The impact of collaborations between universities and private organizations on cluster development and competitiveness in Romania

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Abstract. While the European Union has put a lot of emphasis on cluster development due to their inherent advantages such as lower transaction costs, technological transfer and regional development, little is known about how clusters emerge and what can facilitate their competitiveness. This paper aims to study the impact of public-private cooperation between universities and organizations on cluster development and competitiveness. A literature review is employed to develop the model while 4 qualitative case studies provide the initial test of its validity. The analysis suggests that cooperating with research institutions impacts cluster development first through education of industrial staff, but also by developing innovation processes through the facilitation of the appearance of innovative ideas and also of knowledge sharing among organizations. The research has several implications both for organizations and for government officials. First of all, R&D and top management should actively seek to cooperate with research institutions both for training of their staff but also in seeking new ideas and as a way of collaborating with other organizations within the field without fear of losing competitive advantage. Second, government officials should try to create more incentives both for organizations (through for example tax returns) and for universities (extra funding or salary incentives) that can increase collaboration between these actors. This paper is the first one to assess empirically how cooperation with research institutions affect cluster competitiveness and development, especially within the developing region of Eastern Europe, Romania.

1. Introduction

During the enlargement of the European Union, projects were funded facilitating the integration of all states by creating cross-border areas through cooperation in industry, agriculture, education, culture, technology transfer, etc., in order to develop the component states, to equalize the level of technological advancement and the overall quality of life through sustainable and smart development.

In order to ensure good economical-social-political conditions for development, it is not enough to let natural conditions to act, but it is also necessary to ensure a top-down encouraging system of development by the means of legal and administrative rules. In this context, it was decided to facilitate the creation and development of economic clusters. These clusters lead to the development of geographical areas by the very existence of their operating system. It is generally acknowledged in
the specialized literature [1] that the new form of economic organization enables, from the beginning, the rising of the competitiveness and business efficiency of all participating companies. The way that these companies manage to become competitive and to contribute to the rising of the industrial development level of their region depends on the existence of a so called "triple helix" [2].

This is all the more important as economic activities in European Union countries already take place in some economic models that lead to interaction between clusters and innovation systems of processes of generation IV and V. Until now, five generations of models of innovation processes have been defined by literature [3], [4]:

- **Functionally integrated models (generation IV):** the model is built on the integration and simultaneous development of all levels of product innovation model instead of sequentially evolution. These models involve complex business processes, feedback and mutual relations between marketing, research, development and distribution departments of innovative companies with other companies even with competitors.

- **System integrated models (generation V):** a complex overall design integration model of systems and organizations by forming innovative networks, customer units, universities, suppliers and other industrial companies and local communities, a combination of innovative technologies for solving problems of high complexity of new products by working within a network involving the use of CAD/CAM software, performance through simulation modeling, the use of rapid prototyping systems-expert, by the mean of concurrent flows that occur both in the sense of crossing streams and competitive flow between them.

The actual development levels of societies in different countries in EU can be seen as especially the fourth and fifth generations of models of innovation. So, those societies should be in a close relationship with industrial clusters in order to accelerate the development of a certain region. Therefore, problems of regional development should also be solved by increasing the innovation level in that area. A basis study of the development of clusters in the North-West of Romania was made in [5]. In these study some possible potential links between competitiveness of the cluster-type economic agglomerations and systems of innovation process in the North-West of Romania were analyzed. The idea was that, in order to accelerate the development of society, a solution would be to take advantage of the similarities between the two networks: the innovation processes and the one created by the clusters that arise.

In the frame of such similarities of networks, making more complex ties between the universities (as research entities and also as educational sources to ensure the quality of technical and economic education of the specialists working in the field of interest) and businesses (as places where innovation processes are brought to life) should be efficient in the evolution and development of that clusters. From this point of view, this paper aims to study the impact of public-private cooperation between universities and organizations on cluster development and competitiveness. This paper is the first one to asses empirically how cooperation with research institutions affects cluster competitiveness and development, especially within the developing region of Eastern Europe, Romania.

2. Methodologies
Specific clusters incipient economic relations in North-Western Romania have emerged due to the existence of particular geographical, economic and personnel conditions in the area. To highlight that, four qualitative case studies have been deployed in order to provide the initial theory of its validity.

The study was conducted in the form of recorded interviews face-to-face with decision makers from four companies that operate in the area of Baia Mare.

