

UNIVERSITY DOCTORAL THESIS (PHD)

**THE INNOVATION SUPPORTING ROLE OF THE AGRARIAN HIGHER
EDUCATION IN THE NORTHERN GREAT PLAIN REGION**

Szabolcs Németh

Supervisor:

Dr. Mónika Rófi
Ph.D.



**UNIVERSITY OF DEBRECEN
Kálmán Kerpely Doctoral School**

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1. THE REASONS FOR CHOICE OF SUBJECT

In the second half of the 20th century the economic processes in the world have changed considerably. The former inflexible "Fordist" system which was based on mass production has been replaced by a flexible production structure continuously adapting to market needs. Due to the globalization processes in the economic environment, the appreciation of non-material resources and the acceleration of technological changes, the production, acquisition and adaptation of knowledge and information determining the competitiveness of regions and companies have come to view. In the information society of the 21th century the competitiveness of the regions is determined mainly by innovations, therefore higher competitive advantages require constant renewal (*Lengyel, 2000b*). The value of the companies is no longer primarily based on their property, but their strategy and its supporting intellectual resources (*Daum, 2001; Lukovics, 2005*). The linear characteristic typical of the '60s is not common in today's innovation processes, nowadays there are innovation culture and systems in which higher education institutions have reached a decisive role in the constant interactions between the participants. Amidst the shortened product life cycle and the accelerated processes research and education have to be developed at the same time, furthermore effective cooperation between universities, companies and the government need to be strengthened by the development of the technology-transferring institutions (*Etzkowitz, Leydesdorff, 1997*). The transposition of the higher education institutions' accumulated knowledge into the region, and the strengthening of the institutions' third function are key factors to a competitive regional economy (*Lukovics, 2005*). In the literature there are a number of successful regions proving the effectiveness of innovative collaboration between universities and companies (*Dóri, 2005*).

In the 90s the unified definition of competitiveness has already been widely accepted, which is the ability of companies, industries, regions, nations and supranational regions to permanently establish relatively high income and relatively high employment rate, while being exposed to external (global) competition (*OECD, 1997*). *Imre Lengyel (2003)* illustrated the factors affecting and used to measure the competitiveness of the regions in three successive levels, as a pyramid. *Research and technological development* is one of the most relevant factors among the short-term (directly) factors affecting the basic categories (regional income, productivity, employment) that determine competitiveness. Innovation culture and capacity are

present among the success factors (based on the results of empirical studies) affecting the basic categories of competitiveness in the long term (indirectly). Universities / colleges have a key role in both the main factor and the success factor with their education and research function supporting innovative activities.

Interesting consequences can be drawn from the Hungarian NUTS 2 regions (especially from the Northern Plain region) using indicators (basic categories) measuring regional competitiveness and innovation potential. Based on the GDP / capita, the employment rate and the labor productivity indicators the North Great Plain region is considered to be Hungary's second least competitive region. The R & D indicators show exactly the opposite, as the region has podium place in the national ranks, furthermore the University of Debrecen is located in the region which has one of the largest and widest education / research profile among the higher education institutions in Hungary. This dichotomy of the area justifies the deeper and more detailed understanding of the regional innovation processes not only from the university's side, but also from the perspective of the knowledge user participants.

2. THE AIM AND METHOD OF THE STUDY

The aim of my empirical study is to explore the types of interactions between the two subsystems of the RIS (regional innovation system) and to explore the nature of the connections and their future development. The aim of studying the external environment was primarily (in addition to the spatial characteristics of the interactions) to understand the R & D & I activities of the enterprises operating in the region and their potential collaborative partners, and to understand the competing (R & D) institutions. Besides, the present difficulties of innovation processes and their future development is also at the forefront of the study, and priority the mapping of regional impacts and spatial characteristics of the knowledge flowing from the university. From the university's side the analysis of the strengths and weaknesses of the institution (in connection with the third function) was in the focus of the study. The horizontal aim of the study is to contribute with the results to the development of a more effective university strategic planning and / or thinking, which intensifies the integration of the knowledge originating from the institution to the region's economy and society.

My study focuses on the agricultural sector, which is justified by several factors. First, the spreading distance of the knowledge emerging from the universities may vary

(e.g. by industries), so studying different sectors requires different methodology, on the other hand the natural conditions of the region are clearly favorable to agriculture, which defines economic characteristics and land use in the area (*Nemes-Nagy, 2003*). The share of agriculture in the economic performance of the region is significant, since in 2008, in the Northern Plain region the agriculture had 9.34% in the sectoral distribution of gross value added, which is more than twice the national average (4.31%) (*INNOVA, 2010, Central Statistical Office, 2008*). Besides, in the situation analysis made for the innovation strategy of the North Great Plain region agriculture is represented as a key sector, on which the management can rely during the decisions assisting the development of the regional economy in the near future. The internal factors also justified the reduction of the line of research, because the University of Debrecen, as a multidisciplinary institution is structured by disciplines (centres, faculties, institutes, etc). Mapping of the regional effects of different disciplines requires different methodology, because they have different 'clientele', goals, profile, etc., which would only allow joint management in a rather simplistic form without meaningful results.

