatial distribution point of view, having the goal to identify cluster type agglomerations between companies operating in the high-tech industries.

Keywords: agglomerations, cluster type agglomerations, high tech industry, spatial concentration.

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O ANALIZĂ SPAȚIALĂ A INDUSTRIEI DE ÎNALTĂ TEHNOLOGIE A ROMÂNIEI

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Rezumat

În ultimii ani, o atenție sporită a fost acordată, în țările europene și nu numai, dezvoltării industriilor de înaltă tehnologie, existând o mulțime de cercetări care încearcă să explice importanța acestora în dezvoltarea națiunilor.

Crearea de noi tehnologii, aplicarea lor pentru a crea noi produse și servicii și punerea lor pe piață au devenit esențiale în cursa globală pentru competitivitate. Industriile de înaltă tehnologie reprezintă factori-cheie ai creșterii economice, ai productivității și bunăstării și sunt, în general, o sursă importantă de valoare adăugată.

Companiile tehnologic-intensive sunt denumite firme de înaltă tehnologie (sau high-tech). Acestea sunt vitale pentru a asigura o poziție competitivă unei țări, deoarece acestea sunt asociate cu inovarea și tind să creeze noi piețe pentru produse și servicii, și să folosească resursele în mod eficient. Ele sunt legate de producția cu valoare adăugată mare și de succesul pe piețele externe.

Scopul acestei lucrări este de a se analizează industria high-tech din România, din punctul de vedere al distribuției spațiale a activității firmelor care operează în acest domeniu, în vederea identificării aglomerărilor de tip cluster între companiile care operează în industria high-tech.

Cuvinte cheie: aglomerații, aglomerații de tip cluster, concentrații spațiale, industria de înaltă tehnologie.



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1. INTRODUCTION

Economic activity starts, grows and develops in space. Natural resources are distributed unequally in space; they are frequently concentrated in specific places and are entirely or partly non-existent in others. The economic activities tend to follow the localisation pattern of natural resources, having various distributions in space. Quantitative and qualitative inequalities in the geographical distribution of resources and economic activities generate different factor remunerations, different levels of wealth and well-being, and different degrees of control over local development.

Space influences the way in which an economic system works. It is a source of economic advantages, or disadvantages such as high, or low endowments of production factors. It also generates geographical advantages, like the easy, or difficult accessibility of an area, and a high or low endowment of raw materials. Space is also the source of advantages achieving from the cumulative nature of productive processes in space.

High-technology industries have different characteristics than other industries, and the detection of these differences is significant to understand innovation and growth.

For example, Premus (1984) notes that high-technology industries employ a considerably higher percentage of scientists, engineers, and technicians than other manufacturing firms. In addition, research and development (R&D) inputs are much more important for the productivity of these companies.

There is still a much debate, regarding the type of agglomeration which is providing the best results and performance. Some support the idea that specialised agglomerations or clusters give rise to sectoral high tech spillovers as a key of innovation. (Glaeser et al., 1992, Baptista et al., 1998, Henderson, 2003). Another point of view supported among others, by Feldman and Audretsch (1999) shows that sectoral diversity is most strongly associated with regional innovativeness.

There are a lot of researches available in many countries, developed by institutions, organizations and scientists, aiming to analyse the high tech industries in OECD countries, in China, in United States and in Australia. But it is a small number of researches that concentrates on the high-tech industry in East European countries, and after my knowledge it is not such a study available about Romania.

This paper analyses the high-tech industry in Romania, from spatial distribution point of view, having the goal to identify cluster type agglomerations between companies operating in the high-tech industries.

After an overview of the spatial distribution of high tech industries in Romania, in 2011, the research next proceeds by investigating the agglomeration and specialization features of high-tech industries.

A database with companies acting in high tech industries, in Romania, in 2011 is used to develop the research and to underpin the conclusions.

2. SPATIAL DISTRIBUTION OF HIGH-TECH INDUSTRIES

In general, the high-tech industry assumes a geographic feature, in the form of specialized locational clusters (Scott 2006). It is similar to traditional industries, in concentration behavior, but the degree of specialization is much higher (Cutrini 2010).

Based on these observations, this paper attempts to investigate the spatiality of high-tech industry in Romania by examining its pattern in agglomeration and specialization.

The high-tech industry is distinguished as an industry having a relatively higher research and development (R&D) intensity, and with a higher proportion of professionals, scientists, and skilled workers in the workforce (Goetz and Rupasingha 2002; OECD 2006). To analyse the high-tech industries acting in Romania, I considered the definition used by Eurostat, see Table 1.

