

# **WORK AND EFFECTS OF RESEARCH AND TECHNOLOGY ORGANISATIONS ON REGIONAL DEVELOPMENT – APPROACH OF A NEW MEASURING AND DESCRIBING METHOD**

*Fabian Schenk<sup>1</sup>, György Kocziszký<sup>2</sup>*

<sup>1</sup>M.A., <sup>2</sup>Prof.

<sup>1</sup>*Fraunhofer Institute for Factory Operation and Automation IFF Magdeburg*

<sup>2</sup>*University of Miskolc, Faculty of Economics, Institute of World and Regional Economics*

## **INTRODUCTION**

Research and development (R&D) plays an essential role in the economic development of countries and regions. In comparison to other European countries, Germany is the driver of the R&D of the EU. The landscape of German R&D is split into universities (basic research), research and technology organisations (applied research) and industrial research. The focus of this article and the ongoing study is on the research and technology organisations (RTOs) and on measuring and describing their impacts on regional development. This article reviews some approaches used to analyse the impact of research facilities on regional development and growth and show an approach for developing a new measuring and description method for the influence of a research institute. Institutional activities, particularly knowledge production such as testing, experimenting, applied research, and technology development have substantial effects on a lot of regional aspects, especially when the region is structurally not that strong.

## **TYOLOGY OF RESEARCH AND TECHNOLOGY ORGANISATION FUNCTIONS**

The contributions of research and technology organisations (in the following: RTOs) to the regional development and social functioning have some aspects in common with the contributions of universities. As mentioned above, universities are the primary public producers of knowledge and responsible for basic research. They play a central role to accumulate knowledge and to create human capital [1]. The traditional understanding of universities is to perform three basic functions: research, education and learning and providing services to the community under conditions of institutional autonomy and academic freedom [2]. The university has come to be regarded as a place of education, an area of scientific research, cultural, artistic and reference pillar integrative approach: university – administration – community made up of economic and social actors [3]. Four mechanisms by which universities can contribute to regional development: (1) enhancing their regional innovation through research activities; (2) promoting enterprise, business development and growth; (3) contributing to the development of regional human capital

and skills; (4) improving social equality through regeneration and cultural development [4]. The role of universities in local and regional development is: (1) the creation of knowledge through advanced research and technologic transfer; (2) the transfer of knowledge towards society through education and the development of human resources; (3) the cultural and civic development of the community, which can generate optimal conditions for innovation [5].

In contrast to universities, RTOs employing the university graduates and try to connect their acquired knowledge with the mission, goals and applied research topics. In many cases the career of a future employee of a research institution starts during his study with a job as a scientific assistant. The European Association of Research and Technology Organisations (EARTO) define RTOs as organisations “which as their predominant activity provide research and development, technology and innovation services to enterprises, governments and other clients” [6]. The basic rationale for RTOs “is to perform some of the essential functions of national or European research systems that they are better fit to perform than other R&D players (enterprises and universities) in terms of quantity and quality, reliability, stability and accountability. Thus, in a general sense, RTOs are a response to perceived actual or potential market or systemic failures.” [7] The characteristic functions of RTOs are (A) fundamental/strategic research, (B) technological support to economic development, (C) supporting public policy, (D) technical norms, standards, (E) constructing, operating and maintaining key facilities [7]. A Research institution has also the functions of licensing inventions and engaging in collaborative research projects with the private-sector industries [8] [9] and governmental authorities. Important to say is that “RTOs do not compete with universities; RTOs partner with universities. (...) The skills of RTOs and universities are complementary, their relationships synergistic, mutually beneficial, long-term” [6]. Because of the similarity it is possible to use the eight different functions of modern research universities [10] for the functions of RTOs. The functions are: (1) creation of knowledge; (2) human-capital creation; (3) transfer of existing know-how; (4) technological innovation; (5) capital investment; (6) regional leadership; (7) knowledge infrastructure production; and (8) influence on regional milieu.

The functions can be equated with the outputs of a research institution and affect the regional development directly or indirectly. Effects like the creation of new firms, the increase of regional creativity, sustainable development and economic growth, obtaining productivity gains [11], stimulating city districts, and creating regional identity. A hypothesis can be that people are moving into regions because of a university; they are staying as a scientist in the area because of the research institutions.