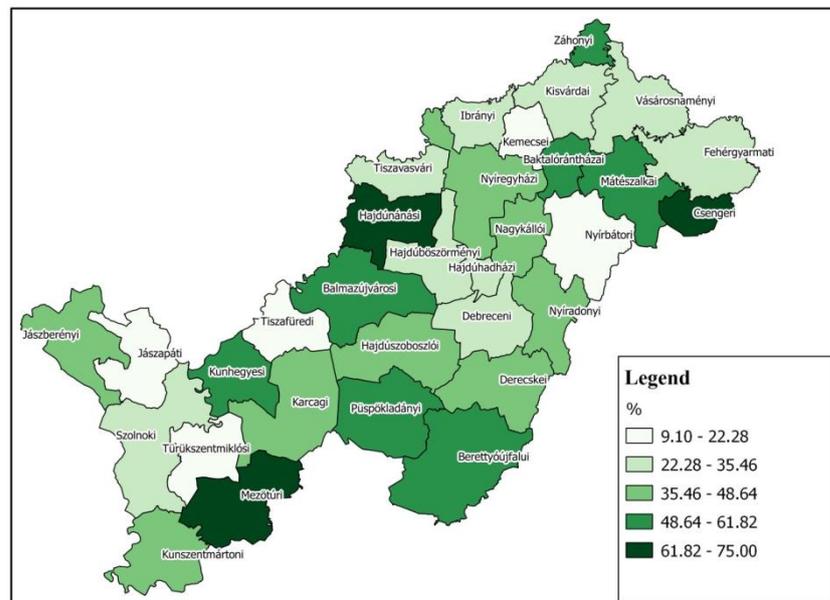
The examinations were carried out in three phases. The first step was to briefly outline the main characteristics of the agricultural sector's R & D and innovation activity based on the results of the NETINNOV Survey (*Csizmadia - Grosz, 2011*). Then I examined the weight of the North Great Plain region's R & D potential (both in every sector and the agricultural sector) relative to national data (source: Central Statistical Office). Both examinations was performed using secondary databases. The aim of the examination was to provide a comprehensive picture of the R & D & I activities in the North Great Plain region and in the agricultural sector.

The second and third step – using strategic management and planning – was to carry out empirical analyses about the internal and external environmental factors (Figure 2). The subjects of the survey were the agribusiness firms operating in the region and the faculty and institute leaders of the DE AGTC's (University of Debrecen, Centre for Agricultural and Applied Economic Sciences) Faculty of Agricultural and Food Science and Environmental Management (hereinafter referred to as MÉK). Both surveys were carried out with own (primary) databases.

The preparation of the outside survey sample was based on definition of the agribusiness (the selection was based on the TEÁOR codes), which was created in the 1950s in the United States. In addition to the food industry the agribusiness

encompasses other related sectors (e.g. machinery, chemical industry), thereby enhancing the role of agriculture in the national economy (Tracy, 1993). The study focuses on companies with more than 10 workers, which is justified by several factors. Previous studies and experiences have shown that small firms are less active in collaboration and innovation processes than larger enterprises (Csizmadia - Grosz, 2011). According to Imre Lengyel (2003) small and medium-sized enterprises have a key role in the competitiveness of the regions. On the one hand SMEs usually operate in local markets, which means that the produced goods and the profit remain in the region, on the other hand the speed of the structural changes affecting the competitiveness is mainly depends on the innovation capacity of SMEs. In the North Great Plains region 572 businesses met the criteria above, of which 222 were willing to be involved in the study. The average return propensity was 39.2%. The Figure presenting the spatial division of sending-back rates shows that the Tiszavasvári, Tiszafüredi, Kemecei, Nyírbátori and Jászapáti districts had a relatively lower return propensity, while 'above average' values can be seen in the Csengeri, Hajdúnánási and Mezőtúri districts (Figure 1). Overall, the sending-back rate exceeded 20% in almost all districts, thus the sample is relatively homogeneous spatially.

