University of West Hungary
Faculty of Economics
István Széchenyi Management and Organisation Sciences Doctoral School

EXAMINING THE INNOVATION ACTIVITY OF SMES
IN WESTERN-TRANSDANUBIA AND BURGENLAND

Thesis of Doctoral (PhD) Dissertation

Author:
Gábor Keresztes

Supervisor:
Prof. Dr. Csaba Székely DSc.

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Doctoral School: István Széchenyi Management and Organisation Sciences Doctoral School

Head of Doctoral School: Prof. Dr. Csaba Székely DSc.

Programme: Entrepreneurial economics and management program

Head of Programme: Prof. Dr. Csaba Székely DSc.

Supervisor: Prof. Dr. Csaba Székely DSc.

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Supporting Signature of Supervisor

1. REASONS FOR CHOOSING THE TOPIC, OBJECTIVES, HYPOTHESES

1.1. Justification of the topic and its importance

In recent years, the study of the innovation processes has become a priority area in the academic world and the economy alike. It is not a coincidence, for their actors have recognised that taking into account and applying innovativeness is a prerequisite for long-term and sustainable development. The states, international organisations and the leaders of the economic life have changed their attitude and have begun to pay attention to the processes of research and development. Apart from them, society members - the average consumers – have also recognised the importance of having access to the benefits of innovation, because it increases their standard of living. This topic is particularly important at the beginning of the 21st century, when knowledge-based societies have gained significance and knowledge has become one of the most valuable capital assets.

One of the main motivations behind the research is that even though a number of comprehensive impact studies are being prepared about the innovation processes, a vast majority of these innovation researches focus on a specific macroeconomics, region or sector, rather than on the examination of regional innovation systems or results of different countries or the examination of the economic players. Comparing disparate regions of a specific country is also typical, but there is less emphasis on contrasting the innovativeness of the SME sector in neighbouring regions of different countries. Understanding the innovation processes and demonstrating the complex results that can be implemented at a practical level in everyday life is of special importance for the SME sector and with that, for the entire economy. Other reasons for choosing Burgenland and Western-Transdanubia for my investigation are the common historical background and the co-operational opportunities and constraints stemming from their geographical location.

The research was also spurred by the fact that the domestic literature about the Austrian R&D&I (Research, Development and Innovation) sector is rather scarce. Yet, the topic may well be of interest, because there is hardly a Hungarian researcher who pays special attention to the innovation performance of the neighbouring state. Another motivating factor during the investigation was the aspiration of the European Union to create an Innovation Union by 2020. One priority of this objective is to improve the innovation performance of the SME sector and to foster SMEs; therefore, I think that the research will be of use for the monitoring processes of this sub-goal and its results could be used by decision-makers.

A further motive of the research is more of a personal nature: at the beginning of my doctoral studies, as a Sopron provincialist, I wanted to have a more detailed picture of the innovation status of Austria -and the neighbouring Burgenland in particular - being a country which is considered to be an exemplary model for Hungary in several respects.

1.2. Objectives and tasks

The main objective of the dissertation is to provide a complex comparative analysis on the innovation processes of the SME sector of Western-Transdanubia and the region of Burgenland, by discussing the major components of the Hungarian and the Austrian innovation systems and comparing the primary results of the two regions.

A further objective of the thesis is to use the research results to serve the Hungarian scientific and economic life and to give direction with regard to the further development of the innovation output of the Hungarian SME sector.

After the introduction, the thesis offers an overview of the relevant specialist literature complemented by my own opinions, whereby the theoretical approaches to innovation are typically presented from the side of economic and management sciences. This chapter is intended to clarify the concept of innovation, to provide a complex analysis of other relevant approaches and models, to describe the actors of the R+D+I process and to go over the internationally accepted measurement methods .

The purpose of the subsequent parts of the thesis is to present and analyse the secondary and the primary data. The demonstration of the methods used is followed by a systematic presentation of the secondary data and the presentation of the conclusions that can be derived from them. The following chapter is devoted to describe the results of the primary research, by way of a statistical analysis based on the responses of companies surveyed in Western-Transdanubia and Burgenland. This chapter ends with the examination and assessment of the hypotheses.