TABLE 1 - HIGH-TECHNOLOGY INDUSTRIES – SOURCE EUROSTAT

NACE Rev. 2 codes – 3-digit level	Manufacturing industries
21 - Pharma	Manufacture of basic pharmaceutical products and pharmaceutical preparations
26 – CompEIop	Manufacture of computer, electronic and optical products
30.3 - Space	Manufacture of air and spacecraft and related machinery

To demonstrate the spatial high-tech patterns, a map has been designed, see figure 1, with the real concentration of high-tech industry across Romania's counties, in 2011. To create the map, I used the number of employees from the companies acting in one high-tech industry. To determine the spatial concentration of companies acting in high-tech industries, I used the location quotient index.

The general formula for location quotient is:

$$Location\ quotient = \frac{\frac{n_{A,R}}{N_R}}{\frac{n_{A,T}}{N_T}} \quad , \text{ where: } n_{A,R} \text{ is the number of employees in industry A in county R, } N_R \text{ - the whole number of employees, in the county R, } n_{A,T} \text{ - the number of employees in industry A, at the national level, } N_T \text{ - the whole number of employees, from national level.}$$

All counties with a location quotient value greater than 1.25 are considered to be high tech, and are colored in red. Based on these considerations, the Romania's high tech counties are: Timis, Arad, Bihor, Cluj, Sibiu, Arges, Bacau, and Iasi.



FIGURE 1 - HIGH TECH COUNTIES IN ROMANIA, 2011

3. AGGLOMERATIONS

Following to identify the agglomerations, two approaches have been effective in the literature: the first one employ a variety of direct measures associated with the magnitude of industrial economic activities, and mapping them to highlight regional gaps, and the second is used when a mapping technique is unavailable or regional gaps are not visually significant, computed indirect measures such as location quotients are often adopted (Cruz and Teixeira 2009). In this paper, I started with the first approach, and complement this with the second one.

In Figure 2, the spatial distribution of establishment in all Romania's high-tech industry, in 2011 is mapped. The map contains information about the agglomerations of companies acting in high tech industries, based on their county of residence.

