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Abstract: This paper aims to reveal the role played by open innovation schemes in the development of new competitive advantages. Furthermore, it aims to present a normative model for networking knowledge clusters, that is, traditional clusters that are applied to the case of the Cova da Beira region (Portugal) such as Agro-Food, Textile, and Public Sector; and a set of emergent clusters that include Bioscience, Biotechnology, Multimedia, Tourism, Health, and Knowledge. In this paper, the basic framework about clusters was expanded, taking as reference the studies of Porter (1985, 1990, 1998, 2005), Feldman (1994), Porter and Stern (2001), and Furman, Porter and Stern (2002). The problematic related to open innovation schemes is integrated in this framework in order to reveal the importance of building new kinds of open innovation networks that don't involve the geographic concentration of the enterprises. After making a literature review in order to present the analytical framework that includes the clusters theory, a normative model is presented through the development of a case study applied to the Cova da Beira region (Portugal). This option is due to the existence of a local University that has historically interfaced the launching of open-innovation spin-offs into local and international clusters networks. The present paper reveals a high degree of originality, since it contributes to the introduction of the concept of open innovation into the literature about clusters. The main point is that open innovation provides two main implications to build up and leverage both internal and external knowledge into international clusters networks. First, this study presents a basic implication for several agents such as, entrepreneurs, researchers, and policy makers; that is, universities are principals in interfacing the sources of open innovation and the transfer of processes of knowledge into the international clusters networks. Second, it promotes the inclusion of the issue related to the creation of international and institutional networks in the short agenda of the referred agents in order to promote the introduction of new open innovation schemes.

Key Words: Clusters, Institutional Networks, Open Innovation.

1. Introduction

Nowadays, the institutional networks assume a special importance due to the possibility of promoting an efficient articulation between common values and the needs of different agents. This possibility is based on the access to the information.

In this sense, the public policies should be oriented to the promotion of continuous efforts of innovation, and to the integration of mechanisms. On the one hand, these mechanisms should promote the dissemination of innovative practices developed in the Universities and in its research units and, on the other hand, they should provide an open access to innovations developed by other business partners or start-ups.

This paper aims to reveal the role played by open innovation schemes in the development of new competitive advantages. Furthermore, it aims to present a normative model for networking knowledge clusters, that is, the traditional clusters that are applied to the case of the Cova da Beira region (Portugal), such as Textile, Agro-Food, and Public Sector; and a set of emergent clusters: Bioscience, Biotechnology, Multimedia, Tourism, and Health.

In the first section, the basic theory about clusters is reviewed. In the second section, the concept of open innovation is presented. In the last section, a scheme of dynamic knowledge clusters that are located in the Cova da Beira region is designed. Afterwards, the conclusions and the guidelines for future research projects are presented.

2. Theory of Clusters: Literature Review

In the present global economy a paradox should be emphasized, that is, the main sources of competitive advantages are originated from private and local aspects, such as the traditions, information flows, institutional networks, knowledge, and innovation.

The world economic map has been dominated by entrepreneurial activities that are spatially concentrated in clusters, which present singular competitiveness in a specific field or activity (Porter, 1998, 2005; Porter and Stern, 2001; Snowdown and Stonehouse, 2006).

In the opinion of Porter (1998, 2005), a cluster provides the microeconomic foundations of prosperity, since it expresses the full operation of the Diamond model in a national economy and it involves the advantages that are originated through the interconnection between different companies, clients, and suppliers. This kind of interconnected links lead to a positive pressure for the development of new innovation schemes and for the reinforcement of the economic performance.

According to the opinions of Porter (1985, 1990, 1998, 2005), Feldman (1994), Porter and Stern (2001), Furman, Porter and Stern (2002) and taking into consideration the empirical results obtained by Glaeser, Kallal, Scheinkman and Shleifer (1992), Audretsch and Feldman (1996), Baptista (2000), and Baptista and Swann (1996, 1998), the geographical concentration of related entrepreneurial units stimulates the pressure for the concurrence. For its turn, it stimulates the need to develop innovation activities and to assure the transference of the knowledge that is both produced at the research units and at the enterprises that belong to the cluster.

In this sense, the enterprises that adopt the generic strategy of differentiation need to develop continuous flows of innovation in order to increase their competitive capacity. This must be carried out in an environment that should be open not only to the innovations that are produced al a local level, but also to the innovations that are produced at an international level that is, in internationally networked clusters.

