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Faculty of Agriculture
Institute of Land Use, Regional Development and Engineering

KÁLMÁN KERPELY DOCTORAL SCHOOL

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THESES OF DOCTORAL (PhD) DISSERTATION

**ASSESSMENT OF THE EDUCATIONAL AND INNOVATIONAL ROLE
OF THE CENTRE FOR AGRICULTURAL SCIENCES,
THE UNIVERSITY OF DEBRECEN
IN THE NORTH GREAT PLAIN REGION**

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**Debrecen
2008**

1. INTRODUCTION, OBJECTIVES

The Lisbon Strategy set the objective of making the European Union the most competitive and dynamic knowledge-based economy in the world by 2010. The implementation of this requires vigorous and steady economic growth providing more and better jobs. Solid grounds for the knowledge-based economy and society ought to be ensured by the owners of intellectual capital, the higher education institutions (*Rodrigues, 2005*).

The traditional role and the expectations of higher education institutions have been altered. The development process already completed in Western-Europe has dragged on in Hungary. However, the powerful change of the economy, the dramatic increase in training costs, the limitations of subsidies, the speedy decline in social appraisal, the problems of financing and the higher education challenges of EU membership equally call for rapid changes (*Polónyi, 2002*). For higher education there is no way out but establishing a rational, continuous discourse with the characters of the receiving environment, the region and the formation of an ideal balance of training-research applications *(Dobay, 2004)*.

Higher education institutions can absorb demands of the region through institutional relationships like further training institutes, entrepreneurial centres, consultation services, joint development applications and research commissions. Obviously these organizational units, experts and procedures can only be operated by institutions beyond a certain size. The interpretation of the internal demands of a region and the elaboration of competent responses are equally important: without institutions with several faculties which are capable of interdisciplinary work it is an unfeasible mission (*Talyigás, 1998*).

Business organizations ought to make more effort to deal with the issues of training and further training, and higher education should be present as a provider of a service. The emphasis will be shifted from knowledge transfer to the acquisition of learning skills and methods, thus training institutions have to keep abreast of the development of information and communication technologies (*Horváth K., 2004*). There is a need for regional networks. In the implementation of the process of training, knowledge, execution, feedback and development higher education institutions may play a significant role, as intellectual centres, in the development of the region (*Székely, 2003*).

Learning and analysing the expectations, experience and recommendations of the employers are indispensable for the formation of the development strategy of the Centre for Agricultural Sciences of Debrecen University. The Centre is the nucleus and coordinator of agricultural higher education, research and extension in the area east of the River Tisza. The mission of the Centre for Agricultural Sciences is the agricultural, environmental and rural development of Eastern-Hungary. The institution trains educated, innovative experts who are able to apply, develop and upgrade knowledge, perform high-level organizational and management tasks and also possess sound theoretical and practical knowledge. The user side includes organizations in agricultural education, research, production, extension, services, trade, technical public administration as well as financial institutions. The quality development of training, a continual increase in the number of students and a wide range of courses are the priorities of the Centre for Agricultural Sciences.

The Centre for Agricultural Sciences of the University of Debrecen plays a regional and macro-regional role as well: the agricultural higher educational potential so determinant of the region is concentrated here, thus it is the shaping base of innovation processes. Innovation is a key factor of competitiveness and it can also be described as the application of knowledge as a strategic tool. The preconditions for the development of knowledge society are the following: the creation of new knowledge, its transfer and spread as well was its use in industrial processes and services. Higher education institutions enjoy a special situation as they take part in all the three processes: their R+D activities produce new knowledge, they transfer knowledge through education and training and finally they utilize research results by the foundation of spin-off companies, the establishment of industrial relations furthermore by participating in regional and local development projects.

The feasibility study of the process concerned offers an ideal area for analysing the corporate relations of the Centre for Agricultural Sciences of the University of Debrecen as well as for examining the relationship between research and application, with special respect to agricultural organizations still possessing a significant role in the economy and society of the North Great Plain region. I intended to complete a scientific study concerning the roles of the Centre for Agricultural Sciences, the University of Debrecen, furthermore I aimed at focusing on the comprehensive relations of the Centre and the region, with special emphasis on agricultural institutions and enterprises.

2. MATERIAL AND METHOD

When systematizing the factors describing the theoretical and practical sides of innovation I consider the notion of innovation as defined in the Frascati manual, compiled and used by the OECD (1993), as determinant. The starting point of the notion is research and development (R+D) forming the logical background of success factors determinant in the long term. Innovation is one of the most significant factors of competitiveness; therefore, on the grounds of KSH (Central Statistical Office) data I investigated the success factors of the North Great Plain region searching for correlations regarding population, productivity of labour, employment, investments and national and international enterprises.

The Centre for Agricultural Sciences of the University of Debrecen, the largest agricultural higher education institution of the region, maintains relationships with more than 300 Hungarian and 200 foreign enterprises. Using a self-designed questionnaire I requested the opinion of more than 200 managers working in agriculture about the erudition of graduates, the expedience of their knowledge, the situation of agricultural higher education as well as about their views of the Centre. Apart from the questionnaire survey I rely on empirical examinations, i.e. interviews with prominent figures of the economy and society including managers, entrepreneurs, owners of big companies and heads of economic chambers. In the qualitative interviews I asked managers of agricultural organizations about their experience with former students of the Centre for Agriculture, the level of university training and the innovative cooperation between the university and the public and private organizations.

2.1. Description of the quantitative (questionnaire) examination

Quantification involves expressing facts and processes by numerical data; therefore quantitative research − from one aspect − is a research model which is aiming at gaining numerical results and their statistical process. Quantitative strategies are primarily applied when variables examined in the research are exact and can be adequately expressed with numbers; the possibility for generalisation is significant, and the examination of the phenomenon in its own natural environment also plays importance.

On the establishment of the research sample my major aspect was entailing mostly those agricultural institutions and companies which have assisted with finding

jobs for graduates of the Centre for Agricultural Sciences of the University of Debrecen. The investigation involved the three counties of the North Great Plain region: Hajdú-Bihar, Szabolcs-Szatmár-Bereg and Jász-Nagykun Szolnok *(Figure 1.)*. Up to October, 2007 the questionnaires were forwarded to owners, managers, experts of small, middle-sized and big agricultural establishments who are associated with the university at present also.