The last sections of the dissertation are intended to describe the new and novel scientific theses and results drawn from the research representing its essential part. This is followed by conclusions and recommendations for the different sectors, drawn from the experiences gained during the research and the results that had been processed. The last section summarises the most important achievements of the dissertation and the possible future

research directions related to the topic. The dissertation ends with acknowledgements, bibliography, references and the annexes.

1.3. Research hypotheses

H1: In case of the companies analysed, innovativeness is influenced by the geographical location and companies examined in Burgenland are more innovative than the companies examined in Western-Transdanubia.

H2a: In case of the companies examined in Western-Transdanubia, the probability of innovation activity increases together with the size of the company.

H2b: In case of the companies examined in Burgenland, the probability of innovation activity increases together with the size of the company.

H3: In both regions, the younger a company, the higher the probability is that it is engaged in innovation.

H4a: In both regions, the companies examined consider innovation important in order to increase their revenue.

H4b: In both regions, the companies examined consider innovation important in order to reduce their costs.

H4c: In both regions, the companies examined consider innovation important because of prestige.

H4d: In both regions, the companies examined consider innovation important in order to become more widely known.

H4e: In both regions, the companies examined consider innovation important in order to stay competitive.

H5a: Those companies examined in Western-Transdanubia that regarded their overall economic situation as being above the average are more innovative than those, which considered it to be average or below the average.

H5b: Those companies examined in Burgenland that regarded their overall economic situation as being above the average are more innovative than those, which considered it to be average or below the average.

H6a: Companies examined in Western-Transdanubia and having a higher proportion of graduates are more likely to be innovative than those with a lower proportion of graduates.

H6b: Companies examined in Burgenland and having a higher proportion of graduates are more likely to be innovative than those with a lower proportion of graduates.

2. RESEARCH PROCESS AND METHODS

2.1. Background and process of the research

The researches on the topic of the dissertation began at the start of the doctoral training by an in-depth studying of specialist literature about innovation and the integration of such material. I could carry out some targeted basic and applied researches almost right from the start, because at that time, I was involved in several research projects. In the course of one of these projects, a comprehensive study entitled: *„Increasing cross-border co-operation between the companies and educational institutions of Western-Transdanubia and Burgenland"* was written. The study was commissioned by the National Employment Service in the frameworks of the EURES-T-Pannonia project „Network of HR managers" (project phase 2011) and was prepared in co-operation with the Empirica Economic and Social Research Institute Ltd. for the Austrian Industriewissenschaftliches Institut.

Taking part in the research project *"Innovation position of the cross-border region from the aspect of joint RDI capacities in the agro-food sector at the geographical area of the Inno-cropFood project"* on behalf of the South-Transdanubian Regional Innovation Agency (DDRIÜ Nonprofit Kft.) helped me further to become more actively involved in researches on the topic. The tender was announced in the frameworks of HUHR/1001/2.1.3/0001/01 for European Union External Actions, HU-HR IPA CBC Programme and was submitted early 2013.

I was involved as co-author in the project *„Participation in the development of a case study on the research of regional processes, regional development and best practices for integrated regional development in the framework of the project TÁMOP-4.2.2.A-11/1/KONV-2012-0010 of the Széchenyi István University"*, here again, I could gain some useful practical experiences concerning the research and development of regional business networks.

My explorations were immensely helped by the Apáczai Csere János PhD Scholarship I won in 2013, for which I had applied in the scope of the project TÁMOP 4.2.4.A/1-11-1-2012-0001 entitled: „National Excellence Programme − National programme for the elaboration and operation of an inland student and researcher personal support system". Thanks to the scholarship I was awarded for my application entitled *„Analysis of the competitiveness of the national SME sector from the aspect of R&D&I"* I could carry out a targeted research.

Besides project duties and the synthesising of the relevant national and international theoretical specialist literature, I was collecting, analysing and evaluating also secondary data. The sources of the secondary data processed were mostly – without aiming to give an exhaustive list – international, Austrian and national specialist literature, organisations (WEF, OECD, EU, ministries etc.), statistical institutions (Statistik Austria, KSH, Eurostat etc.), analyses of research institutes (TÁRKI, university research centres, WIFO etc.) as well as studies and statements of various specialised organisations (NIH, MISZ, MSZH, MTA, BIC, WIBAG, WKO etc.).