To avoid misunderstanding, it is worth specifying the outputs in more detail. The creation of knowledge relating to research institutions means professional development and adopting the knowledge in continuously changing tasks. If the research institution is (fully or partly) funded by the state, the acquired knowledge has to be an added value for the society. Human-capital creation is only tacit knowledge and connected to the people. The improvement of the intellectual and technical skills is a main goal for a research institution; the output continuously increases the scientific standard of the infrastructure. Existing know-how can often be transferred and utilized somewhere else in deviating situations. Transferring activities are possible between sectors, organizations, or individuals. The difference between the transfer of existing know-how and technology transfer is the intention to create and commercialize a new product, process, or service. In the case of research institutes, capital investment means to construct, to maintain and to expand buildings, laboratories, technology centres or other facilities or rather infrastructures. "Knowledge infrastructure can be defined as the stock of knowledge together with the institutional and organizational components that support its growth and application." [12] On the regional scale, knowledge infrastructure extends beyond public and private knowledge-producing institutions and the network of connections among them." [11] The last output, influence on regional milieu, is often not easily measurable. It is a side product of the research institutes' presence and work. The environment is influenced in a social, a cultural, an intellectual, and a reputational way.

## WORK AND EFFECTS OF RESEARCH AND TECHNOLOGY ORGANISATIONS ON REGIONAL DEVELOPMENT

The title of this article reveals the intention of a new approach for measuring and describing the impacts of RTOs. Regarding to the types of impact studies, this approach can be classified into the single-case studies, but will have elements of a survey. One of the main differences is that this approach considers quantitative and qualitative data for assessing the impact of a research institute. The other main difference is to develop new indicators for the regional influence.

This study is answering the following questions:

*What is the model/procedure of this study?*

*Do the project characteristics and the industrial revenues have changed?*

The reason of measuring the impact on the regional development is the 25th anniversary of the analysed research institute. After the fall of the Berlin Wall and the reunion, a lot of research institutes were founded in East Germany. Nowadays, the public structure of this part is well established, but the research and development standard is on a low level. The

small-spatially of the economy, with a lot of small and medium sized companies (SMEs), transfers because of the lack of resources the task of research and development to the located institutions. This is proven by the EARTO “often they [the SMEs] lack the necessary technical competence; often the costs [of R&D] are simply unaffordable.” [6]

Regional development aspects are analysed in the Sustainability Report of the research society (the considered research institute is part of the society and the society is a RTO) within the term of sustainable location development. The institutes are classified as a locational advantage for a competitive industry and for attracting other companies. All institutes are working with the same model of performance-based core funding by the state and independent reinforcement funds of the executive board. Thereby, the political will is codified and the society obtains their flexibility to react on the constantly changing framework in science and on the market. An intensive cooperation with universities, the regional cross-linking with the economy and the know-how of the existing research institute is the strategy of the research society to have a sustainable location development. The adjusted model is shown in the next figure (see Figure 1).