In the survey between October, 2007 and January, 2008 I sent out 248 questionnaires, and 206 were returned as appropriate. Since 83 per cent of the forwarded questionnaires were sent back I met that requirement of scientific research which prescribes that search should be carried on until at least 60 per cent of the inquired give valuable answers *(Horváth Gy., 2004)*. A representative sample bears significance for the employed.

The questionnaires were sent out to establishments closely related to the Centre for Agricultural Sciences. The Institute of Land Use and Regional Development of the Centre for Agricultural Sciences, the 4M-ECO project, the Directorate for External Relations, the Department of International Relations and Applications and the Centre President's Office provided the list of relevant organizations. A guide and an addressed envelop were enclosed. Based on the returned questionnaires the sample includes 206 organizations.

Figure 1.

<p align="center">Program of the research</p>
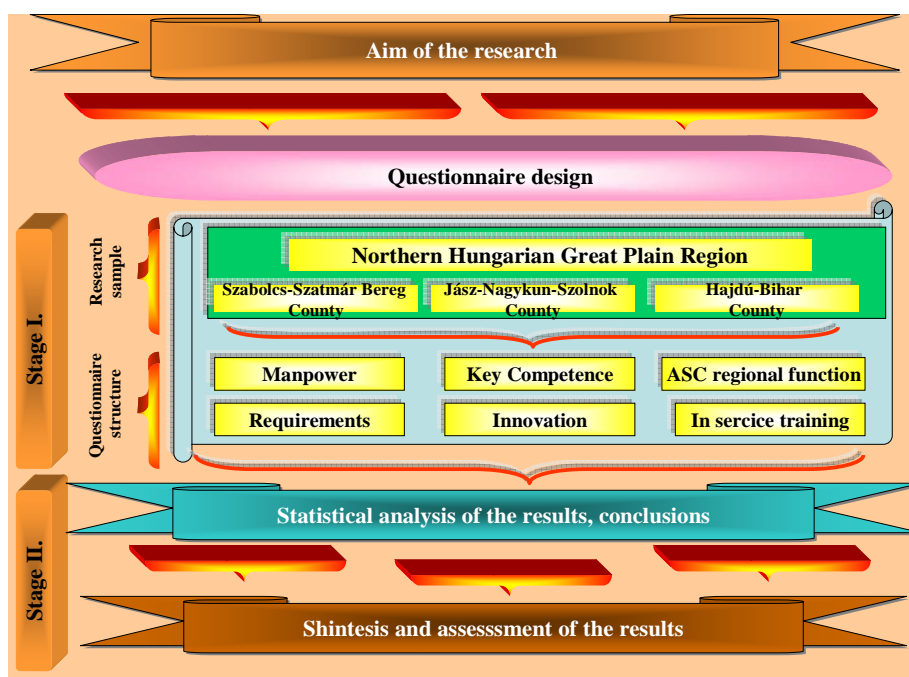
Source: Author's own construction, 2008.

2.2. Methods used in the quantitative (questionnaire) investigation

Apart from descriptive analysis applicable for non-parametric statistics I performed a hypothesis examination (Kruskal-Wallis), and following scale transformations I applied parametric descriptive statistics and data reduction procedures (cluster analysis, factor analysis and MDS, i.e. multidimensional scaling) *(Kolosi-Rudas, 1988 b)*.

In the case of comparing more than two samples, because of the data received on the nominal and ordinal scales opinion uniformity of organizations of different size and ownership form is normally established with the application of the Kruskal-Wallis procedure. This method is not sensitive to normality, standard deviation and number conditions desirable in other cases.

The dimension of professional opinion and expectation has been covered by 9-10 indicators and due to scale transformations they have become high level from measurement point of view. In order to ease interpretation I substituted the ten indicators by dimension – describing a ten dimensional space – for a more comprehensible, 2-or-3-dimensional space by applying data reduction procedures. In each case the applied methods have been tested with the fitting of the models (KMO values in factor analysis and Stress values in MDS).

2.3. Description of the qualitative interview and methods used in the qualitative interview

The interview method is ideal for unveiling the differences between the quantitative and the qualitative strategies as deviations are clearly revealed in the two versions of interviews. Qualitative interviews are dominated by descriptive elements. The interview is primarily aiming at exploring, documenting a phenomenon, demonstrating its versatility and complexity. Data gained in qualitative interviews are also suitable for strengthening or weakening the likelihood of certain, previously worded hypotheses.

Qualitative, otherwise structured, interviews are built on planned dimensions. They have been processed by content analysis and quantification, i.e. the counting of the dimensions. In the qualitative interviews the empirical weighting of the dimensions took place on a seven degree Likert scale. From research point of view the application of the structured interviews was justified by being regarded supplementary to group questionnaire surveys in conference methods. I intended to enhance the objectivity of my research by a joint application of methods.

3. MAJOR RESULTS OF THE THESIS

Due to the topic of the research targeted sampling has been applied. Using the theory of systematic sample selection those persons have been selected for the examination exclusively who have had any kind of work relations with the university in the past seven years. The ventures and institutions in the investigation have been affiliated with the Centre for Agricultural Sciences in one of the following forms: joint innovation projects, applications, vocational days, forums, extension evenings, methodology publications, conferences, affiliated departments, locations for trainees or Farmer-expo.

Geographically the 206 organizations are all located within the borders of the region. Hungarian owned private enterprises make up 99.5 % (205 elements) of the sample and only 0.5 % (1 element) is purely foreign owned.

3.1. Employers' expectations, opinion

I hypothesized that the innovative use of knowledge attained at the Centre for Agricultural Sciences is significantly different depending on the size, ownership form and activity profile of the enterprises or institutes.

Establishments of different size are identical in making best use of the knowledge obtained in the Centre by the application of research and development. Science gained at the university is most beneficial in extension and finance. Knowledge obtained is made good use of to different extent depending on the firms' or institutes' size in the following fields of use *(Table 1.)*.

Table 1.

Areas of benefiting from knowledge based on the size of the organization

Innovative use of knowledge	Size of the organization					
	2-9 persons	10-49 persons	50-99 persons	100-199 persons	200-499 persons	above 500 persons
In economic areas	6	19	6	8	4	0
In management systems	3	3	8	2	1	0
With the application of research and development	11	28	15	9	4	1
In applications and projects	1	5	4	3	0	1
In vocational practice	5	6	6	3	1	0
In extension	9	16	6	8	3	1

Source: Author's own construction based on empirical examinations, 2008.