One of the companies is working in the field of thermal rehabilitation of industrial and civil buildings, but has the ability to carry out activities also in the design of mechanical equipment such as processing of ores and non-ferrous metals. Another company is active in designing mechanical
machines in a wide range of industries and is part of a panel of collaboration with other similar units for design and execution of equipment and services in achieving the idea of "turnkey business". The next company is a subsidiary of a European trust working as regards the production of packages. The last company, operating in the IT industry, is part of a specific cluster in the North-West of Romania.

These are enterprises with activities that can be included in the scope of research/technology development, exchange of technologies and introduction of technical progress. These units were selected for study because their areas of activity are very different, both in purpose and in type of industry, but all have preoccupations in innovation/new technologies, while having the tendency to group into the preceding-cluster economic structure type.

Interviews were conducted based on a questionnaire as in Table 1.

| Table 1. The questionnaire used on the study |
|---------------------------------------------|
| 1. How many R&D & technical staff do you employ? |
| 2. What type of learning mechanisms do you use? Do you scan the market for trends, and new technologies? If yes, how? |
| 3. Why have you started cooperating with the university? How did the idea first come up? Did you think of any inherent advantages in starting to cooperate with the university? |
| 4. How was the cooperation? What was good and what was bad? |
| 5. Did you experience any advantages of the cooperation after the fact (more knowledgeable workers, easier to come up with new ideas, easier to get new ideas accepted in the organization)? |
| 6. Do you work with any other firms that cooperate with universities? |
| 7. If yes, how is the cooperation in comparison with other companies? |
| 8. If no, why not? |
| 9. Do you know if any of your competitors are cooperating with universities? Elaborate on what do you know about this? |
| 10. Are you part of any business networks? Do you engage in joint R&D with other firms? |
| 11. Do you see any agglomeration patterns in your industry? Geographically? |
| 12. If yes, why do you think this is happen? |
| 13. If no, what do you think can create it? |
| 14. Do you see any way in which the government/government policies support or impede the creation of clusters in your industry? |
| 15. Do you see any way in which the government/government policies support or impede the collaboration between firms and universities? |
| 16. Do you attend local industry seminars? Why? Do you know of others in your organization that do? |
| 17. Do you hire local graduates? What do you think of them in terms of: on the job knowledge, knowledge of trends in industry, ability to think innovative, ability to come up with new ideas? |

3. Results

The responses were generally framed in the following topics.

1. How many R&D & technical staff do you employ?
A weak in R&D and technical staff unable the companies to absorb scientific and technical research results and technological transfer products [6], [7]. Technical staff account from few (6 persons), for about half (46 persons), to even all of the structure of employees. Most employees have technical skills and provides support activity in the field. In one case the R/D component is represented even by a research/development and training department, who ensure the dissemination of research results and the development of technical personnel.
2. What type of learning mechanisms do you use? Do you scan the market for trends, and new technologies? If yes, how?

The current learning activities are summer practice for students, that contribute to diminish the gap between the theoretical knowledge acquired by students in the university and the concrete practical knowledge that companies need of their employees. Other activities are scholarships, lifelong learning, courses based on resources on-line. This can be seen as a learning mechanism due to the capacity of students to bring in new knowledge from the university realm.

Regarding the scanning the market for trends and new technologies, the current main activities are involving departments of R&D that participates at events, internal workshops, seminars, courses, conferences organized by relevant actors/technology leaders, where relevant technologies in areas of interest are presented. Also, there are cases of partnerships with already existing clusters in the region, also e-learning training, job-shops and meetings between students and businesses organized by university, etc.

Other mandatory information sources for technology transfer and introduction of new technologies are the library patent consultation of the State Office for Inventions and Trademarks (OSIM), companies catalogs, web pages (Space-Net).

In one case the research themes are coming from the headquarter of the company from abroad, where the clients are also in concordance with needs of European markets.

This showcases that these companies, even though they don’t have very advanced or purposeful mechanisms in place, they do engage in learning especially through networking and hiring students temporarily.

3. Why have you started cooperating with the university? How did the idea first come up? Did you think of any inherent advantages in starting to cooperate with the university?

For one of the companies collaborating with the university as a shareholder was mandatory condition for a project with EU funding, to establish an engineering design unit commercialized for profit, to be an active network of local business units.

Also, the need for qualified personnel helped identify a new option for cooperation - organizing summer internships for students. Throughout time, the relationship with the university developed and became more complex, initiating joint research and development initiatives, with funding under the National Investment Program, and thereafter a framework for continuous cooperation in the field of fund raising for research was established.