Apart from the comprehensive analysis of the relevant literature and the analysis of the relevant secondary data, it was indeed necessary to carry out a primary research too, which was conducted among the micro and small enterprises of Burgenland and Western-Transdanubia.

Primary data were collected in the form of a questionnaire sent out to the companies via e-mail. In order to obtain the e-mail addresses of the companies of the Western-Transdanubian Region, I contacted the following organisations: Chamber of Commerce and Industry of Sopron, Chamber of Commerce and Industry for Győr-Moson-Sopron County, Chamber of Commerce and Industry for Zala County, Chamber of Commerce and Industry for Vas County, Hungarian Chamber of Commerce and Industry, central customer service of the Hungarian Central Statistical Office (KSH), KSH Departments of Győr, Szombathely and Zalaegerszeg, Company information service of the Ministry of Public Administration and Justice etc.

The opportunities and conditions of the Hungarian research sector are faithfully reflected by the fact that a number of organisations did not even reply to the letter sent. Those that did actually reply refused to give away any data for various reasons. The electronic contact details of the companies were eventually made available by the Hungarian Central Statistical Office KSH (after contacting its central and regional departments and paying for the costs of the database). The list included those companies which had agreed that their e-mail addresses be disclosed by KSH. In the region analysed, there are about 150.000 companies registered according to the record. Because the database included several duplicates, it was necessary to narrow it down. The database of the department of Győr of KSH contained those companies

that had been registered in the counties Győr-Moson-Sopron, Vas and Zala[1]. I received the database in December 2013.

Getting hold of the contact details of the Austrian companies was even more difficult. I contacted the following organisations: Statistik Austria, Statistik Burgenland, Wirtschaftskammer Österreich, Wirtschaftsservice Burgenland AG, Österreichisches Institut für Wirtschaftsforschung, Business & Innovation Centre Burgenland, etc.

All of these organisations sent a reply but for various data protection reasons, none of them were in the position to disclose an online database about the companies. After that, I contacted the Eisenstadt-based Fachhochschule Burgenland GmbH operating in Pinkafeld in March 2014. This college could not provide assistance either, except for the fact that they had referred me to the company database on the website of the Austrian Economic Chambers, (WKO) from where I could collect the e-mail addresses of quite a few companies one by one. The database of WKO included a total of 496.207 companies, from which I picked the ones based in Burgenland and grouped them according to business sectors.

After database organisation, in April 2014, I started to send the invitation letters and the questionnaires relating to my research in Hungarian and German, to the e-mail addresses provided. The questionnaires were put together with *Google „Drive"* allowing the subjects an online completion. Another advantage of this system is that it collects the answers systematically and imports them automatically into an Excel-table, which was a big help in the evaluation of the data.

The questionnaire-phase of the research was split into two parts: first, I had collected data in Austria from 10.04-26.05.2014, then in Hungary from 15.07.-07.08.2014. However, due to summer holidays, the last data were received on 30th November 2014. As for Hungary, 3.3% of the questionnaires (522 answers) have been completed, while the completion rate in Austria was 5.8 % (126 answers).

The evaluation of the data with Microsoft Excel and the inspection of the hypotheses with the programme package IBM SPSS V22.0 started in December 2014.

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[1] The database included companies with the following GFO (2013) codes: 113-114, 121-125, 129, 131, 133-136, 211-213, 226, 229, 231-233.

2.2. The statistical methods used

During the processing and analysis of the *secondary* data coming from official organisations, I mainly relied on the method of descriptive statistics, in order to give a professional description of the essential features.

During the *primary* research, the data were collected in the form of a questionnaire with 36 questions, using quota sampling. The questionnaire included mainly non-metric (e.g. nominal, ordinal scale) scales; however, ratio scales can also be found in it. It typically consisted of different attribute variants, i.e. it was intended to collect properties more of qualitative (e.g. spatial) nature than of quantitative (e.g. temporal) nature. The statistical calculations started after processing, clearing-up and sorting out the answers, typically using more simple, descriptive statistics, performing univariate analyses and carrying out status indication (average, modus etc.) and dispersion (frequency, relative frequency etc.) calculations.

