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Зміст

Різні (економіка, біологія...)

*

Привітання Феєр Клари

Tartalom

Történelem

Pedagógia

Filológia

Egyéb (gazdaság, biológia...)

*

Fejér Klára köszöntése

Éva Bakota Pósfai[*]

The Geographical Interpretation of the Diffusion of the Information Technology Engineer Knowledge

Rezümé. A cikkben arra vállalkozom a geográfia kutatási eszközeit és módszerét felhasználva, hogy bemutassam a magyar felsőoktatás intézményrendszerén belül, annak bizonyos értelemben elszigetelt pontjaként értelmezhető és helyszínéhez köthető felsőoktatási intézmény, a Gábor Dénes Főiskola oktatás innovációs tevékenységét. Nevezetesen, hogy az új „oktatási ötletének" a műszaki informatikus és a gazdasági informatikus alapképzési szakok nyitott és távoktatási képzési formában történő (invenció) megszületése, majd megvalósulása (innováció) miként válhatott a társadalom, a gazdaság egésze számára hozzáférhetővé.

Abstract. In this article, our aim is to present the innovative educational activity of a tertiary educational institution, the Dennis Gabor College, being in certain aspects an isolated spot and situated in an isolated location within the institutional system of the Hungarian higher education, by using the research methods of geography. Namely, how its new "educational idea", the establishment (invention) and realisation (innovation) of the information technology engineer and computer economist bachelor-level courses in open- and distance education forms became available for the whole society and economy.

Introduction

In economic development and growth, there is even more emphasis on the need for knowledge economy, where knowledge is the source of growth which leads to the formation of knowledge society, where human resources are considered to be the most decisive factor of production (Drucker, P. F. 1993; Trócsányi A. – Tóth J. 2002; Dövényi Z. 1993; Dövényi Z. 2007). However, the organizational and educational structure of the tradition-based higher education institutions could not react adequately to the challenges of the dynamic changes. The paradigm shift of education and learning is inevitable, being a further reinforcement of the economic functional adaptation of knowledge.

In 1992, the effects of the changes of the socioeconomic environment were perceptible also in the Hungarian education policy, providing the legislative background to the establishment of an open private technical college based on distance education methods. For the most suitable way of lifetime learning of the application of microelectronics and microcomputers, the creation of the British 'Open University' in Hungary was considered to be the most expedient solution. Based on a governmental decree [Nr. 1027/1992. (V.12.)], two institutions, the LSI (Large Scale Integration) Informatics Education Centre for the Culture of the Application of Microelectronics (hereinafter LSI Foundation) founded by the LSI

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Education Centre and the Institution for Informatics and Applications established the technical college, the Dennis Gabor College (hereinafter DGC) operated and maintained by the foundation and based on a distance education system. It started a new era in the history of Hungarian higher education, since it meant that the knowledge of tertiary education became easily available for people with various geographical, sociocultural and economic backgrounds.

Higher education perceptively approximated those factors which may link economic growth and competitiveness to the innovation potential of a given territory or region from the aspect of the interrelations of regional inequalities, and thus, these factors are inseparable from the development of human resources based on education and transfer of knowledge. From this aspect, there is a distinguished role of educational systems, which provide possibility for the establishment, acquisition and transfer of knowledge, and their externality effect can be shown in the economic growth of countries and regions (Krugman, P. 1991; Romer, P. M. 1990). Our geographical interpretation of innovations was based on the work of Hägerstand, T. (1967). The scientific results of Valente, T. W. 1995; Granovetter, M. 1979 and Rogers, E. M. – Medina, U. E. – Rivera, M. A. – Wiley, C. J. 2005 were used by the investigation of the diffusion of innovations. The works of Anselin L. – Varga A. – Acs Z. 1997 and Malecki, E.J. – Oinas, P. 1999 were referred to when examining the spatial diffusion of knowledge and the possibilities of knowledge access, while for investigation of the connections to regional development the works of Sheff, J. 1999; Rösch, A. 2000; Florida, R. 1995; Morgan, K. 1997 and Chandler, A. D. – Hangström, P. – Sölvell, Ö. 1998 were used.

The role of knowledge and human resources in regional development is of significant importance, since each regional unit has defined resources that form a coherent unit of several separate factors. Enyedi gy. (1996) stated that these factors are present both separately and concomitantly, moreover, they take effect and shape the regional unit by weakening and strengthening each other, and through the large number of regional units they affect the spatial structure. Human beings as biological entities and individuals and the socioeconomic living and inert surroundings take a prominent role among the factors. In a scientific review Tóth J. (2001) calls attention to the cooperation of the innovative activity of universities, research institutes and enterprises utilizing the inventions. Feedback systems do not remain ”external”, but ”clusters” are formed and the formerly independent processes lead to the formation of explosive processes. Development reacts to education, since innovation society as a knowledge-based, knowledge producing society is a new challenge for higher education. The realisation of it requires reconsidering the role of the mission of the higher education institutions, universities and colleges in the innovative knowledge society, placing emphasis on the service-providing higher education. In his work Krisztián B. (2009) summarizes

the views of Tóth J. regarding cultural globalization saying that the information-communication technologies not only enhanced the accessibility of knowledge, but also enabled new means of establishing interpersonal relationships. As these factors are considered to be responsible for raising new differences between countries, social clusters and individuals (Dövényi Z. – Tolnai Gy. 1993).