This approach, currently in the initial stage, generates optimism because the relationships became more intense by the means of the company itself who was invited to join the Advisory Board of the University, which aims to develop cooperation with business environment and to adapt education to labor market requirements.

This showcases that companies initially decide to cooperate with universities due to a severe lack of qualified personnel and this materializes either by generally employing temporarily (internships) or permanently students or graduates from the university or by directly engaging with the university on projects [8].

4. How was the cooperation? What was good and what was bad?

The respondents described that the university showed openness to the business, and cooperation was very well conducted both at the institutional level (management) and across team activity, in that specific projects (practice, competitions, funding applications) have had support from the university management team and active involvement of academics.

There have been important actions like cross border projects based on EU funds, establishing occupational standards at national level (CAD/CAM operators), distribution of computer software products, training in computer-aided design based also on EU funds.
Cooperation in organizing summer practice sessions, granting scholarships, organizing competitions and events was also very good, and communication was fast, direct and effective.

In many cases the university have had the initiative of starting the cooperation in domains mentioned already.

One respondent insisted on an idea to institutionalize relations between universities and industrial units in order to develop the emerging structures.

One unsuccessful event was described relating to the writing of the grant application within the National Program of Innovation, due to a very late identification of opportunity and the extremely short time in which it was prepared. From this experience resulted an agreement of mechanisms for future cooperation, and to try to materialize this type of collaboration at every opportunity.

5. Did you experience any advantages of the cooperation after the fact?
The respondents agreed on an openness from academics in order to adapt course content to the needs presented by company. Scholarships offered by companies with the cooperation of university had also a positive impact on the company's image among customers and fellow companies community.

The companies also appreciated the higher-skilled are university graduates for knowing the language requirements of advanced CAD / CAM.

6. Do you work with any other firms that cooperate with universities?
7. If yes, how is the cooperation in comparison with other companies?
8. If no, why not?
Generally, the companies are in economic relations with other companies that cooperate with universities.

There is not a significant difference between companies that cooperate with the university and other companies.

9. Do you know if any of your competitors are cooperating with universities? Elaborate on what do you know about this?
Direct competitors collaborates with universities, mainly in the aspects as organizing internships, courses and competitions, obtaining financing for research and development and other projects financed with EU funds, and organizing of joint workshops and conferences.

10. Are you part of any business networks? Do you engage in joint R&D with other firms?
One of the companies interviewed is a member of an industrial cluster specific for its industry. Within the cluster there is openness to perform joint research activities, mainly through the identification of common sources of financing to cover the costs of joint research. It is possible also to attended business meetings, joint training (technical and software skills). A participation was declared also in a project funded by the European Space Agency.

Respondents are aware of the existence of collaborations between university and a variety of industrial units whether they work together or not.

All of the interviewed declare collaborations in the frame of Chamber of Commerce of the region.

11. Do you see any agglomeration patterns in your industry? Geographically?
In general, respondents were quite optimistic regarding spotting the signs of cluster formations in the region. The IT industry was presented as one of the most open structures such as cluster aggregation. In terms of geographic aggregation, today there are two relevant regional entities: Romanian Association of Electronic and Software Industry, and a cluster-type structure iTechTransilvania based in Cluj Napoca which is trying to expand its coverage. There are also preliminary discussions,
including the interest being expressed by local authorities, to build an association at Baia Mare for the IT industry.

In the design and manufacture of mechanical products industry, *TransMechWorld* was identified as an industry association, with companies from the Noth-West zone of Romania. Collaborations tend to turn into panels collaborative projects providing turnkey approach to customer strategies, etc. Collaboration on mechanical, electrical engineering and CNC machining are also existing among industrial unities in the region.

12. *If yes, why do you think this is happen?*

The reasons to clustering that the respondents identified were:

- Funding joint opportunities for this type of structures
- Sharing access to larger contracts or projects that exceeds the capacity of only one company
- Identifying common interests themes and support in relation to local or central authorities
- Reducing the cost of training/life learning of staff, in technical or soft skills
- Satisfying the need for belonging to the community
- Image benefits
- Friendly environment in region
- The level of development of existing relations and technical activities in the area due to the area's industrial traditions

13. *If no, what do you think can create it?*

Even though the companies agreed that agglomeration and clustering was taking place, they did identify some potential factors that might accelerate and enhance the process:

- Enhancing the added value
- Developing of panels of collaborative projects
- State financial and legal support to facilitate the structuring of collaborative panels of existing businesses in the area, and between them and the university.