However, the role played by the local clusters in the determination of the mentioned competitive pressure should not be forgotten. From this, it is essential to clearly identify the more important agents, the traditional activities, and the emergent activities that could promote, on the one hand, the reinforcement of the international competitive capacity of the clusters and, on the other hand, the transference of the knowledge between the emergent activities and the traditional ones.

Porter (1998) has defined the clusters as a form of spatial organization that consists of geographical concentrations of enterprises or institutions that are interconnected. That includes in its own network a series of other industries and other interconnected entities, namely no Governmental and Governmental Institutions, Universities, Polytechnic Institutes, Professional Associations, Business Associations, and Commercial Associations, which play a determinant role in the design of new kinds of innovation schemes.

The clusters include different agents that are interconnected in order to produce complementary goods that are usually produced through the exploitation of a value chain where common inputs, specific skills, and technologies are used. The limits of a cluster are defined by the interconnections and the complementarities that are established between the industries and the institutions that play an important role in the reinforcement of the competition that is generated in the market (Porter, 1998).

The clusters not only promote the competition but also stimulate the cooperation. Therefore, the cooperation (mainly, in terms of the vertical value chain) can involve companies of industries and local institutions that are interconnected. This represents an alternative way of organizing the value chain.

The enterprises can be simultaneously very cooperative and sophisticated. They may also use advanced technologies in order to reach high levels of productivity. However, the way that companies compete in international terms is determined by the quality of the local economic environment. The modern competition depends on the productivity. It depends neither on the access to the inputs nor the dimension of the enterprises. In this sense, higher levels of productivity are originated through the cooperation among the agents that are integrated on the networks of knowledge clusters in which the enterprise participates.

According to Porter (1998, 2005), the microeconomic foundations that are more important to drive competition derive from the general characteristics presented by the clusters. This way, the clusters affect competition in distinct ways, namely through: (i) The increase of the productivity of the enterprises located in the influence area; (ii) The reinforcement of innovation schemes that is going to affect the productivity level; (iii) The incentive for the creation of innovative activities that are going to expand and reinforce the competitive advantages of the cluster.

This way, the enterprises that belong to a certain cluster have a higher propensity to the increase of the productivity through the improvement of the access to different inputs, information, technology, and institutional networks (Porter, 1998, 2005; Porter and Stern, 2001).

Taking into consideration the opinion of Porter (1998, 2005), the enterprises may plan the clusters networks through the inclusion of the following four points in their short agenda: (i) Choice of the locations (the enterprises should globally distribute their activities through the selection of the preferential access to certain markets; (ii) Local commitment (the companies should establish and promote a significant local presence in order to maximize the resulting benefits of the cluster); (iii) Improvement of the Cluster (the enterprises that belong to the cluster should promote local business, namely through the promotion of new activities related to the core activity); (iv) Institutional and Cooperative Networks (the enterprises should rethink the role played by the Universities, Business Associations, and Commercial Associations in order to guarantee the creation of institutional networks, where innovative ideas and practices may be promoted and this aims to reinforce the productivity and the economic growth of the regional influence area of the cluster).

The regional and national responsible institutions should guarantee inputs of high quality in order to promote an adequate functioning and articulation of the knowledge clusters. For this is meant to educate citizens with new competences, as well as, to provide infrastructures that may promote the development of innovative practices.

In what concerns the national governmental institutions, a strategy should be built. This strategy should involve the initiatives developed by the private agents with the aim of reinforcing the traditional or the emergent clusters. The basic idea is not to create completely new clusters, because new innovative activities usually grow in the networks of the knowledge clusters that already exist.

In this sense, the governmental initiatives should explore the competitive advantages of the existent clusters and promote the specialization in innovative areas that are directly linked with the traditional clusters that present an ancestral know-how, instead of trying to imitate existent clusters in other geographic locations.

However, the capacity to create new productive specializations should not be forgotten, but this capacity depends fundamentally on the national business environment, and on the institutional networks that should include universities, research centres, enterprises and other related public and private entities (Porter and Stern, 2001).