The *hypotheses* were examined using bivariate or multivariate analysis, by means of analysis of contingency tables in the first place. The analysis of contingency tables allows the comparison of several nominal or ordinal, non-metric variables, i.e. one can examine the association relationship, [Sajtos-Mitev, 2007] which in this case means the relationship between the frequency of dependent and independent variables, that's why it was extremely important to choose the right variables.

During the testing of independence, Pearson's chi-squared test (χ^2) was applied. This test shows whether there is a significant relationship between the dependent and the independent variable. However, it must be noted that the chi-squared test is sensitive to the size of the given sample and is linearly dependent on the number of components. [Sajtos-Mitev, 2007]

If the test proves that there is indeed a significant relationship between the two variables, one may continue by analysing its strength. In case of nominal scales, the Phi coefficient, the contingency coefficient or Cramer's V coefficient can be applied as symmetric indicators. A symmetric indicator means that an exchange of the dependent and independent variables does not influence or change the output – as opposed to asymmetric indicators. The Φ (phi) coefficient is usually used in case of 2x2 contingency tables. Its value may vary between 0 and 1, where 0 stands for independence and 1 denotes a deterministic relationship. [Sajtos-Mitev, 2007] Generally, tests tend to prove a stochastic relationship of different strength.

In case of contingency tables bigger than 2x2, the interpretation of the contingency-coefficient (C) is even more complicated; therefore, it is better to use Cramer's V indicator which a lot of researchers consider to be the most reliable coefficient. Its possible values and its interpretation are similar to that of the phi coefficient. [Sajtos-Mitev, 2007]

The **H1 hypothesis** was analysed in case of both regions on the basis of three questions (8., 18., 21.) of the questionnaire. I considered those respondents to be innovative who had answered these questions with yes. These three questions asked about the past, the present and the future innovation activities of the respective company.

The **hypotheses H2a and H2b** were analysed on the basis of the answer given to the first question categorising the size, as well as on the basis of nationality and the innovation activities of the past (Question 8), since for international standards, the latter is enough to be categorised as being innovative.

The **hypothesis H3** was - unlike the rest of the hypotheses - analysed with logistic regression. According to logistic regression, (or logit-model), one metric variable is independent and a non-metric variable is dependent. The logit model is used to predict the probability of something, its two possible values are 0 (= non-occurrence) and 1 (= occurrence). The model has the advantage that it lays down fewer criteria than the discriminant analysis. [Sajtos-Mitev, 2007]

The hypothesis was examined on the basis of the age of the company derived from the year of its establishment (Question 6) and the analysis of the innovativeness. (Question 8)

The **hypotheses H4a-e** were evaluated on the basis of the respondent's answers as to his nationality and the reasons for his innovation activities (19., completion was not compulsory, but those who did respond could also choose more than one answer.). These hypotheses were to analyse the attitude of the companies as to how much they stimulate innovation.

In case of the **hypotheses H5a and H5b,** the analysis aimed at examining the relationship between the economic situation of the company as seen by the company itself (Question 33) and the innovativeness (Question 8), taking into account also the respondent's nationality.

When examining the **hypotheses H6a and H6b,** I compared the respondent's nationality, the ratio of graduates working for the company (31.) and the innovativeness (8.).

All hypotheses were analysed at a *significance level of 5 %*, i.e. the hypothesis was actually accepted with a 95 % probability, as long as it proved to be right.

3. NEW AND NOVEL SCIENTIFIC RESULTS

Based on the hypothesis analyses, the primary and secondary data as well as the analysis of the specialist literature, the new and novel results can be formulated as seen below. (The theses concern the micro and small enterprises of the two regions.)

T1: In respect of the innovation results and characteristics described, the province of Burgenland is ahead of the region of Western-Transdanubia, which is clearly supported by the secondary data. At the same time, based on the inspection criteria, the hypothesis analysis proved the Hungarian companies to be just slightly more innovative than the Austrian ones, which again was demonstrated by the primary research, too. However, even this proven innovation-level is considered to be under the EU-average. As regards the regions as a whole, Burgenland seems to come across as more innovative, but this is not confirmed in the sector of the micro- and small enterprises inspected.