$Khi^2_{calculated} > Khi^2_{threshould\ value\ 0.05;\ 25}$ *(Table 2.).*

Table 2.

Khi-square test

	Value	Degrees of freedom	Two tailed significance level
Pearson Khi square	20.484	25	0.721
N	206		

Source: Author's own construction based on empirical examinations, 2008.

Examining the organizations on the basis of activity classification - in evaluating the knowledge efficacy of the Centre for Agricultural Sciences – one can observe that science and skills acquired at the Centre are most profitable in research and development, extension and finance *(Table 3.).*

Table 3.

Areas of benefiting from knowledge based on the activity profile of the organizations

Innovative use of knowledge	Activity profile				
	Animal husbandry	Trade	Public administration	Plant production	Services
In economic areas	11	13	2	12	5
In management systems	6	3	0	4	4
With the application of research and development	12	14	1	26	15
In applications and projects	0	5	0	7	2
In vocational practice	3	6	1	5	6
In extension	13	12	2	6	10

Source: Author's own construction based on empirical examinations, 2008.

$Khi^2_{calculated} > Khi^2_{threshould\ value\ 0.05;\ 20}$ *(Table 4.).*

Table 4.

Khi-square test

	Value	Degrees of freedom	Two tailed significance level
Pearson Khi square	22.659	20	0.306
Likelihood	26.840	20	0.140
N	206		

Source: Author's own construction based on empirical examinations, 2008.

Business enterprises of different ownership forms can mostly profit from the acquired knowledge in the Centre in using the results of research and development, in economic and financial fields of work and in agricultural extension services.

Intensive use of knowledge acquired in vocational practice is only typical in Hungarian owned enterprises under Hungarian circumstances *(Table 5.)*.

Table 5.

Areas of benefiting from knowledge based on the ownership form of the organizations

	Ownership form						
	Sole proprietorship	Hungarian owned enterprise	Foreign owned enterprise	Joint ownership form	Government owned company	Public administration institution	Non-profit organization
In economic areas	5	23	0	15	0	0	0
In management systems	0	11	0	5	0	0	1
With the application of research and development	2	50	0	11	0	4	1
In applications and projects	0	9	0	4	0	0	1
In vocational practice	2	16	0	3	0	0	0
In extension	2	27	1	12	1	0	0

Source: Author's own construction based on empirical examinations, 2008.

$Khi^2_{calculated} > Khi^2_{threshould\ value\ 0.05;\ 30}$ *(Table 6.)*.

Table 6.

Khi-square test

	Value	Degrees of freedom	Two tailed significance level
Pearson Khi square	36.183	30	0.202
Likelihood	35.681	30	0.219
N	206		

Source: Author's own construction based on empirical examinations, 2008.

Examining the extent of utilizing knowledge obtained at the Centre for Agricultural Sciences on the basis of the size, ownership form and activity profile of the organizations I came to the conclusion that the six areas offered in the questionnaire were not regarded as equal. The combination and pattern of the selected areas of

utilization show a developed level of innovative skills. The result of the Khi-square test showed that there is a significant difference between the areas of utilization. I investigated the utilization of innovative knowledge on the basis of six dimensions. Based on the examinations I established that different areas of innovative knowledge are prioritized in organizations of different size, ownership form and activity profile. I justified my establishment with the Khi-square test. The statistical verification justified the differences between the organizations. Furthermore depth interviews performed within the investigation with prominent figures also support this statement (Gran-Export Ltd. Hajdú-Bihar County, Debrecen; Hajdú Bihar County Office for Agriculture and Technical Public Administration, Debrecen).

According to my hypothesis the method of staff selection depends on the size and ownership form of the organization as well as the size of the settlement.

The university prepares the students to start with equal chances in the labour market regardless of the geographical location, ownership form and staff number of the organization. In my investigation I intended to find out whether there are differences in staff selection between organizations of various ownership form, size and geographical location. Based on the Khi square test I came to the conclusion that organizations of different ownership form employ different recruitment procedures. A significant difference has been found in the case of headhunting agencies, job fairs and employment centres. Wholly foreign owned enterprises mostly employ the services of headhunting firms.

The method is present in the recruitment of headhunting firms, joint ownership form companies and to a lesser extent in the case of Hungarian owned organizations also. Sole proprietors, government owned companies, public administration institutions and non-profit organizations do not turn to headhunting agencies or job fairs. Job fair services are chiefly employed by government owned companies and to a lesser degree joint and Hungarian owned enterprises. Foreign business organizations, public administration or non-profit institutions do not apply job fair services. Recruitment through the Employment Centre occurs in different degrees in all organizational forms. The only exception is the group of foreign owned companies: they neglect this way of recruitment completely. Government owned companies give equal chances to three forms of recruitment (newspaper advertisement, job fair, employment centres). All the six staffing methods appear in the Hungarian owned enterprises and the joint ventures.

(Figure 2.). Public administration and non-profit institutions both apply four methods for staff selection. The term frequency refers to the hundredth of relative frequency.

Figure 2.

Employee selection methods typical of ownership categories
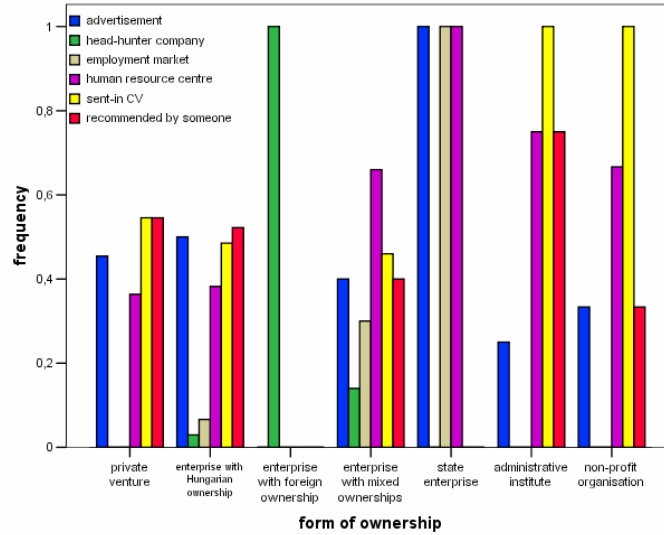
Source: Based on empirical research SPSS, 2008.