1. Figure: Spatial division of sending-back rates (N=222)

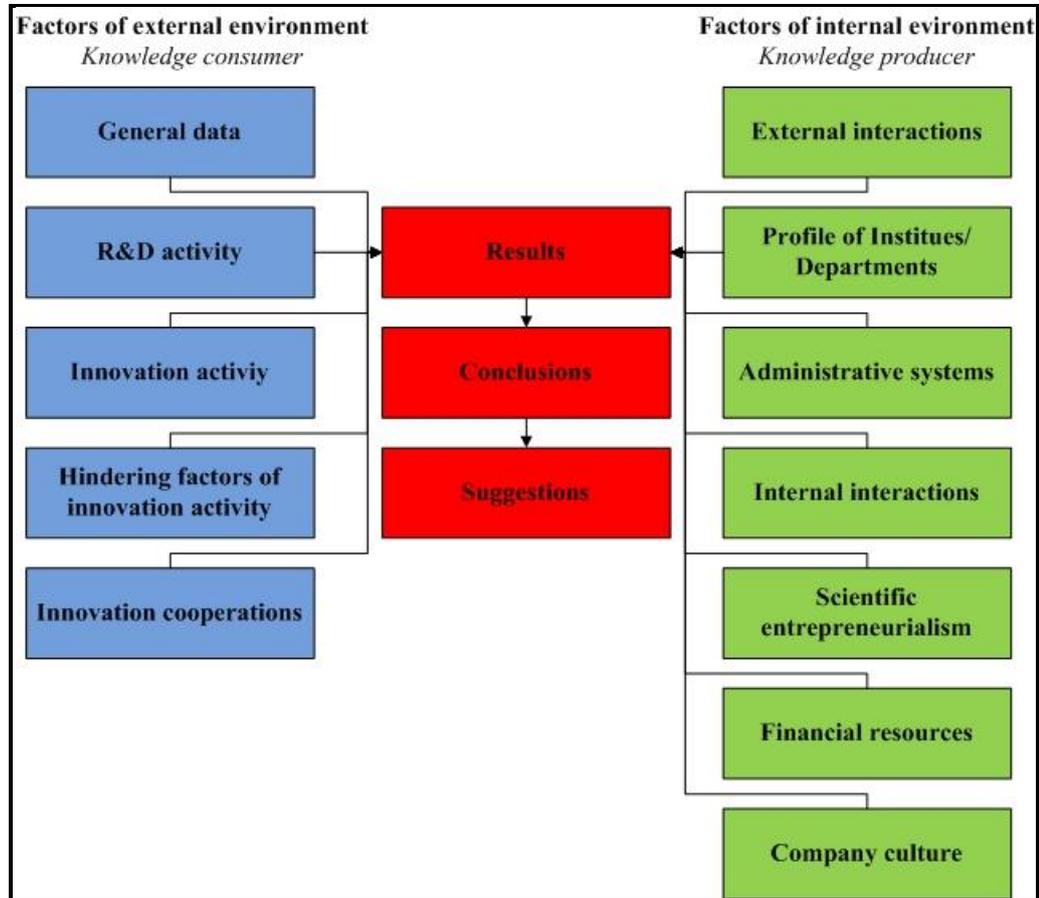


Source: Own construction

Sampling procedure was not necessary, as I worked with the entire list. I made a survey in the summer of 2012. The questions were arranged in five categories: general

characteristics, R & D activities, innovation activities, factors influencing innovation and different types of interactions (Figure 2).

2. Figure: The process model of the empirical research (based on primary database)



Source: *Own construction*

Research and development activities of the business were assessed using two indicators (the ratio of R & D expenditures of sales revenues and the number of R & D employees relative to the total employee number).

The questions about the innovation activities of the enterprises focused on the introduction of the innovations and the types of the introduced innovations. The OECD’s Oslo Manual-defined standardization has been used (product, process, organizational, organizational and marketing innovation) in the survey (*OECD, 2005*):

In addition of the different types of innovation the difficulties of activity were also studied. According to the literature macro and regional factors can be distinguished. The macro factors can affect the innovativeness indirectly and they primarily affect the overall functioning of the businesses, and their absence and limitedness may have

negative effects. This includes the vagaries of the economic and legal environment, the excessive bureaucracy and administration, distrust between business participants and the lack of qualified labor. The second group is the regional factors that are directly related to innovation activities of the enterprises and that are specific in the close environment of the enterprises. This includes the lack of inside and outside financial resources of the enterprises, the difficulties to gain information necessary for innovation, as well as the often necessary base conditions to the successful implementation of them (finding suitable cooperation partners, the access to the local science and technology infrastructure and capabilities and the availability of the services that helps innovation) (*Csizmadia-Grosz, 2011*). In addition to the examination of the obstacles the questionnaire contains questions about tender activity and their success rate, because the lack of financial sources of innovation is a frequent obstacle in Hungary, and a possible way to remedy the problem is the use of financial sources of the tenders.

I examined the innovation processes of the RIS from three perspectives. I collected information on the types of interaction partners' incidence and geographical characteristics, then I examined the characteristics of the corporate partnerships with higher education institutions. I distinguished eight different interaction types between universities / colleges and businesses (*own standardization based on Inzelt, 2004; B. Lengyel, 2008; Varga, 2004*):

- Discussions between company employees and university teachers (tacit knowledge);
- Vocational training of company employees by university teachers / researchers (tacit knowledge);
- Doctoral and master courses in universities with corporate employees participation and with shared leadership (tacit knowledge);
- Mobility of graduates from universities to businesses, and vice versa, either temporarily or permanently (tacit knowledge),
- Employment of academics / researchers as experts (tacit knowledge);
- Purchase of the university's research results (explicit knowledge);
- Formalized research and development co-operations (tacit / explicit knowledge);

- Access to the physical facilities of the university / company (tacit knowledge).

The study focused on two time periods: the three years period between 2009-2011 and 2012-2014 with the aim of making a forecast about the processes taking place in the near future based on the experiences of the past and the present. In addition to the projection another important objective of the research was the understanding of the spatial characteristics of the studied indicators.

The internal investigation was carried out in the spring of 2013 with questionnaires in the form of interviews. The questionnaire was built up of seven question groups. The analysis of the interactions was almost the same as the query of the connection types used in the outside environment analysis, with the following differences: the leaders had to give the frequency, the regional characteristics and the preference values of the contacts. In addition to the interactions the questions focused on the following areas: internal interactions / co-operations, institutional / departmental profile (based on the research profile), administrative systems (the main stages of strategic planning), academic entrepreneurship / business history, distribution of financial resources, culture (attitude in connection with the third function).