T2a-b: In Western-Transdanubia, the probability of innovation activity of businesses grows together with the size of the company. Apart from the hypothesis analysis, this thesis was confirmed also by the primary results and the secondary sources.   In case of the companies in Burgenland, there is no demonstrable correlation between the growth of the size of a company and the increase of its innovation activity, which leads to the conclusion that the innovation performance of micro and small enterprises is nearly the same, independent of the size of the company. For the sake of completeness it should be added that it can be seen on the basis of the evaluation of the primary research results that companies tend to get more innovative as they grow.

T3: There is typically no correlation between the age of a company and its innovativeness. There is no significant difference between the innovation potential of micro and small enterprises of different age. A reason for this could be that young companies and older businesses alike can be regarded as equally innovative on the basis of the aspects examined, of course to various degrees.

T4a-e: RDI activity is equally important for the majority of the companies of both regions. (see Question 18). For the businesses of Western-Transdanubia, revenue increase and cost efficiency are more important aspects than for the businesses of Burgenland, who in turn rank staying competitive higher than the Hungarians. The companies of Burgenland focus more on

long-term operation, while those in Western-Transdanubia are primarily interested in keeping the daily business going and getting fast and direct benefits from innovation.

T5a-b: Those companies examined in Western-Transdanubia that consider their own economic situation as being better than the average, are undoubtedly more innovative than the ones considering it to be weaker. They can focus on improvements better and they also have the necessary resources. Such a difference could not be proved in the case of the businesses of Burgenland, which is explained by the fact that their level of innovativeness is quite the same, irrespective of their economic status. The economic status of the companies does not influence the innovation activity insomuch that a significant correlation between these two factors could be proved.

T6a-b: Compared to Burgenland, there is a demonstrable correlation between the number of graduates at a company and the company's innovativeness in Western-Transdanubia. The reason behind – amongst others – is that there are proportionally more graduates in the latter region, which can be attributed i.a. to the different educational goals of the two regions and the migration of labour force within the country. Companies with a higher proportion of graduates in the Hungarian region are more innovative than companies with only a few graduate employees or companies having no graduates at all. The companies examined in Burgenland can be regarded as having almost the same level of innovativeness, irrespective of the number of graduates employed by the company.

4. CONCLUSIONS AND RECOMMENDATIONS

Before presenting the conclusions, the following general stipulations should be stated: the primary results may apply with full certainty only to the businesses examined; any generalisations and conclusions arising from them may be accepted only with reservations, just like in the case of results obtained by way of non-random sampling. The primary research is instrumental, reliable, successful and representative in terms of the aspects I consider to be important. The statistical sample is considered quite large and increasing the number of the components would bring about only a minimal change in the results. The novelty and the essence of the research lies in the fact that it gives a primary and thorough analysis about the innovation potential of the SME sector of regions that are located in different countries (!), which is one of the most difficult tasks for an economic researcher. For one thing, getting companies of this size to respond is enough of a challenge in itself, because they are fairly closed-up, indifferent and are typically reluctant to respond to questionnaires (Moreover, a request from a foreign researcher is quite rare, which might make them even more reserved). On the other hand, examining the RDI activities of such companies might indeed generate special interest, especially because some of the questions were rather delicate (e.g. turnover, content, reasons and consequences of R&D activities etc.). In drawing the conclusions, specialist literature data as well as primary and secondary data were also taken into account.

Innovation activity means thinking long-term and with a sense of perspective when making everyday economic decisions. Research has proven that the professional use of innovation processes is a precondition for a company to stay competitive and operate successfully. In several cases, this is the key to overcoming recession and starting to grow.

The results of the RDI system of Austria and Hungary are rather different from each other; still, it was important to draw a comparison between them, because the adoption of best practices is vital for the country being in the more disadvantaged position. As regards innovation, Austria may soon become one of the innovation leaders in Europe, for it has all the necessary prerequisites and it constantly performs above the average. Some of its systems need to be adjusted or re-considered, particularly the practical implementation of the innovation results, political decision-making, the educational structure and the support of entrepreneurs. In Hungary, more significant steps need to be taken, which is going to be one of the most important tasks during the next seven-year long budgetary period. In terms of RDI results, Hungary performs below the average, the share of R&D expenditure (GERD) is low,

knowledge transfer is sluggish, the corporate sector is centralised. The signs of a slow but continuous development may give reason for hope and could result in becoming as innovative by the end of the decade as Austria is now.