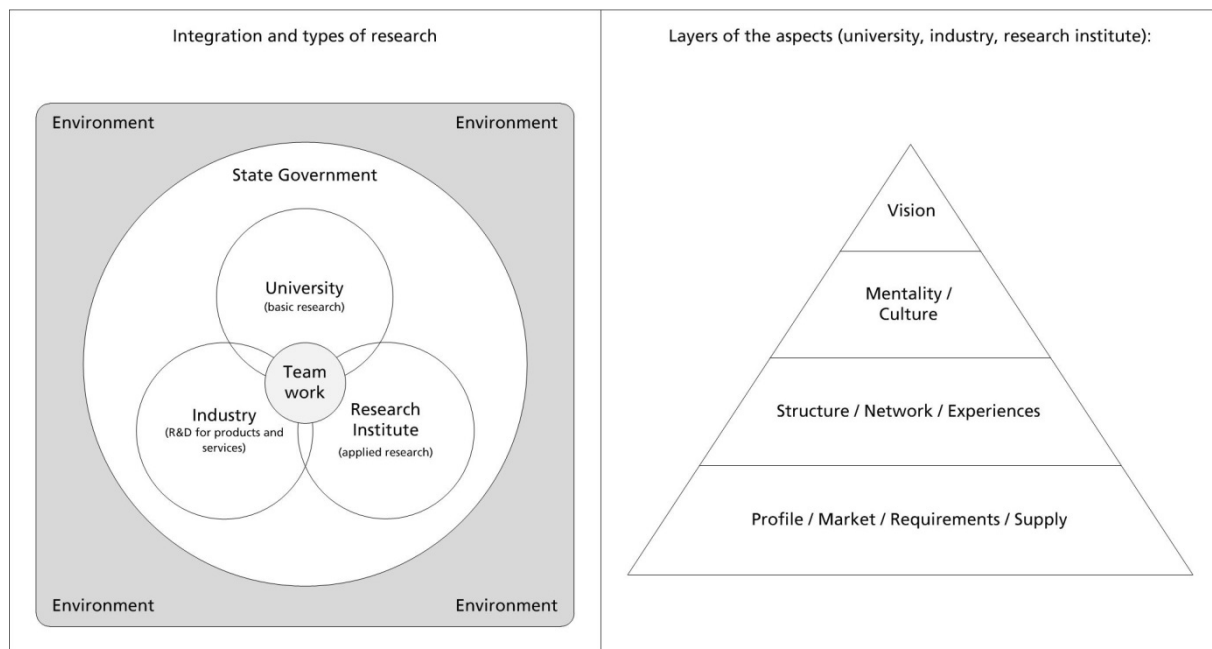


Figure 1: Integration and types of research, layers of aspects

*Hypothesis: The project characteristics have changed over the years.*

To prove this presumption projects are classified into types of innovation (according to [13]). The classification of projects will be discussed with some selected regional partners. These types of innovation are shown underneath.

Table 1: Types of innovation

<i>Type of innovation</i>	<i>Forms</i>	<i>Description</i>
Product innovation	Substitutive innovation	
	Value added innovation	demand-driven renewal and optimization of products and services
	Application innovation	
Process innovation		renewals in the performance process
Market innovation		to make a product or service available on the market for the first time
Social and organizational innovation	Social innovation	
	Organizational innovation (or structural innovation)	changes in the organization, human resources or field of laws

Furthermore, the data of the region (federal state) was investigated. The focus is on the data of clients or partners and their development in the same time period. Again, there is a gap between the data in general databases and the real numbers. For example the information about the clients or partners differs from the database of the society to the given information on companies' websites (operation revenues, allocation to industries, number of employees, development of these figures). That's why the control expenditure is very high and the considerations are how to reduce this expense. The last sub step is to collect data in connection to the institute and region. Following the previous data collection, the object of this investigation is to calculate the direct effects of demands (side of inputs), and the direct impacts of outputs. Direct effects of demands can be calculated from the staff expenditure, material expenses, construction expenditure and consumer spending. The considered direct impacts of outputs are number of spin-offs and the access of young graduates as employees in comparison to the leaving of older employees.

The second step is to verify the data. Especially the data of the clients has to be proved. Therefore, we are still developing a questionnaire to realize correct data.

Evaluating the gained information is the third step of the analysis. Thereby, the number of projects during the years is calculated. The shortened and anonymized version of this statistical evaluation is presented in the Figure 3. The focus here is on the project partner in the same federal state like the research institute and in the number of projects starting in the respective years.

	Projects with the research institute																										
Client Name	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	total	
Client 1							1	2				2		1	1	1		1				1	1			11	
Client 2						4	7	6																		17	
Client 3	1		2	1	3	2	4	5	2																	20	
Client 4																			4	1	1	3	4	4	3	20	
Client 5						1		1	2	1	1				2						1	2	1	1		13	

Figure 2: Projects with the research institute

Obviously, there are project partners which are almost cooperation partner the whole time. Some others were predominant partners in the past and some in the last years. A more detailed analysis is to look into the project duration of every partner over the years to realize an exact period of time in which the research institute and the partner have worked together. An exemplary presentation of one partner and his project durations over the time is demonstrated in the following Figure 4.