In the determination of the profile of the departments in the sample ("product / market unit") two criteria were considered: the basic and applied research ratio and the preference points given interaction types. Based on the variables information can be obtained about the interaction and research profiles of the institutes / departments and the entire faculty, which is not a negligible factor in the planning process. The examination of the informational and communication systems was carried out along two dimensions: the weight of information about the third function during the use of the various communication forms, and the number of co-operations between the institutes / departments. During the examination of the administrative systems connected to strategic management I examined the existence of the various stages of planning and the role of the third mission in the planning process. Academic entrepreneurship can be interpreted from several angles, in this case it means the extended method of the two classical functions (teaching and research) of higher education which can be realized through the eight types of interaction that are examined during the empirical analysis. The examination of the institutions' / departments' budgetary funds aimed to look for links between the distribution of the funds (corporate, tender, etc.) and strategic importance of the undertaken third mission. My study does not aim to understand

deeply and in more detail of the "corporate" culture of the university, only to get an overview through some questions in order to get a general picture (based on the managers' opinions) on the attitude of the institution's research and teaching staff towards the third function.

In the theoretical and empirical examinations I (primarily) tried to answer the following questions:

In what kind of system can be the regional role of the higher education institutions can be examined, furthermore can the regional innovation processes be modeled?

What kind of research and innovation activities have the businesses operating in the North Great Plains region what spatial characteristics do these processes have?

What micro and macro (regional) factors hinder innovation processes in the region, which can cause the ambiguity of the area?

How will the regional innovation processes shape over the next three years? What can be the role of the higher education institutions (in particular the University of Debrecen)?

Are the internal and external conditions of The University of Debrecen in harmony, so can the institution satisfy the emerging innovation (for knowledge) demand with adequate supply palette?

3. PREVIOUS STUDIES IN THE SUBJECT

Several domestic and international studies have already examined the regional effects of the universities. Many of the domestic studies have provided a great help and an excellent basis for the planning of my study. In her studies *Monika Rőfi (2005, 2006, 2008a, 2008b; Rőfi - Mohácsi, 2007; Rőfi - Hajdu, 2006; Rőfi - Vincze, 2008)* primarily examined the regional impacts of the University of Debrecen from social aspect. In her empirical studies she found significant relationship between the faculties and the workplaces of the graduates, the job-finding time, the workplaces suitable for graduate qualifications, the size of their income and their job title.

Károly Teperics (2005, 2009) constructed student gravity maps using the institutional databases and the outlined the catchment area of the University of Debrecen. His study covered the competitors as well (University of Miskolc and University of Szeged), and he approached the issue in regional, national and international aspect too.

Márta Mohácsi (2008) examined the corporate relations of the (the region's largest agricultural higher education institution) University of Debrecen, Centre for Agricultural and Applied Economic Sciences in her Phd dissertation using quantitative research methods

Annamária Inzelt (2004, 2010) analyzed the co-operations between domestic universities and enterprises. I made the list of possible co-operations based on her interaction typology used for the examination of the relations between the two parties.

Katalin Erdos and Attila Varga (2010) examined the academic entrepreneurship using the entrepreneurial university model of Etzkowitz. Their methodology and results were a great help in the examination of internal environment of the institution.

Katalin Mezei (2008) studied the role of the universities in regional economic development. Her theoretical and empirical examinations focused on the identification of the third function's content besides the classic functions of the university. The university innovation models presented in the thesis have served as an excellent theoretical basis for the planning of my study.

Ádám Novotny (2010) examines the technology transfer from academic aspect in his Phd dissertation. He sought to answer the question of how academics relate to the third function of the institutions and whether they accept the innovation policy of the U.S. The research methodology and the theoretical background was a great help in the examination of the internal environment.

During the development of the external environment's examination methodology the results and the methodology of the previous studies in the topic of innovation made an excellent basis (*al Csizmadia et 2007a, 2007b*; *Csizmadia-Grosz, 2006, 2008, 2009, 2011, Gál, 2005; Imreh, 2005; Sass 2007*).

4. HYPOTHESES RELATED TO THE RESEARCH

My first hypothesis connected with external environmental diagnostics is about factors affecting innovative activities. Giving reasons for the choice of subject I have already dealt with the contrast between the regional competitiveness and the innovative potential in the Northern Great Plain region. For some reasons the intellectual resources of the region do not seem to reach enterprises. As far as the causes are concerned, in my opinion the most relevant obstructive factors are the lack of resources and the relatively longer rate of return, which are presented in the weak competitiveness of the region. In

most cases the introduction of various innovations is relatively costly, which is beyond the means of most enterprises. The innovative activity of enterprises can be significantly affected by the turbulently changing economic environment, as in a continuously changing environmental system inflexibility (partly due to the lack of resources) may paralyze long-term planning and the process of uninterrupted renewal, which have recently become key conditions in the market competition.

(H1): The innovative activity of the interviewed enterprises is mainly hindered by the insecurity due to the rapid change in the economic environment and the relatively disadvantageous economic situation (lack of resources).