Employers of different ownership form prefer different recruitment methods, which is presented in more details in the following table showing the distribution of the sample also *(Table 7.).*

Table 7.

Frequency table of staff recruitment methods by ownership categories

	Ownership form of the organization					
	Sole proprietor-ship	Hungarian owned enterprise	Foreign owned enterprise	Joint ownership enterprise	State owned companies	Public administration institutes
Newspaper advertisement	5	68		20	1	1
Headhunting agency		4	1	7		
Job fair		9		15	1	
Employment centre	4	52		33	1	3
Submitted CV	6	66		23		4
Recommendation	6	71		20		3

Source: Author's own construction based on empirical examinations, 2008.

Applying the Khi square test I analysed the relation between the frequency distribution of recruitment methods belonging to different ownership forms and the distribution to be expected theoretically *(Table 8.)* and received the following relationships. If $p < 0.05$, the result is significant i.e. there is a difference between the recruitment methods.
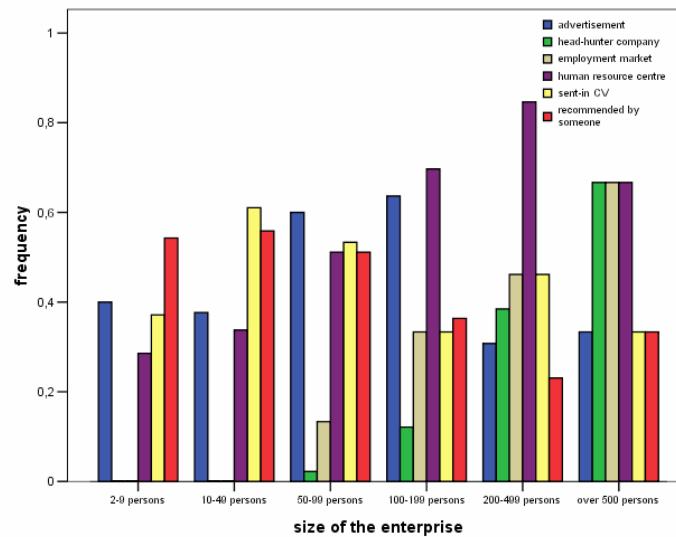
Table 8.

Khi square test by ownership categories

	Khi square value	Two tailed significance level
Newspaper advertisement	4.494	0.610
Headhunting agency	25.495	0.000
Job fair	28.721	0.000
Employment centre	15.653	0.016
Submitted CV	9.510	0.147
Recommendation	5.613	0.468

Source: Author's own construction based on empirical examinations, 2008.

When employers decide about the acceptance of an applicant based on personal recommendations or submitted curriculum vitae, there is no significant difference between organizations of different staff number. Thus these two methods give equal chances to applicants regardless of the size of the organization. Out of the six categories based on staff number newspaper advertisements are predominantly used by employers having 50 and 200 employees, headhunting agencies are chiefly hired by organizations above 500 employees and to lesser extent by establishments between 200-500 employees, and job fairs are called in by the employers in the same proportion. Services of the Employment Centre are used by institutes and ventures of all categories but principally by organizations between 100 and 500 staff number *(Figure 3.).*

Figure 3.

Employee selection methods typical of different organizational sizes

Source: Based on empirical examinations SPSS, 2008.

Establishments of different size make use of different recruitment processes. *Table 9.* presents the most common ways of selection.

Table 9.

Frequency table of staff selection methods by organizational size

	Size of the organization					
	2-9 employees	10-49 employees	50-99 employees	100-199 employees	200-499 employees	Above 500 employees
Newspaper advertisement	14	29	27	21	4	1
Headhunting agency			1	4	5	2
Job fair			6	11	6	2
Employment centre	10	26	23	23	11	2
Submitted CV	13	47	24	11	6	1
Recommendation	19	43	23	12	3	1

Source: Author's own construction based on empirical examinations.

With respect to recruitment techniques significant difference ($p<0.05$) has been found between organizations of different size *(Table 10.)*.

Table 10.

Khi square test by organizational size

	Khi square value	Two tailed significance level
Newspaper advertisement	11.702	0.039
Headhunting agency	55.860	0.000
Job fair	51.910	0.000
Employment centre	25.162	0.000
Submitted CV	10.326	0.067
Recommendation	7.814	0.167

Source: Author's own construction based on empirical examinations, 2008.

Regarding the ways of recruitment a significant difference has been found by settlement size since personal recommendations possess the best chance for finding a job in small settlements and partly in county centres also. As regards the other recruitment methods no significance ($p<0.05$) has been identified from among the different geographical locations of the organizations *(Figure 4.).*

Figure 4.

Employee selection methods typical of types of settlements
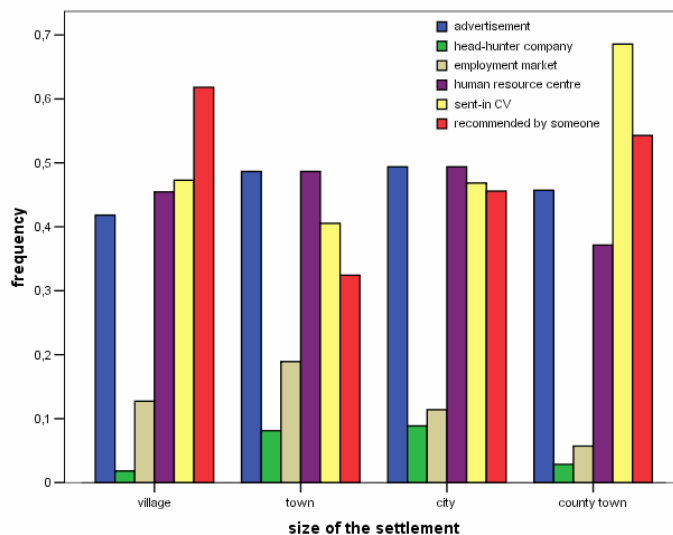
Source: Based on empirical examinations SPSS, 2008.

In the frequency table showing the recruitment methods of organizations operating in different settlement categories significant difference between the measured

and the expectable data has only been found in the case of personal recommendations *(Table 11.).*

Table 11.

Frequency table of staff selection methods by settlement size

	Settlement size			
	Village	Small town	Big town	County centre
Newspaper advertisement	23	18	39	16
Headhunting agency	1	3	7	1
Job fair	7	7	9	2
Employment centre	25	18	39	13
Submitted CV	26	15	37	24
Recommendation	34	12	36	19

Source: Author's own construction based on empirical examinations, 2008.