The innovation, that is defined in a Schumpeterian sense as a new combination of productive factors which include new production techniques, new goods, new management practices, and new ways of exploiting the markets, should be reanalysed. It should be taken into consideration not only the economic innovation, but also the social innovation that is directly linked with the structure of knowledge clusters (März, 1991).

For such, the role played by the catalyst agent, that is the State, is fundamental to create a dynamic environment in critical areas, namely the reinforcement of the national scientific capacity, the dissemination of the use of new information and communication technologies, and the creation of communication networks that are crucial to develop new kinds of long distance related clusters, and to popularize new practices of open innovation.

3. The Model of Open Innovation

The traditional model of closed innovation has been based on a virtuous circle, that is fundamentally characterised by the investment in internal Research and Development (R&D), that led to breakthrough discoveries. These discoveries usually yield new products and services to market, which, for its turn, provide increased sales and profits via existing business model. Then it is reinvest in more internal R&D, and so on.

In spite of the historical profitability of this model in certain productive activities, there is a great disadvantage associated with this traditional model, that is the fact that the closed innovation process has been designed to weed out false positive projects that are initially appealing, but that afterwards turn out to be inadequate for the market preferences.

According to Chesbrough (2003), we can identify other erosion factors that have undermined the logic of the closed innovation such as the increasing mobility of highly experienced and skilled people, the burgeoning amount of college and post-college training that many people have obtained, and the growing presence of private venture capital which has been specialized in the creation of new enterprises that have commercialized external research.

From the previous arguments, it is necessary to surpass the boundaries of the enterprise, through the exploitation of bidirectional flows of external and internal innovation. The implementation of an open innovation model makes it clear that enterprises should use external ideas, as well as, internal ideas, and also external and internal paths to the market, as the enterprises want to develop their technology. This new model requires that ideas both flow out

of the enterprise, in order to promote adequate targets for their monetization, and flow into the enterprise, by pushing new offerings and new business models (Chesbrough, 2003).
This model provides a fundamental advantage, that is, the reduction of the error of both ignoring a winner and backing a loser. Furthermore, it moves the enterprises closer to the main research that is developed outside their boundaries. It also enables the recovery of false negatives. These are projects that are initially taken as worthless, but that turn out to be very valuable in the market.

The model of open innovation requires the identification of interstices between different but related clusters, as it happens, for example, in the cases of the bioscience, biotechnology and agro-food clusters. This way it is necessary to combine the different knowledge assets that are owned by the different clusters and the different tools or methods that are unfamiliar for each of them. In traditional clusters, such as in the Agro-Food sector, enterprises are beginning to learn how to integrate genetic and genomic technology in order to protect the crops against potential diseases, and also to increase their productivity.

The core idea about the scheme of open innovation that is now presented consists on the promotion of innovating innovation through the design of institutional networks that should be oriented to the combination of different scientific areas. This process involves several entities located inside or outside the clusters.

Take in Figure 1

The logic of open innovation is based on a landscape of knowledge produced in the scope of institutional networks that involve both traditional and emergent clusters. This way, the knowledge that is going to be used by the enterprise should not only result from the internal research. Instead, it should incorporate external research that may contribute, on the one hand, for the expansion of the pathways to the market and, on the other hand, for the costs reduction.

The *modus operandi* is based on the systematic scan of the innovating ideas that are born at the start-up enterprises, and at the research units that are catalysed by the Universities. From this, it results that the enterprises that belong to a certain cluster may access to the finest research discoveries without providing much internal research of their own.

4. Clusters in the Cova da Beira Region (Portugal)

The clusters of the Cova da Beira region are classified according to two dimensions which are the traditional clusters (where the tradition and the know-how derived from the natural conditions of the geographical base are observed), and the emergent clusters (where a combination of technological competences, education, and human capital is observed).

The traditional networks in the Cova da Beira region are two dimensions, that formed by clusters. These are Agro-Food, Textile and Public Administration. In 1986, the regional potential for open innovation schemes and for the transference of knowledge was reinforced through the creation of the University of Beira Interior (UBI), which at the time offered graduation courses in the fields of Textile Engineering and Management.

UBI keeps supporting the traditional clusters through the development of several research activities, scientific areas and graduations that are offered. This institutional procedure has also provided the possibility of creating the necessary conditions for the emergence of new clusters such as Bioscience, Biotechnology, Multimedia, Tourism, and Health. These were all catalyzed by the core cluster and that is Knowledge.