HYPOTHESIS CONFIRMED

In both the Hungarian and international specialized literature it has been stated that there is a close and positive relationship between innovative activity and regional development, which means that regional competitiveness is determined by the innovative activity and potential of the given region (*Lengyel, 2006; OECD, 1996*). Concerning RIS I have already analyzed in detail how the institutions of higher education support innovative proceedings and the roles they play in RIS. Regarding specialized literature it can be assumed that the innovative activity of enterprises is related to the cooperation with the institutions of higher education.

(H2): Enterprises in association with institutions of higher education are more likely to introduce innovations than the ones which do not cooperate with colleges/universities.

HYPOTHESIS CONFIRMED

According to the Polányi typification knowledge can be divided into two types: tacit and explicit knowledge. The main difference between the two types can be observed along spatial dimension. The non-verbal, hard-to-communicate knowledge such as creativity has its incentive effect on the economy locally. However, the economically less relevant explicit knowledge can spread independently of space (distance). The applied interaction types are primarily based on tacit knowledge transfer, and analyzing the regional characteristics of these relations conclusions can be drawn concerning the extensity of knowledge.

(H3): Tacit knowledge transfer from the University of Debrecen (DE) towards the agribusiness enterprises of the region is mainly locally typical.

HYPOTHESIS CONFIRMED

The next (H4) hypothesis in connection with the internal examination is related to the employees' business experience and the standard applied in the third mission strategy.

In specialized literature analyzing the results of sociological experiments researchers often find that university employees are more inclined to begin scientific enterprise if there are entrepreneur-researchers among their colleagues, or their co-authors have industrial relations or their colleagues are industrial researchers (*Novotny, 2010; Stuart and Ding, 2006*).

(H4): Organizational units which employ workers having business relations and experience are in favor of fulfilling the third mission.

HYPOTHESIS NOT CONFIRMED

The (H5) hypothesis is quite common among researchers dealing with the topic of higher education and innovation. Scientific enterprise is often associated with pushing the basic research into the background, which has negative effect on the culture of "free science", the teacher-student relationship, the quantitative and qualitative features of basic research, the curriculum, the research tendencies and it reduces the time devoted to education significantly (*Poyago-Theotoky-Beath-Siegel, 2002*). A considerable number of researchers have a totally different opinion. According to them, reversed knowledge transfer also exists, which means that education and teaching material can be made more life-like, professional and timely through company and market experience (*Novotny, 2010; Stephan P.E., 2001*). Researchers often show more interest in the field of applied research because the energy they invest returns sooner.

(H5): With the shifting of institutional/departmental research work into the direction of applied research the third function is also emphasized in managers' strategic thinking.

HYPOTHESIS NOT CONFIRMED

My (H6) hypothesis is meant to be connected with the complexity and dynamism of environmental factors. Complexity and dynamism are the two most important features of the problems/changes occurring in the macro- and microenvironment of the

university. For managers and researchers complexity means interactions between certain environmental factors, therefore a system is made complicated not by the number of elements but by the characteristics of interactions between the elements. The dynamism of environment change reflects how much time it takes for the external environment of the university to transform from a given state into another one (*Barakonyi, 1999*). Basically, nowadays the problems that occur/may occur in the wider and narrower environment of the university require a complex, dynamic and interdisciplinary approach. Regarding the internal organizational structure of the university we have to consider the dichotomy caused by the different areas of science (soft: e.g. history and hard: e.g. physics as well as pure and applied sciences) (*Kováts, 2009; Becher, 1994*). In my opinion the demands of RIS or the effective solution of problems necessitate internal cooperation and interdisciplinary attitude on behalf of the university.

(H6): With the strengthening of internal cooperative activity between the institutions and departments of DE-AGTC-MÉK the third function is also emphasized in the managers' strategic thinking.

HYPOTHESIS CONFIRMED

My last (H7) hypothesis is about the relations between the distribution of institutional/departmental budget resources and the preference for the third mission. Will the extent of company resources presented in the budget be able to emphasize the assumed third function or will not? Presumably, the necessity to utilize external resources will divert teachers'/researchers' attention from their original aims to the direction of the company's interests. This process will probably represent itself in strategic thinking as well in such a way that the importance of knowledge- and technology transfer will grow in the direction of the region.

(H7): With the growth of company resources presented in the institutional/departmental budget resources the third function is also emphasized in the managers' strategic thinking.

HYPOTHESIS NOT CONFIRMED

5. NEW AND NOVEL SCIENTIFIC RESULTS

After studying relevant foreign and Hungarian specialized literature about the subject I conducted empirical researches among the agribusiness enterprises of the Northern

Great Plain region and the institution/department heads of the University of Debrecen, at the Centre for Agricultural and Applied Economic Sciences and the Faculty of Food Science and Environmental Management. In the course of my studies I managed to reveal the following significant results.