On the basis of the Khi square test performed to verify the frequency of recruitment techniques examined by settlement types it can be established that significant difference between the settlement types has been proven in the case of personal recommendations *(Table 12.).*

Table 12.

Khi square test by settlement size

	Khi square value	Two tailed significance level
Newspaper advertisement	0.822	0.844
Headhunting agency	3.850	0.278
Job fair	3.009	0.390
Employment centre	1.575	0.665
Submitted CV	6.614	0.085
Recommendation	8.443	0.038

Source: Author's own construction based on empirical examinations, 2008.

Statements raised in my hypothesis have been justified as I established significant differences ($p<0.05$) in the application of recruitment methods: regarding ownership form in three cases, concerning organizational size in four cases and by settlement size in one case. All these have been supported by bar graphs, frequency tables and Khi square tests.

3.2. The opinion of the employers and students about the training at the university

In my hypothesis I assumed that the opinion of the employers and that of the students about the quality level of the training at the university would not show a significant difference.

In the hypothesis examination I performed a comparative analysis. Based on student questionnaires a previous PhD dissertation was dealing with the competitiveness of Debrecen University. Dr. Rőfi Mónika, PhD, who was in charge of the examination, has placed the basic data of the students at my disposal. Since the data reflect the feedback of students from all the 15 faculties of Debrecen University I selected the data of the Faculty of Agricultural Economics and Rural Development and the Faculty of Agriculture. Considering the two faculties the number of elements is 365 (N=365). I compared the responses with those of the managers where the number of elements was 206 (N=206). In both cases I examined proposals referring to the quality improvement at the university. I solicited opinions concerning the level of training at the Centre for Agricultural Sciences from the user and the student side. I measured the standard of education on the seven-degree Likert scale. The two groups (employers', students') of opinions were unanimous in evaluating the quality standard as good. The average of the employers/organizations (5.42) was slightly higher than that of the students (5.24) *(Figure 5.)*. By using the two-sample T-test I intended to check if this is a significant difference or only an accident

Figure 5.

Evaluating the quality level of education − based on employers' and students' opinions
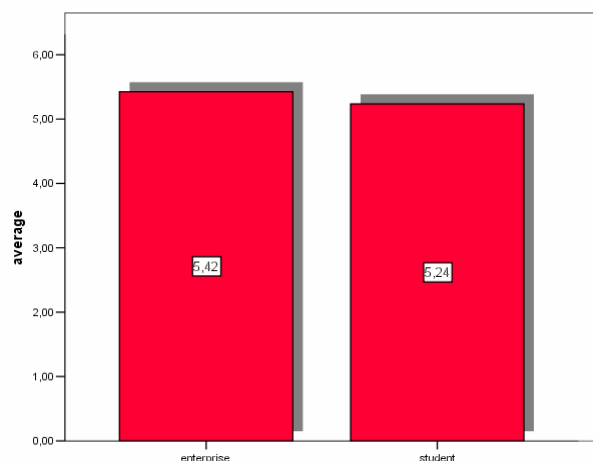
Source: Empirical examinations SPSS, 2008.

Parameters (average values/means, standard deviations and the standard deviations of the error of the average) received from the application of the T-test brought me to the conclusion that there was a slight difference between the two groups (employers, students). The average value of the students was lower (5.24) and the standard deviation of their opinion was much bigger *(Table 13.)*. The coefficient of variation (24.1) of the students' opinion can be regarded as considerable.

Table 13.

Parameters of the two samples

Quality	N	Average	Standard deviation	Standard deviation of the error of the average
Employer	206	5.4239	0.71222	0.04962
Student	365	5.2356	1.26202	0.06606

Source: Author's own construction based on empirical examinations, 2008.

When applying the independent samples T-test one needs to decide first if the standard deviation of the sample is identical or not. Based on Levene's test the significance level is lower than 0.05 thus the standard deviations are not identical. In this case one should pay attention to that row in the table where the calculated T is 2.28. The significance level is 0.023, which considering the normal 0.05 level can be regarded as significant *(Table 14.)*.

Table 14.

Independent samples T-test

|	Levene's test for the accord of the variances		T-test for the accord of the averages				
	Quotient of F variances	Sign.	T	Degrees of freedom	Sign.	Difference of average	Standard deviation of the error of difference
Assuming the accord of variances	64.946	0.000	1.972	569	0.049	0.18833	0.09553
Assuming the difference of variances			2.280	568.999	0.023	0.18833	0.08262

Source: Author's own construction based on empirical examinations, 2008.

The box plot type of figure expressively presents the standard deviation of the data. It is well-known that the positional mean values of sets arranged in statistical sense and values received when quartering the number clearly characterize the standard deviation in the sample. The bold black line in the rectangle part of the figure, the median, shows the positional mean value of the two samples. The median of the employers is approximately 0.5, which is higher than that of the students'. The area above the median in the rectangle demonstrates the interval belonging to the 25 % of the number, whereas the stick above the rectangle shows the quarter giving the highest value of the sample. 25 % of the employers marked the highest values (6 and 7). Altogether half of the sample −25% above and 25% below the median − chose the values of five and six. Even that part of the number (25%) which opted for the lowest value marked values between 3.7 and 5. There was one element (Number 98) which, due to the low value, did not fit the sample but even this one was higher than 3 *(Figure 6.).*

The figure clearly shows that the opinion of the employers about the quality of training is highly favourable and the standard deviation of the opinions is exceptionally homogenous, the coefficient of variation is 13%, consequently their assessment can be considered unanimous. The standard deviation of the students' opinions is clearly expressed in the figure. One quarter of the students (91 persons) selected value 6 or 7 but the median value was lower than that of the employers. Half of the number − 25% above and below the median − chose values 4, 5 or 6, but that quarter of the sample (91 persons) which marked the lowest values opted for values between 1 and 4 when evaluating the quality standard of the university.

Figure 6.