In the context of the new institutional networks that aim the development of open innovation schemes, it should be emphasized that the Knowledge cluster plays an important role since it incorporates all the infrastructures, laboratories, research units, science and technology park, enterprises incubator, and the human capital of the UBI. These are used in open innovation activities that are developed in cooperation with entities that belong to the mentioned networks.

The Bioscience cluster arises from the possibility of the new enterprises, that are incubated by UBI, to develop new businesses related to any of the branches of natural science that deal with the structure and behaviour of living organisms. This cluster is especially important since it represents an alternative to the traditional industries, and that can contribute to the development of institutional networks among the pharmaceutical, biotechnology and healthcare industries, and to the raise of processes of product development, clinical trials and venture finance.

The Biotechnology cluster also involves the enterprises and the scientific research projects which develop different tools that make use of living organisms (or part of organisms) to create, innovate or modify products, to improve plants or animals, or to develop micro organisms for specific uses. Early biotechnology includes traditional animal and plant breeding techniques, and the use of yeast in making bread, beer, wine and cheese. But, modern biotechnology includes the industrial use of recombinant DNA and the cell fusion that can revitalize the traditional offer of the Agro-Food cluster through the creation of new competitive advantages such as new competences and new consumer conditions.

Only if the unique characteristics of the traditional agro-food and textile products are internationally promoted can the idea of creating a future Bio/Bio cluster be possible a scenario. They may be promoted through the attraction of new investments in the medical and pharmaceutical industries.

The Multimedia cluster also arises from the possibility of creating new businesses, that are incubated by the UBI, through the creation of societies that are installed in the local Science and Technology Park, and that produce multimedia contents in outsourcing.

The Tourism cluster has been recently reinforced by the creation or the expansion of new hotels and by the recuperation of the historical urban centres, and also by the creation of new units of Rural Tourism and Agro-Tourism which will certainly make the exploitation of the natural conditions of the Serra da Estrela profitable. The design of historic and gastronomic routes must also be emphasized. They create the necessary conditions to exploit the great potential of Cova da Beira in what concerns its natural, historical and industrial patrimony.

The Health cluster is related to the creation of both the Centro Hospitalar da Cova da Beira and the Medicine Faculty of UBI. Their medical and research activities are the basis for developing new industrial activities and services that are integrated in the mentioned Bio-Bio cluster. It is expected that the development of Medical Engineering (for example, the production of instruments of precision, prosthesises, and artificial organs) will expand the scope of the competences reserved to the full operation of the local Science and Technology Park.

However, there are many strategic infrastructures that need to be developed in the field of a new Mobility cluster. In this specific field, it is essential to upgrade the national and regional railway network. It is also crucial to build both an alternative high road to Spain, and a high road between Covilhã and Coimbra, including the tunnels of Serra da Estrela.

This is a core strategic question because, without a perfect mobility of the economic agents and of the productive factors, the proposal that is now presented is at least inconsistent. It involves a clustering scheme based on institutional networks that are catalyzed by joint actions performed by the central knowledge cluster and other related clusters which proceed to the implementation of open innovation schemes trough the design of cooperation mechanisms.

In the Cova da Beira region, the emergent Knowledge cluster, in which the University is a key player, should be faced as the catalyst of institutional networks that are designed in order to transfer new ideas and competences. They should be promoted through open innovation schemes established between the related clusters.

Take in Figure 2

According to the main aims of the Strategy of Lisbon enunciated by Gelauff and Lejour (2006), and taking into consideration the institutional networks that were identified in the clustering scheming previously presented, it should be emphasize that the clusters should implement the following strategic directives in order to reach operational synergies: (i) Development of Junior Academic Enterprises through the establishment of partnerships involving the UBI and some enterprises; (ii) Creation of operational programs to reinforce the Open Innovation Schemes (iii) Adoption of benchmarking tools, taking as reference the experiences of other related international clusters; (iv) Creation of articulated Competence Poles; (v) Support for launching trade marks; (vi) Dissemination of the use of Information and Communication Technologies (ICT) in the trade and distribution of the goods that are locally produced; and (vii) Participation in international and national networks.

5. Conclusions

The framework about clusters is increasingly explored by the different institutional agents that have responsibilities in the reinforcement of the competitive capacity of the regional influence area, through the planning of new productive specializations.