1. Through the analysis of external and internal environmental processes the characteristics of interactions between the two subsystem in RIS and the regional effects of the University of Debrecen on the agricultural sector can be detected. The knowledge transfer from the institution towards the region is based on frequent and mostly tacit knowledge elements in the immediate neighborhood of the university. The results verified the characteristic feature of implicit knowledge previously defined (by Polányi, 1967; 1994; 1997) in theory, according to which non-verbal, hard-to-decode knowledge elements have their incentive effect on the economy mainly locally.
2. Detailed external environmental diagnostic examinations made it possible to determine precisely the demands of the knowledge-using subsystem in the regional innovative system (innovation and types of interaction, regional characteristics, future plans, etc.), in order to establish the regional agricultural knowledge demand. Based on the internal environmental diagnostic results found at the University of Debrecen it can be laid down as a fact that the internal interactive “supply” palette meets the external demands, making it possible for the institution to build on this asset in the following three years.
3. Detailed external environmental diagnostic examinations revealed the most relevant obstructive factors of regional innovative processes and the attitude of enterprises in connection with production of knowledge at the university. The results may provide mainly the regional management with useful information, as the biggest obstacle to innovative interactions/processes is the stochastically changing economic- and legal environment as well as the lack of resources which are essential for enterprises. Regional development centers and agencies can help the enterprises in need (e.g. with counseling, submitting tenders) to cope with their problems.

4. Both in Hungarian and foreign specialized literature we can find statements about the close, positive relationship between innovative activity and regional development, which means that regional competitiveness is determined by the innovative activity and potential of the given region. In connection with RIS I analyzed in detail how the institutions of higher education support innovative activities. According to literature it may be presumed that the innovative activity of enterprises and the cooperation with institutions of higher education are connected. Based on the results moderate but significant relationship has been found between the innovativeness of the interviewed enterprises and the cooperation of the participants (calculated for each examined period), therefore enterprises collaborating with institutions of higher education are more likely to introduce innovations than those businesses which do not cooperate with colleges/universities.

5. The shifting of institutional/departmental research work into the direction of applied research does not necessarily result in the promotion of the third mission assumed by the institution, neither does the managers' and colleagues' business experience. The above-mentioned results do not preclude the operating possibilities of theoretical models, although the financial problems and issues in Hungary in these days often relegate knowledge and tech transfer activities to the background.

The joint representation of the results connected to internal and external environmental diagnostics can provide the university management with a lot of useful information - based on regional characteristics to support innovative activity directly – attempts to create such databases have not been made before. Considering the (expansive, consolidated, etc.) transformation of local governmental marketing policies – based on the characteristics of university knowledge transfer and the spatial features of processes a strategic frame system has been provided for the centre, which is to serve the exactitude of the third mission and the stimulation of efficiency within the system.

Among the university innovation models – regarding the results of empirical researches in the agrarian sector – the Goddard conception with its regional commitment suits the operation of the University of Debrecen (AGTC MÉK) best. Considering the existing and planned interaction types as well as the results achieved by the internal management the institution functions well due to a classical, cooperative,

adaptive attitude, which meets the innovative demands made on the knowledge-producing subsystem of the regional innovative system in the Northern Great Plain region.

6. THE PRACTICAL UTILIZATION OF RESULTS

According to surveys conducted by KSH (Central Statistical Office) and NETTINNOV the agrarian sector can be regarded as the least innovative sector which accumulates the least R+D expenditure and engaged labor force in Hungary. Analyzing the results it became evident that the small-, medium- and big agribusiness enterprises in the Northern Great Plain region are not involved in research and development activities; 75 % of the interviewed businesses do not expend energy on these purposes. However, the lack of the activity does not exclude its necessity and demand, which may be potentially taken into account by institutions (e.g. institutions of higher education) dealing with R+D activities.

As far as innovations are concerned, I have found promising results as almost 50 % of the interviewed businesses can be regarded as innovative, which rate is expected to increase in the next three years. Among the introduced innovations product- and process innovations have been typical, which will probably remain dominant within this sector in the near future as well. Interactions within RIS play an important role in the innovativeness of enterprises. Quite often entrepreneurs cooperate with institutions of higher education and they are planning to establish further relations. In the Northern Great Plain region the University of Debrecen (mainly the AGTC) has been a dominant cooperating partner among all educational institutions and the regional importance of the institution will probably be maintained in the following three years. The most characteristic interaction type is the discussion between subsystems and students' mobility but sharing material facilities with each other, formal R+D cooperation, expert employment and special trainings are also frequent forms of cooperation. The ranking of relations is not likely to change in the near future but there will be growing demand for mobility, discussions, purchasing results of research (in the forms of publications), employing experts and the access to each other's physical infrastructure. The majority of enterprises collaborating with the University of Debrecen operate within a 50-60 km radius of the university and the most frequent interaction types are based on tacit knowledge transfer.

According to the (interviewed) agribusiness enterprises in the region the biggest obstacle to effective and continuous innovative interactions is the steadily changing economic- and legal environment as well as the lack of capital, which problem is made worse by the lack of quest for financial resources (tenders, applications).

The internal examinations confirmed the results found in the external environmental studies. In the managers' opinion the most typical interaction types are the discussions with the employers and employees of the enterprises, the two-way students/workers mobility, college/university teachers/researchers involved as experts and the formal R+D cooperation between the participants will be dominant strategic aims in managers' thinking in the institutions of higher education. The majority of existing and planned interactions is concentrated on enterprises within a 50-60 km radius of the university and (similarly to the external environmental research results) relations based mainly on "tacit" knowledge transfer are typical.