Evaluating the quality level of education − employers' and students' opinions
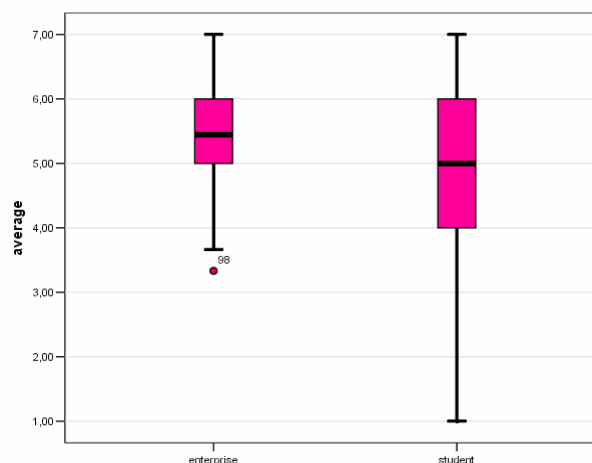
Source: Empirical examinations SPSS, 2008.

The students' coefficient of variation was found to be considerable; even extremely different opinions occurred. Employers' opinions, which can be judged as unvarying, were subjected to further investigations based on ownership forms and organizational sizes and applying the Kruskal-Wallis test. Individual ownership categories formed fairly different opinions about quality because the rank averages show sizable standard deviation and significance hardly deviates from the reference value as p=0.06. The major difference lies between the group of public administration and non-profit institutions and other ownership forms. Concerning the groups of organizations based on size, rank averages are similar and the significance level is higher (p=0,744) indicating more identical opinions.

Organizations disclosed a higher than average and better than the students' satisfaction with the quality level at the Centre. Results of the parametric statistical procedure, the two-sample T-test, indicate that views of the examined samples do not differ significantly. My hypothesis has been justified as both the employees and the employers are satisfied with the quality level of teaching.

3.3 The role of the Centre for Agricultural Sciences

My hypothesis was that professional opinions and professional expectations of the Centre for Agricultural Sciences are closely correlated.

More than 93% of the areas of the nine-indicator professional opinion and the ten-indicator professional expectation systems show close correlation with each other, consequently it can be stated that the expectations and the opinions almost cover each other. In the relationship system of professional expectations and opinions communication skills do not show a close relation with professional knowledge and practical skills. The correlation between the opinions concerning the establishment of professional attitude and the practical expectation is negative, (r=-0.058) but considering the two tailed significance this correlation is not significant. No close interrelationship was shown between treating people and professional knowledge, furthermore between orientation in the world and practice. *To recapitulate* one can establish that the lack of correlation between the indicators of professional opinions and professional expectations occurred in the highest number in the case of the indicators of professional knowledge and practice. The most interesting connection

emerged from the indicators of informatics skills and preparation for professional problems, because the low value of the correlation coefficient between the two reveals that when solving professional problems employees can make use of informatics skills to a lesser extent *(Table 15.)*.

Table 15.

Intercorrelation matrix for the indicators of professional opinions and expectations

Pearson correlation	Economic studies	Law studies	Social studies	Organizational skills	Management skills	Communication skills	Language skills	Informatics skills	Professional knowledge	Practice
Practical skills	0.145	0.270	0.298	0.244	0.349	0.220	0.371	0.228	0.297	0.561
Two-tailed sign.	*0.038*	*0.000*	*0.000*	*0.000*	*0.000*	*0.002*	*0.000*	*0.001*	*0.000*	*0.000*
Professional knowledge	0.319	0.302	0.456	0.456	0.388	0.442	0.392	0.401	0.544	0.145
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.038*
Communicational skills	0.482	0.483	0.535	0.444	0.408	0.346	0.267	0.274	**0.120**	**0.099**
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.086*	*0.155*
Problem solving skill	0.417	0.463	0.564	0.495	0.497	0.389	0.295	0.230	0.178	0.188
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.001*	*0.011*	*0.007*
Professional attitude	0.407	0.355	0.538	0.580	0.498	0.551	0.346	0.423	0.482	**-0.058**
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.406*
Preparation for professional problems	0.252	0.344	0.291	0.301	0.368	0.254	0.166	**0.137**	0.205	0.419
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.017*	*0.050*	*0.003*	*0.000*
Treating people	0.468	0.505	0.603	0.478	0.530	0.334	0.365	0.271	**0.130**	0.357
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.062*	*0.000*
Foreign language skills	0.419	0.473	0.577	0.525	0.523	0.493	0.532	0.461	0.309	0.203
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.003*
Orientation in the world	0.546	0.537	0.691	0.597	0.644	0.588	0.511	0.518	0.310	**0.099**
Two-tailed sign.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.159*

Source: Author's own construction based on empirical examinations, 2008.

In order to provide precise mapping for the relationship system of the indicators the intercorrelation matrix is processed into an aggregate matrix. By marking cells showing significant relations with a 1 and cells showing no relationship with 0 an aggregate matrix is received, thereafter by deleting rows and columns containing 0 one can get the dimension referring to purely significant relations *(Table 16.)*.

Table 16.

Aggregate matrix of the correlation between expectations and opinions

	Economic studies	Law studies	Social studies	Organizational skills	Management skills	Communication skills	Language skills	Informatics skills	Professional knowledge	Practice
Practical skills	1	1	1	1	1	1	1	1	1	1
Professional knowledge	1	1	1	1	1	1	1	1	1	1
Communicational skills	1	1	1	1	1	1	1	1	0	0
Problem solving skills	1	1	1	1	1	1	1	1	1	1
Professional attitude	1	1	1	1	1	1	1	1	1	0
Preparation for professional problems	1	1	1	1	1	1	1	0	1	1
Treating people	1	1	1	1	1	1	1	1	0	1
Foreign language skills	1	1	1	1	1	1	1	1	1	1
Orientation in the world	1	1	1	1	1	1	1	1	1	0

Source: Author's own construction based on empirical examinations, 2008.

The opinions of the employers in practical skills, professional knowledge, problem solving and foreign language command were fully identical with economic, legal, social, organizational, management, communication and language knowledge appearing in the expectations *(Table 17.).*

Table 17.

Developed aggregate matrix presenting the system of relationships

	Economic studies	Law studies	Social studies	Organizational skills	Management skills	Communication skills	Language skills
Practical skills	1	1	1	1	1	1	1
Professional knowledge	1	1	1	1	1	1	1
Problem solving skills	1	1	1	1	1	1	1
Foreign language skills	1	1	1	1	1	1	1

Source: Author's own construction based on empirical examinations, 2008.