In the Cova da Beira Region, the University of Beira Interior (UBI) is a good example of a catalyst institution of knowledge clusters, since it plays a crucial role in the transference of technology and in the creation of open innovation schemes, which require the design of institutional networks that involve different scientific areas and embrace distinct entities located inside or outside the clusters.

In this sense, it must be stressed that the scheme of open innovation requires that ideas both flow out of the enterprise, in order to pull adequate targets for their monetization, and flow into the enterprise, by pushing new offerings and new business models.

The re-mapping of the existent clusters in the Cova da Beira Region is an indispensable exercise to plan the spatial concentration of traditional productive specializations in a strategic basis. These specializations include the agro-food, textile and the public administration and work in articulation with new productive specializations, especially the Bioscience and Biotechnology (Bio-Bio) cluster and other activities of innovative innovation that are developed by the Junior Academic Enterprises and the spin-offs located in the technological and science park.

The international map of Bio-Bio clusters is dominated by the U.S.A. and by an extensive roll of developed European countries. The geographical location and the human capital of UBI are competitive advantages that can make Cova da Beira an attractive region for the success of future investments, so much in the area of the bioscience as in the area of biotechnology.

In terms of the international research that is going to be developed, it is important to say that, after mapping the international Bio-Bio clusters, we will be able to identify examples of benchmarks and to celebrate future partnerships with other European Science and Technology Parks, industrial polygons or industrial districts. This way, an efficient scheme of open innovation can be improved trough the experience of the Brazilian, Spanish, French, and Finnish partners to develop bidirectional mechanisms of transference of innovating innovation.

In the prosecution of the schemes of open innovation, the universities should play their natural role of key player in the creation of multidisciplinary knowledge clusters. They should be participated, in an active way, by the entrepreneurs and the more representative industrial and commercial associations of the regional influence area.

In future researches, it is important to study different international cases where schemes of open innovation are adopted in order to evaluate the relation between this kind of schemes and the adoption of intrapreneurship practices by enterprises that are integrated in open innovation clusters.

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Figure 1 – Scheme of Open Innovation: Target Innovation Pull versus Development Push

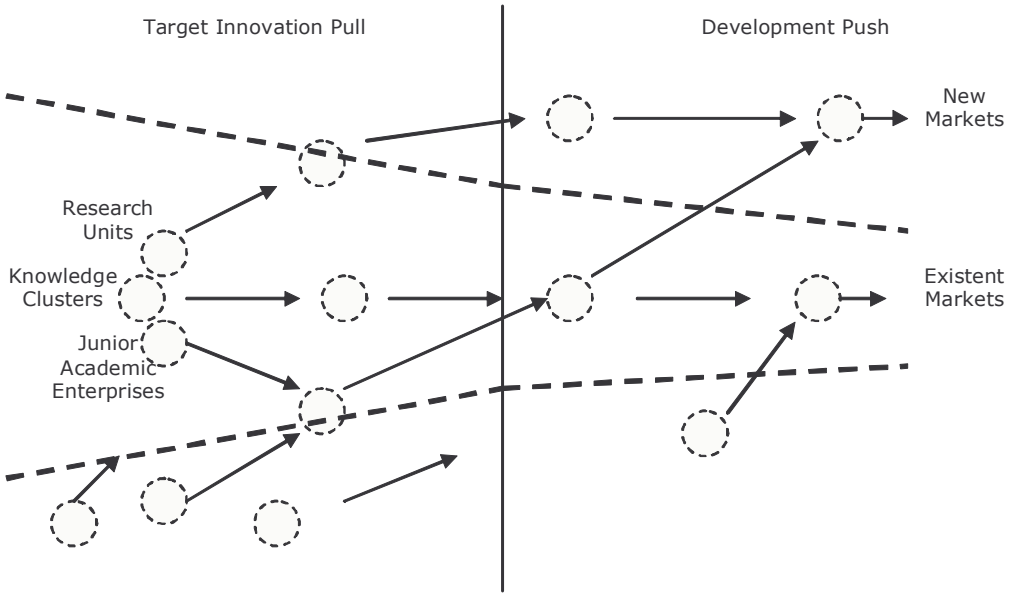

Figure 2 – Open Innovation in the Clustering Scheme of the Cova da Beira Region (Portugal)