Strategic thinking is present in the life of the institutions/departments with relatively greater importance of the third mission assumed by the institution. The organizational units do not have their own incentive and monitoring systems but the lack of the subsystems is compensated by decisions coming from above (top-down process). The internal cooperative activity of the organizational units is quite weak, which in my opinion may obstruct the expansion of the third function. The majority of the interviewed units employ colleagues with business experience but in itself this condition is not enough to strengthen the third function strategically. In addition to mission, the secure operation of the institutions has to be provided, for which continuous resources are needed. There is a connection between an employee with business experience and the importance of the third function represented in aims, which can strengthen the position of the mission in strategic thinking after the financial stabilization of organizational units. On the basis of the results regarding company culture it can be stated that the institutions and departments of DE AGTC MÉK function with an attitude which helps the realization of the third function. In the budget of the organizational units the university (central) and applied tender resources dominate but company inputs are also represented in it in considerable proportion. There is no significant connection between the distribution of budget incomes and the preference of the third function, which means that the additional resources coming from the knowledge-utilizing subsystem (more precisely from enterprises) do not necessarily generate more interest in the third function among managers.

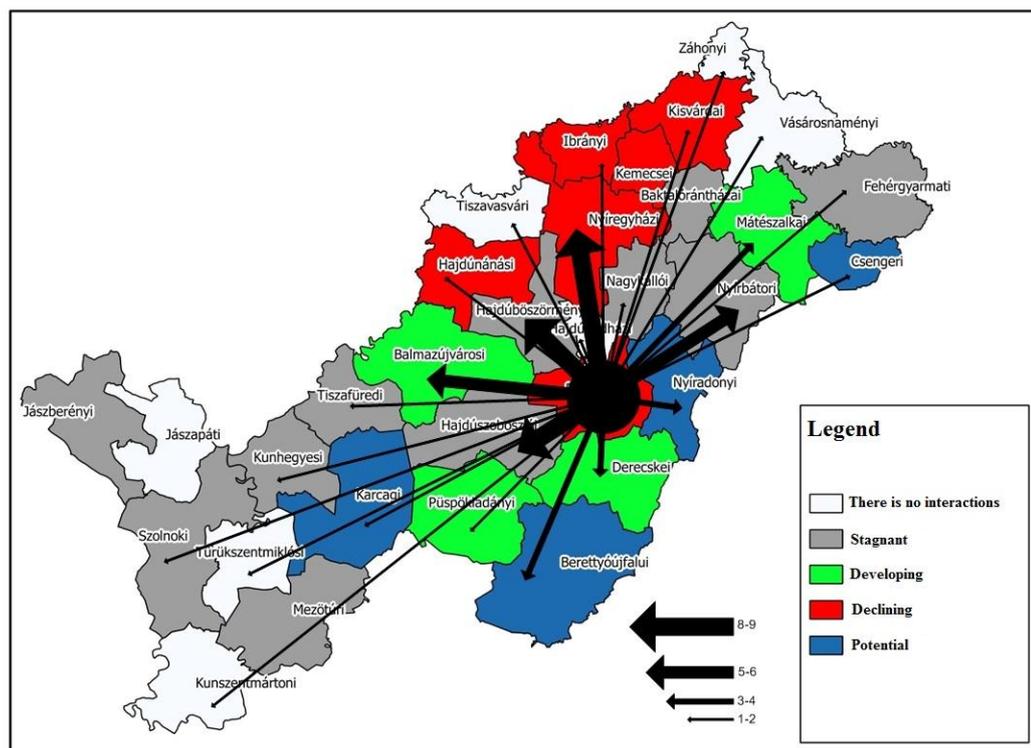
The heads of the centre/faculty/institution/department can be provided with several useful suggestions on the basis of the results.

During the external environmental examinations it turned out that the interviewed agribusiness enterprises do not invest in R+D activity neither from their incomes, nor from their work force, which means that they do not conduct researches for themselves. At the same time more than half of the enterprises will probably introduce some type of innovation in the next three years with the University of Debrecen as a suitable potential cooperating partner. It can be predicted with certainty that enterprises will show preference to institutions of higher education as innovative partners. It is advisable for the University of Debrecen AGTC to move its “supply policy” (considering the planned innovations) in the direction of process- and product innovations. In addition, the introduction of marketing innovations may result in potential relationships. Regarding the mosaic-like structure of regional characteristics a well-aimed marketing policy and strategy is recommended. The district types identified in the external analysis can be used for planning excellently.

The developing, declining, stagnant and potential districts require totally different management policy. Marketing policies used by local governments during strategic planning may provide a starting point for universities to establish appropriate strategic thinking and planning. Four different types of marketing policies intended for local governments can be differentiated: consolidating, quality-improving, expansive and diversifying policies (*Ashworth – Voogd, 1990; Kozma, 2003*). Considering the aims of universities we can interpret the above types in the following ways. In case of consolidating policy universities (with sufficient number of collaborators) continue their previous policy without intending to improve the quality and quantity of their relationships. The policy of quality-improvement is advisable if developments have to be encouraged to keep the previous partners (e.g. services available for enterprises have to be expanded). As for expansive policy, the university would like to increase the number of cooperating partners. The most ambitious policy, the diversifying policy is meant to expand both the range of services at the university and the customer base, which can be considered to be one of the riskiest steps demanding the most resources. The above mentioned policies like a compass may help to work out more appropriate and aimed strategies. For example, in the case of a declining district the university is advised to focus on quality-improvement as the primary aim is to regain and keep the previous partners. On the other hand, in a developing district – in order to strengthen the

previous cooperative base – the expansive policy is more beneficial. The different policies can be combined and like a “framework” they can be filled with more precise aims, action plans, which contribute to more effective operation within RIS. Besides the external environmental conditions the size of the available internal resources respectively and the legal environment regulating the institution can determine the chosen strategy policy. Choosing the right frame policy combined with the comparison of external and internal characteristics promotes appropriate future actions. (Figure 3)