Examining the innovation potential in the entire Burgenland and Western-Transdanubia, one can observe a difference in terms of output and level of development. The fact that both regions regard the development of the RDI system important is reflected in the great number of strategic documents explicating and planning it in detail.

It can be stated that generally, the SME sector faces serious problems also in the regions inspected. In this regard, there is no essential difference, because the majority of companies of such a size have to cope with day-to-day operational and liquidity problems. This is aggravated by competitive disadvantage, a lack of long-term thinking and management skills, the scarcity of financial resources, excessive bureaucracy of the tendering system and the burdens of the sector.

Developing the SME sector is equally important both for the EU and the member states, but unfortunately, in several cases, these concepts achieve the objectives improperly or insufficiently. SMEs require a special handling, both on the part of the state, the EU and its organs. Europe's future lies in the hands of these enterprises, because they are at the forefront when it comes to employment and public burdens. It is recommended to develop the SME sector parallel with the expansion and re-thinking of the innovation system, because they are the prerequisites for successful economic operation on a long-term.

The homogeneous stereotypes and innovation differences of the two regions do not appear at the level of the SMEs. The two regions have almost the same result in this respect; however, in a number of cases, Western-Transdanubia seems to be more successful. Evidently, this is because the Hungarian region is industrially more advanced, while in Burgenland, it is the services sector and agriculture which are dominant.

The demand for the development of the SME sector is visible in case of both regions. Not even 50% of the businesses can be called innovative and one-third of the majority of them do not even consider this activity to be so important. Naturally, as long as daily liquidity problems, circular debt, forced operation or the red tape and administrative burdens are not reduced, one cannot expect substantial progress or a change in the way of thinking in this area.

SMEs often implement both hard and soft innovation processes. They are willing to devote a part of their revenues for this kind of activity, if they are positive that it is going to pay back. In the two regions, most businesses spend an average of 2-5% of their revenue on innovation, which is not too much, but it's still higher if compared to the secondary data (about 1 %). The majority of businesses tend to implement the developments by themselves, without co-operating with each other. Similarly, there is a lack of co-operation with innovation agencies, bridging organisations and higher education. Since we are talking about border regions, it would be essential to exploit the opportunities created by the EU. Still, only a few businesses can collaborate with each other or enter the market of their competitors. Co-operation is mainly set-up with suppliers, sub-contractors, consultants or partner businesses.

The majority of the respondents of the two regions look into the future with pessimism. They do not expect any improvement either in the political or in the economic field. In turn, they expect the reduction of red tape, creation of a stable environment and the reform of the current tender system, because they would like to keep their jobs and develop their competitiveness. They also have reservations regarding the future of the innovation sector and the majority of them do not even have an opinion on the subject. As far as the RDI activities are concerned, they regard practical research results and the development of incubators to be necessary, just like the strengthening of not only large enterprises but also of the SME sector.

It is recommended to assess the problems of the SME sector consciously and regularly and to involve the representatives of the sector in economic and political decision-making. Alleviating the sector of its burdens, its simplification as well as an expansion of tender opportunities and a reduction of the related administrative tasks of the businesses should also be thought over. The participants of the branch do not have the sufficient time, professional knowledge and social capital. Another problem is that also bridging organisations do not fully carry out their mission and there are disruptions in the flow of information of the sector. Because applications are typically outsourced, fewer funds remain at the businesses. Stability and a well-designed alteration of the economic regulations and of legislation are important, because these processes affect the innovation sector more than big businesses.

It is worth repeating the research in the future, particularly after the implementation of the RDI tenders of the EU. Deeper investigations should be conducted in each regional and sectoral units and it would be necessary to impart best practices for the SMEs in a clear and understandable way.

5. PUBLICATIONS LINKED TO DISSERTATION

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