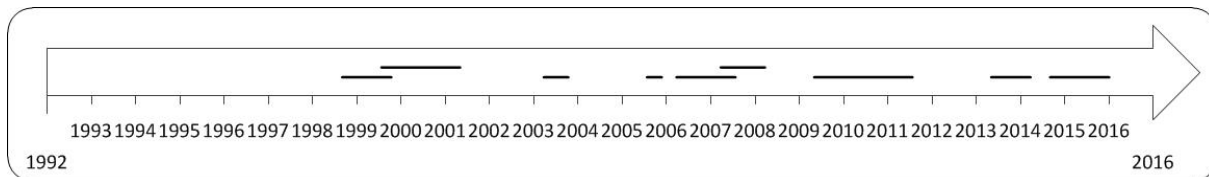


Figure 3: Timeline of projects of one project partner

## CONCLUSION AND OUTLOOK

With this study some regional development impacts of research and technology organisations are demonstrated. RTOs are mostly non-profit organisations but the income and the importance for the region cannot be denied. Hypothesis like “The project characteristics have changed over the years.” was verified; “The industry revenues per year have a constant minimum.” was not confirmed.

In the coming months the study will be continued and the number of variables could be updated. The described model will be used to group the detected variables. With the help of regional industry partners it is also tried to collect some stories and episodes which they connect with the institute and the regional development.

## REFERENCES

- [1] BONANDER, JAKOBSSON, PODESTA, SVENSSON: **Universities as engines for regional growth? Using the synthetic control method to analyze the effects of research universities.** *Regional Science and Urban Economics* 60, 2016, p. 198-207.
- [2] UNESCO: **Communique: 2009 World Conference on Higher Education: The New Dynamics of Higher Education and Research For Societal Change and Development.** Paris: World Conference on Higher Education 2009, 2009.
- [3] ALBULESCU, ALBULESCU: **The University in the community. The university's contribution to local and regional development by providing educational services for adults.** *Procedia – Social and Behavioral Sciences* 142, 2014, p. 5-11.
- [4] EUROPEAN UNION. **REGIONAL POLICY: Connecting Universities to Regional Growth: A Practical Guide.**  
[http://ec.europa.eu/regional\\_policy/en/information/publications/guides/2011/connecting-universities-to-regional-growth-a-practical-guide](http://ec.europa.eu/regional_policy/en/information/publications/guides/2011/connecting-universities-to-regional-growth-a-practical-guide), Access: 25/01/2017, 2011.
- [5] GODDARD: **The engagement of higher educational institutions in regional development: An overview of the opportunities and challenges.** Valencia: OECD/IMHE International Conference, Globally Competitive, Locally Engaged – Higher Education and Regions, 2007.
- [6] EARTO: **Research and Technology Organisations in the Evolving European Research Area.** Brussels: Status Report with Policy Recommendations, European Association of Research and Technology Organisations, 2007, p. 3-7.
- [7] EURAB: **Research and Technology Organisations (RTOs) and ERA.** Final Report, European Research Advisory Board, 2005.
- [8] THANKI: **How do we know the value of higher education to regional development?.** *Regional Studies*, 1999, 84-88.
- [9] GLASSON: **The widening local and regional development impacts of the modern universities: An application of input-output analysis.** *Planning for Higher Education* 18, p. 51-64.
- [10] GOLDSTEIN, MAIER, LUGER: **The university as an instrument for economic and business development: U.S. and European comparisons.** In: D.D. Dill & B. Sporn (Eds.), *Emerging patterns of social demand and university reform: Through a glass darkly.* Oxford, UK: Pergamon, 1995, p. 105-133.
- [11] DRUCKER, GOLDSTEIN: **Assessing the regional economic development impacts of universities: A review of current approaches.** *International Regional Science Review* 30, 2007, 1: p. 20-46.
- [12] SMITH: **Economic infrastructures and innovation systems.** In: Edquist (Ed.), *Technologies, institutions and organizations.* London: Frances Pinter, 1997, p. 86-106.
- [13] STUMMER, GÜNTHER, KÖCK: **Grundzüge des Innovations- und Technologiemanagements.** Wien, 2010, p. 14-16.