3. Figure: The results of the external and internal environmental examination (spatial features)



Source: Own construction

It is shown in the figure in which districts the external (company) relations of institutions and departments (black arrows) will be concentrated. We can also see the classification of the target areas from the viewpoint of the university co-operations. This information may help managers rearrange the internal energy sources. For example in the Ibrány, Kisvárda, Kemece, Hajdúnánás, Nyíregyháza and Debrecen districts the number of enterprises cooperating with the University of Debrecen is expected to decrease. At the same time the institution is not going to make efforts (with the exception of the Debrecen and Nyíregyháza districts) in order to reverse the process, for this reason some of the internal resources should be directed to these areas so as to

revitalize the previous relationships. It can also be useful in the case of developing and potential districts as more local units can be seen in the figure where potential university relationships may form, whereas institution/department heads may not have any information about them.

As far as interaction types are concerned, regional demand and university supply synchronize with each other. The managers developed the range of their organizational units quite well, which “supply palette” as an asset can help to meet the current needs (demands). Regarding the local features of enterprises willing to cooperate with the university, institution- and department heads should concentrate on Hajdú-Bihar County, as the implicit knowledge spreading from the institution into the direction of the region can have its incentive effect on the economy mainly locally. In addition, the majority of possible partners can be found in the districts near the institution.

For the realization of the third function such an incentive system would be required which can improve the internal cooperative activity between the organizational units. In these days managers should see universities as giant ancient ships on board of which everybody has to row in one direction in accordance with each other to reach the desired aim.

The “company” culture of the institution – in the heads’ opinion - can be considered a favorable asset, as the majority of teachers/researchers is open-minded towards the regional knowledge- and technology transfer.

From among the previously described university innovation models (*by Etzkowitz and Goddard*) in my opinion the realization of the regionally committed university conception is more probable in the Northern Great Plain Region. Although the Etzkowitz interpretation is based on the RIS conception, the economic pressure which is responsible for motivation is not the same in the United States as in Hungary in the Northern Great Plain Region. Analyzing the results of the questionnaires it is evident that the biggest obstacle to the region’s innovative processes is the lack of capital and the insecure economic environment, which paralyses the development of solvent demand for innovations. In our days the Hungarian higher education also has financial problems, which diverts teachers’ and researchers’ attention from the third mission towards the direction of “survival”, where the main aim is to provide the basic conditions for operation. The disadvantageous economic situation of the region determines the research profile of the institutions, the innovative activity of enterprises and the strategic thinking in connection with the activity. The realization of research

orientation (significant function), characteristic of the enterprising university model, production (university responsibility) and proactivity (university attitude) is not impossible in the Northern Great Plain region, however considering the external environmental demands the probability of effective operation in case of the University of Debrecen (AGTC) – as an enterprising university- is quite low. Historically analyzing the establishment and development of the European and Hungarian higher education system and the question of autonomy we can draw some interesting conclusions. Hungarian higher education has similar characteristics as the continental European model: a structure with strong central (state) control. The institutions belonging to the American higher education model are often organized on market basis in response to a current economic problem, therefore these institutions and their managers have closer relationships in the world of business, which makes the knowledge transfer and financing much easier. Without institutional autonomy (exemption from state control) the conception of the enterprising university can hardly be realized. On the other hand the Goddard model approaches the regional economic and social problems in an adaptive way. The model specifically strengthens regional processes relying on the classical function (mainly education), so not in a productive but in a cooperative way. Considering community service (taking social responsibility) it combines the innovative, economic and social processes of the region (external environment) with the operating processes of the institution (internal environment) creating synergies that can be beneficial for both systems. Similar consequences can be drawn from the results of the research conducted in the Northern Great Plain region, as the needs of the agribusiness enterprises of the region are not aimed at explicit knowledge but rather at tacit knowledge transfer during cooperation and vice versa it is true for the mentality of the university as well.

International orientation (to innovative interaction) is not characteristic of the environment and the organizational units of MÉK, either. According to *Károly Barakonyi (2001; 2009)* Hungarian higher education has a chance to take a prominent part in the European Higher Education Region only in that case if it manages to find a gap in the knowledge market and can penetrate into it by developing distinctive competitive advantages, because in his opinion the Hungarian higher education is not likely to acquire a big market share – as far as the number of students and research activity are concerned. On the basis of research results and the opinions of the interviewed (MÉK) managers the regional and macro-regional orientation is decisive.

The operation, regional role and strategic thinking of MÉK is closer to the Goddard interpretation, although features of enterprising conception can be noticed (e.g. e-shop) as well, which provide the institution of higher education with specific characteristics (competitive advantages) making it the knowledge-centre of the Northern Great Plain regional agrarian-innovative system.

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