14. *Do you see any way in which the government/government policies support or impede the creation of clusters in your industry?*

The respondents consider that usually the process of clustering flows naturally, supported by available funding, and does not require government intervention. Also, possible clusters artificially created by government intervention could create a division from the initial purpose, with a dilution effect on the goals.

The respondents consider that the involvement of universities as partners in clusters is beneficial because it brings a distinct vision to that of the economic actors.

One of the interviewees presented the fact that they were engaged in proactive cluster development through concrete stages: “initiating community cluster aggregation, joint training, implementation of common initiatives, research, product development, shared services in advanced stages of maturity”.

Some of the respondents agreed that the university can act as a catalyst in all stages on the development and evolution of a cluster.

The respondents consider also that a cluster, specifically an innovation cluster, must be oriented towards economic objectives.

Good opportunities to enlarge the players that can contributes to a cluster forming are students start-up companies, technological incubators, financing facilities. In order to ensure those opportunities, the government can play a positive role through its policies.

15. *Do you see any way in which the government/government policies support or impede the collaboration between firms and universities?*
The triple helix model is a theory that has proved the truth [9]. It proved to be necessary to elaborate a package of legislation to encourage the creation of economic clusters and protecting intellectual property in order to facilitate technology transfer [10].

The main policies through the government can support cooperation between businesses and universities as presented by the respondents are:

- Research funding toward universities that can support the needs of business.
- Adjustment of tax legislation to facilitate the uptake of research by graduates and businesses by providing incentives to companies who purchase research
- Expanding financing lines with joint projects university-companies in the type POCU operational programs at the expense of funding for mass training, which proved to be useless in the 2007-2013 period.

16. Do you attend local industry seminars? Why? Do you know of others in your organization that do? Companies participate in events organized in the specialized fields and those organized in related fields of business meetings, seminars, workshops. Participation in such events bring benefits both in terms of image and a better understanding of potential partners, competitors, technologies and tools available, etc.

17. Do you hire local graduates? What do you think of them in terms of: on the job knowledge, knowledge of trends in industry, ability to think innovator, ability to come up with new ideas?
The company hires local graduates. Most of them have participated in internships or summer or worked part-time during their studies. Thus, when hiring, graduates have to have a minimum of practical knowledge needed in the workplace. Awareness of trends in the industry, speaking in a highly dynamic industry sectors, depends on manifests of personal interest continuous professional development. Creativity and innovative thinking ability are still visible as personal skills, less trained, practiced or encouraged in schools (universities) technical. Again, as a solution, the companies see the involvement of industries in joint programs with universities.

4. Conclusions
The analysis suggests that cooperating with research institutions/universities impacts cluster development first through education of industrial staff, but also by developing innovation processes through the facilitation of the appearance of innovative ideas and also of knowledge sharing among organizations.

Initial clustering and agglomeration occurred in the region to its geographical and economical advantages for the organizations. However, the cluster cannot survive, let alone develop without proper access to qualified employees, especially in innovation focused industries. The critical role of universities is therefore, to facilitate the access to qualified personnel through various means. From this point of view, in the opinion of interviewees, the presence of an university in the area was an essential factor for the setting up of clusters and positive development by offering a solution to the employment of divers technical and economic and managerial staff. One problem is that all businesses in the area are competing for the same specialists and the demand is greater than supply.

Another factor favoring the emergence of trends towards cooperation between enterprises on clustering is the elaboration of more complex projects, including the mentioned university research contracts, collaboration with university in accessing funding [11].

A general tendency is to consider as primary importance, in order to institutionalize relations between universities and industrial entities that work with transfer of technology, technological and science research results, is for the government to elaborate a package of necessary laws.
5. Implications
The research has several implications both for organizations and for government officials:

Implications for universities as research unit and educational one:
- Adapt the educational program to the needs of business;
- Develop a system of collaboration with business in order to access funding from EU and/or National programs for transfer of technology and science and technological research;
- Promote the innovative ideas, develop innovation processes
- Encourage knowledge sharing among firms;

Implications for business (companies):
- To search for relationship which involve financing cooperation contracts with the university
- Create joint teams to work together with the university to access funds for research and technological transfer;
- Identifying common interests themes and support in relation with other units on the business environment market.

Implications for government:
- Adjustment of tax legislation to facilitate the uptake of research by graduates and businesses by providing incentives to companies who purchase research;
- Research funding towards universities that can support the needs of business;
- State financial and legal support to facilitate the structuring of collaborative panels of existing businesses in the area, and between them and the university;
- Government subsidies for economic research required to favor possible future cluster structure.

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