I determined the closeness of the relationship with the help of Pearson correlation which I used to form the variable paired intercorrelation matrix. Considering the significance level of the correlation I applied a simplified aggregate matrix to determine the "significant core" of professional opinions and professional requirements expected of the Centre. My hypothesis has been proven since the statistical investigations and the qualitative interviews (Bátortrade Ltd. Szabolcs-Szatmár-Bereg county, Nyírbátor; Jászkíséri Agroszöv PLC. Jász-Nagykun-Szolnok county, Jászkísér) have verified the closeness of the relationship.

In my hypothesis I assumed that employers' expectations concerning personality features and professional fields conform to the competence level of the university graduates.
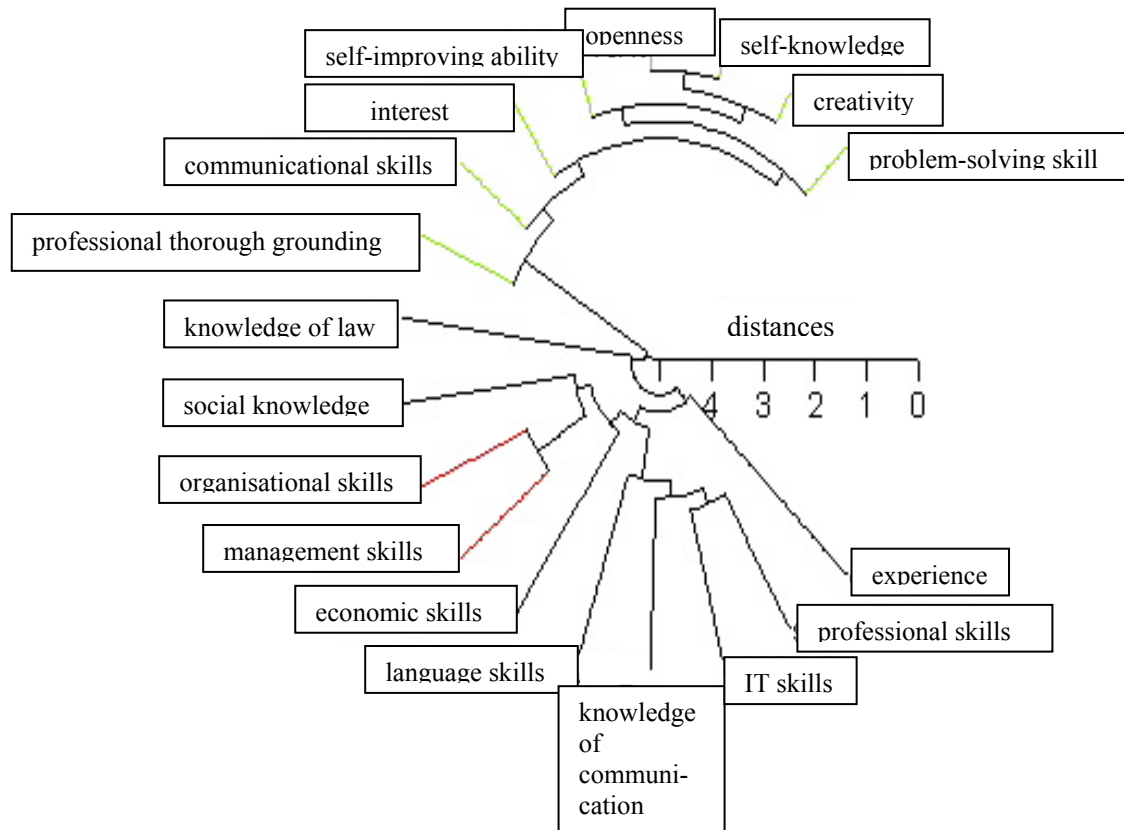
I described the areas of the most important personality characteristics and expectations with the polar dendrogram centroid method (calculated for eudiclean distances) *(Figure 7.).*

Those students have a good chance in the labour market who are creative, communicative and interested. They also need to possess appropriate self-knowledge, an open personality, good problem solving skills and apt professional familiarity. In addition, they should actively follow the strategy of life-long-learning. All this can be interpreted as a field of personal competence. When discussing professional expectations the set of appropriate professional, informatics and communication skills (in foreign languages also) is understood as professional competence supplemented with good organizational skills, economic and social studies and management approach. The latter one could be interpreted as management competence. The professional, management and personal competence are linked by familiarity in law. The competency map defined above is complemented by practical skills.

This could be the ideal competency map employers would be satisfied with.

Figure 7.

Competency map of the employers

self-improving ability

openness

self-knowledge

interest

creativity

communicational skills

problem-solving skill

professional thorough grounding

knowledge of law

distances

social knowledge

4 3 2 1 0

organisational skills

management skills

experience

economic skills

professional skills

language skills

IT skills

knowledge
of
communi-
cation

Source: Empirical examinations SPSS, 2008.

As a result of my examinations the competency map of the would-be employees was outlined. Employers' opinion about the Centre for Agricultural Sciences share dimensions with the competency map of the employees.

4. CONCLUSIONS, RECOMMENDATIONS

A new phenomenon appeared in the countries of Western-Europe in the past decade: competitiveness, innovation and its measurement as they were traditionally interpreted in economics have been replaced by effectiveness, a new way of thinking focusing on the indexes of a region. In today's integrating Europe the role of universities has been upgraded in improving knowledge economy and society as the increase of knowledge society highly depends on the production, transfer, spread (education, training) and application (new industrial processes and services) of new knowledge. The special situation of universities is shown in the fact that they simultaneously participate in the accomplishment of a manifold process: a) research and development; b) students' education and researchers' training; c) the utilization of research findings (industrial relations, spin-off companies, regional and local development) *(Baranyi et al., 2005)*.

Achieving the appreciation of the academic world and the employers is a long process. Although certain institutions have already gained favourable experience (in graduates' finding employment and their position in the labour market) but maintaining quality requires continuous attention and control. Maintaining positions in the economic competition calls for the on-going renewal of existing resources and abilities. In modern economies the most important form of accommodation to the changes is innovation, i. e. a novel combination of resources and capabilities *(Teece- Pisano, 1994)*.

The relationships of companies with universities and research institutions have played an outstanding role in development projects. In addition, increasingly knowledge-intensive developments will boost the importance of cooperation with universities and research institutions.

The attainment an enterprise or a country can reach in innovation and the level of problems it is able to solve depend on the quantity and quality of knowledge it has acquired in the past.