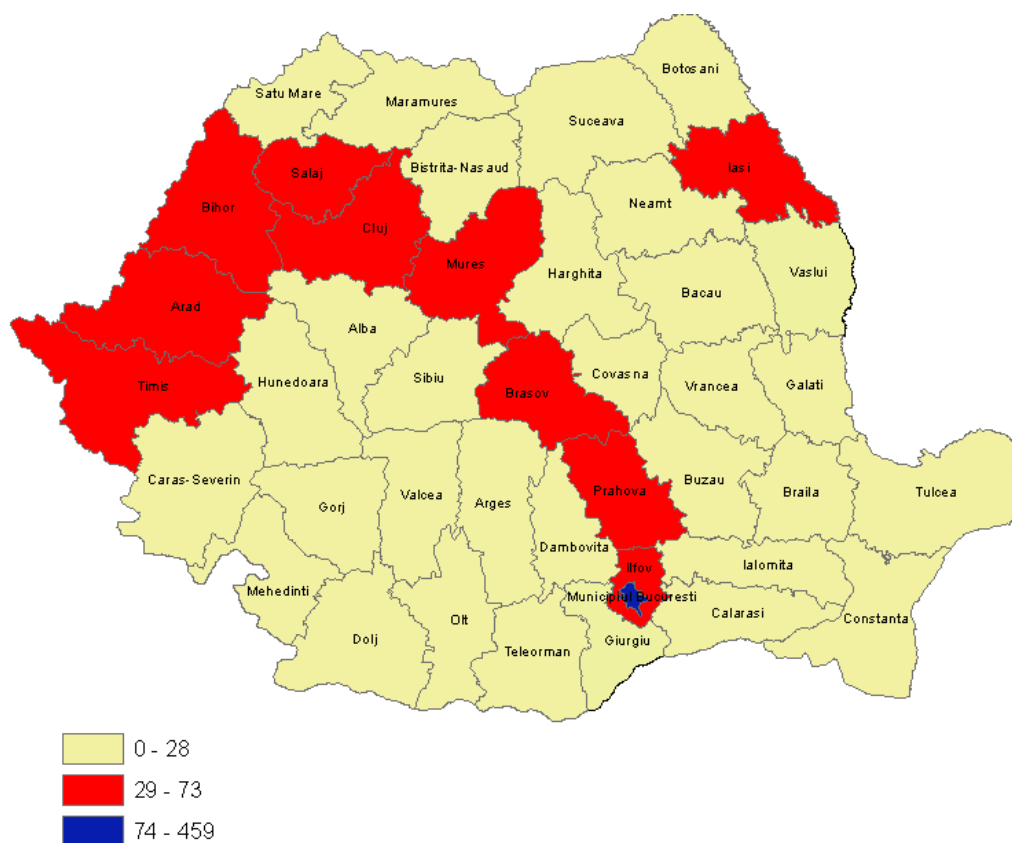


FIGURE 2 - HIGH-TECH ESTABLISHMENT DISTRIBUTION, IN 2011

4. SPECIALISATION

An important finding from the literature regarding the spatial pattern of high-tech industries of developed economies is that high technology varies significantly from place to place (Cortright and Mayer 2001; Maggioni 2002).

The division of labour in high-tech industry has been interpreted as the result of the increased interdependencies among firms, as response to the more differentiated and constantly changing consumer demands on high-tech products (Scott 2006). In this section, I turn to explore the specialisation of Romania high-tech industry.

Following the categories of high tech industries defined in the Table 1, in the Figure 3 it can be observed that within the high-tech counties, Bucharest has the greater number of employees in companies from high tech industries, from all the country. The next level of contribution is provided by companies from Timis, Iasi and Cluj, having approximately the same contribution level. For the rest of the counties, it is a very little variation in the way that each contributes to every high tech sub-industry.

In the CompEIOP industry, the greater number of employees is in companies located in Timis, followed by Bucharest, Cluj, Bihor, Arad, Sibiu, Arges, Iasi, Brasov, and Ilfov.



FIGURE 3 - THE STRUCTURE OF HIGH-TECH INDUSTRY, 2011

In the Pharma industry, the top of the countries, built based on the number of companies acting in, is: Bucharest, Iasi, Cluj, Ilfov, Mures, Prahova, Brasov, and Arges. In the Space industry, the top is composed by: Bucharest, Bacau, Dolj and Brasov.

In summary, my perception is that certain counties like: Timis, Arad, Bihor become specialized in CompEIOP sub-industry and in the rest of the high-tech counties preserve a nearly equal ability in manufacturing CompEIOP and Pharma products.

5. TYPES OF SPATIAL CONCENTRATION OF HIGH TECH INDUSTRY

In order to find out to what extent high tech industries form Romania were concentrated or dispersed in geographical space, location quotients for employment and companies were calculated using the employment data at the company level. However, examining employment concentrations alone is not

always sufficient for identifying sources of regional competitive advantages. Employment location quotients (LQe) do not provide an indication of the number of firms involved, whether the sector is aggregated, disaggregated or somewhere in-between. (Cooke et al, 2007) For instance, a sector's large number of employees may be concentrated in a single large firm. Location quotients for numbers of firms (LQd) are important because each establishment represents a location of activity, a set of business and employment opportunities, and a discrete decision to begin operations or to locate operation in that specific locale, for some specific reasons. Thus, for the purpose of the research, it is useful to compare location quotients based on employment with location quotients for the same industry, which are based on the number of establishments. This can reveal where a particular industry group in the region is more disaggregated than it is in the country. In an attempt to identify where there are a concentration of employment and firms in a particular high tech industry, and whether these could be regarded as clusters, districts or as dominating firms, I used the classification provided by Cooke et al (2007), as presented in table 2.

TABLE 2 – CATEGORIES OF SPATIAL FIRM CONCENTRATION (COOKE ET ALL, 2007)

Types of regional concentration	LQd<1.25	LQd>=1.25
LQe<1.25	No concentration	District
LQe>=1.25	Dominating firm	Cluster

Based on the presented assessment, counties containing potential clusters in high tech industries are Cluj, Iasi, and Timis, dominating firms are in Arges, Arad, Bacau, Bihor, and Sibiu counties and district in Brasov, Bucharest, and Prahova. In the rest of high tech counties are no concentration.

6. CONCLUSIONS

By constructing and mapping relevant numerical measures based on my calculations using data available at the companies' level, the unique locational characters of Romania's high-tech industry are identified and highlighted in this research. They are particularly observed from the perspective of agglomeration and specialization.

The results of this analysis open the door to the next step of my research, aiming to investigate and to introduce in the analysis the available output results of the high-tech industry, like the patent registered at EPO (European Patent Office), by companies acting in high tech industries in Romania. Another research issue for future researches will analyse if there are differences between high tech and low tech industries, in Romania.

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