Companies have the ability to learn, to gain new knowledge, and since they follow various and differing learning routes skills built on the obtained knowledge will also be different, which lays the grounds for lasting differences between enterprises.

In accordance with national and international surveys it can be stated that big companies pursue innovation activities of larger scale, but regarding the expenditure the results of small ventures are better.

As a summary it can be declared that research, development and innovation played an outstanding role in the competitiveness of enterprises. However, familiarity with the markets, marketing, sales, productivity, the costs factor and the quality of products are also important. Understanding and accepting this and approving that this shows adequate adaptation to new challenges, the basis of long term competitiveness can only be provided by a more serious role of development activity. The macro-statistical figures of the period after the millennia reveal positive tendencies, e.g. the increase of corporate R+D locations. Foreign experience shows that R+D inputs can only be materialised with a much more active corporate innovation activity *(Nyíri, 1996)*.

Cooperation between agricultural firms and research institutions has traditions in the region and the county. Primarily the Centre for Agricultural Sciences and its predecessors have established close affiliations in the past years. These relationships cannot be regarded as innovational as they have mainly been initiated by the Centre. In practice it meant that when a research team or the Centre had won an application it started to find corporate partners for the implementation. In the past years a group of firms have kept on occurring in the joint projects. These can be called spin-off and start-up enterprises the establishment of which the faculties and departments of the Centre for Agricultural Sciences have played a significant role.

Empirical research have verified that organisational managers consider the Centre for Agricultural Sciences of the University of Debrecen to be the determinant institution of the region owing to its outstandingly wide spectrum of training, its scientific and intellectual base and its research and development activity.

The investigations revealed the expectations of the managers concerning the quality level of the training and the offer of the university was also presented. I made a proposal for drawing a competency map from the employers' side.

From the aspect of the future an exploration examining the competencies of the students of the Centre for Agricultural Sciences would definitely be expedient. The assessment would disclose the extent the Centre has developed the required knowledge to, and the degree the skills and knowledge of the students have improved to during the years at university.

5. NEW AND NOVEL SCIENTIFIC RESULTS

1. With the intention of harmonizing employers' and employees' sides and improving the educational and quality level of the Centre for Agricultural Sciences, the University of Debrecen I performed the first complex, theoretical and empirical analysis applying scientific methods less known and rarely used in examinations of this kind (eudiclean distance-model; intercorrelation matrix; box plot type of figure; competency map).

2. Based on empirical examinations, with topic specific analyses I established the most important fields of competence developed by agricultural higher education, as well as competencies expected by the employers.

3. The analysis of the research results has justified that organizational managers have a higher than average contentment with the quality level of education at the Centre for Agricultural Sciences, the University of Debrecen. In this issue managers have a more favourable opinion than that of the students.

4. Founded on the results of the analyses I established that professional opinions and professional expectations of the Centre for Agricultural Sciences, the University of Debrecen are closely related.

5. Results of the statistical examinations and the investigations with prominent figures verify that differences exist in the staff selection methods depending on the size and ownership form of the organizations.

6. Results of the empirical examination laying the grounds for the scientific analyses show that the innovative utilization of the knowledge acquired at the Centre for Agricultural Sciences of the University of Debrecen differs in the case of organizations of different size, ownership form and activity profile.

PUBLICATIONS RELATED TO THE THESIS

Mohácsi M.: A felsőoktatás interregionális kapcsolatai az Észak-alföldi régióban. Erdei Ferenc IV. Tudományos Konferencia, Kecskemét 2007. augusztus 27-28. Coauthor: dr. Rőfi Mónika 393-397 p.

Mohácsi M: Corporate relations of the centre of agricultural sciences, University of Debrecen. Erdei Ferenc IV. Tudományos Konferencia, Kecskemét 2007. augusztus 27-28. 456-460 p.

Mohácsi M.: A Debreceni Egyetem és az agrárvállalkozások kapcsolatai. XLIX. Georgikon Napok, Keszthely 2007.szeptember 20-21. CD melléklet
ISBN 978-963-9639-22-5

Mohácsi M.: A Debreceni Egyetem versenyképessége az Észak-alföldi Régióban. IV. Európai Kihívások Szeged, 2007. október 12.: Coauthor: dr. Rőfi Mónika 516-521 p.

Mohácsi M.: A Debreceni Egyetem Agrártudományi Centrum szerepe az Észak-alföldi régió vidékfejlesztési folyamataiban.VII. Falukonferencia: A vidéki Magyarország az EU-csatlakozás után Pécs, 2007. június 21-22. 239-245 p.

Mohácsi M.: Az Agrártudományi Centrum vállalati kapcsolatainak szerepe az innováció tükrében az Észak-alföldi régióban. Regionalitás, területfejlesztés és modernizáció az Észak-alföldi Régióban. Debrecen, 2008. 219-225 p.

Mohácsi M.: Adalékok a vidékfejlesztés gyakorlatának értelmezéséhez a Debreceni Egyetem Agrártudományi Centrum vállalati kapcsolatainak tükrében az Észak-alföldi Régióban. Agrártudományi Közlemények Debrecen, 2008. 2008/29. különszám

Mohácsi M.: Együttműködési lehetőségek az oktatás és az innováció területén Kölcsey Ferenc Református Tanítóképző Főiskola Tudomány Napi Konferencia Debrecen, 2007. november 7.

Mohácsi M.: Versenyképesség, innováció, regionalitás. Tanulmányok 2008. Kölcsey Ferenc Református Tanítóképző Főiskola Debrecen, 2008. (megjelenés alatt)

Mohácsi M.: Regional cooperation in education and innovation. Babes-Bolyai Tudományegyetem. Évkönyv. Kolozsvár. 2008. (megjelenés alatt).

Mohácsi M.: Regional development based an knowledge centers in the North Hungarian Plain Region. Nagyváradi Egyetem. Nagyvárad. 2008. (megjelenés alatt).

Mohácsi M.: Médiakommunkiáció - Terítéken a valóság Tanulmányok 2006. Kölcsey Ferenc Református Tanítóképző Főiskola Debrecen, 2006. 55-65 p.

Mohácsi M.: Gyermekközpontú pedagógiák. Tanulmánykötet. Határon túli magyar tanítók nyári továbbképzése. Kölcsey Ferenc Református Tanítóképző Főiskola Debrecen, 2007. Társszerző: Gömöry Rita