In summary, it can be stated that by the end of the 20th century, the formerly successful method of knowledge production is getting even more inefficient all over Europe. The crisis of higher education is unavoidable, its causes can be traced back to the altered way of existence of knowledge, its metamorphosis and its more widespread application (Convert, B. 2005). The statements and opinions are consistent in assigning the causes of the change of the colleges' and universities' role, namely the unfolding of the knowledge economy connected to the knowledge production. The achievements are considered to be the solutions of the organizational and controlling tasks arising during the realisation of the new "mass education" and "self- financing" (Lukovics I. 2008).

Objective

We aimed at achieving concrete and practical results with this research, namely to present and verify the realisation of distance education as an innovation in higher education through an individual, specific example. For that, we assumed that the introduction and spread of the IT engineering faculty of the DGC in bachelor-level college education by open- and distance education methods, i.e., the spread of knowledge on informatics is an innovation, and its process can be represented by diffusion models. The IT engineer and computer economist courses (as new and considerably renewed products) and the appearance of the open- and distance education and their contribution to the development of human resources were in the focus of our research.

The first main question of the research dealt with innovation. We sought the answer for the question whether the DGC's educational activity which resulted in the introduction of the IT engineering and computer economist college training on bachelor-level in Hungary by renewed distance education methods can be considered as an innovation.

The second main question dealt with diffusion. Namely, whether the 'S-curve' shape of the spread of the IT engineer and computer economist training can be empirically verified, and if yes, whether it is a result of diffusion.

The resources of the research database

The primary sources of the research were education organizational-, management-, and academic register data evaluated and taken from the two departments at DGC: the Department of IT Applications and Department of IT Systems. These

resource data were analysed by statistical (tables, generation of ratios and indices) and graphical methods.

Furthermore, we created a statistical database using the results calculated from our own data of 12 years of education- and training organization.

We explored the innovation process by arranging the datasets into groups according to standardized criteria.

We used a method of spatial informatics as a tool to create a map of the data from our database of cities in Hungary and outside the borders – as it has been elaborated in a previous study (Bornemisza I. – Bakota É. – Kopári L. 2011).

Scientific results

The verification of the innovation process of the DGC distance education

We first answered our main question about innovation, i.e., the new educational activity of the DGC, resulting in a new course – the IT engineer – in bachelor-level college education, and the introduction of this course in Hungary was carried out by the significantly renewed method of distance education. According to the evaluation of our research results, the answer to our first question is: 'yes', this activity can be considered an innovation, because both criteria of the definition of innovation are fulfilled, a 'new knowledge' and a 'new cognition' have been introduced as a product – namely no training has been started with such a content so far in higher education – and its direct economical profit was the development of human resources. We based our answer on our results obtained by plotting the student dataset of the 19 years of DGC's educational and training activity (the number of new students) as a function of time. We used the academic years as a time unit, while for the yearly follow-up of new students (adaptors) we uniformly took the number of matriculations to the first year of the course from the student database. The shape of the resulting curve was similar to that of the 'S-shaped' exponential curve describing the diffusion process of innovation (Figure 1).

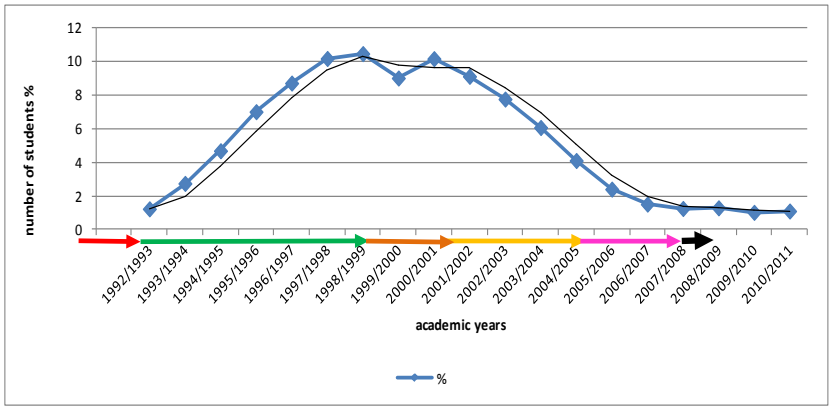
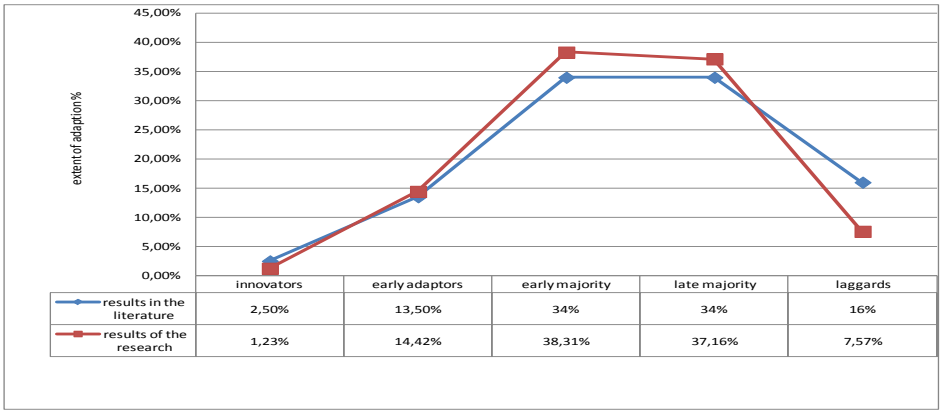


Figure 1. **Adaptation of first year students from the 1992/1993 to the 2010/2011 academic year** *(Source based on DGC data: É Bakota in 2012)*

We could answer our second main question – concerning diffusion – applying the results of the first one, the analysis of the sections of the empirical 'S-shaped' curve describing innovation.

For that, we determined the sections characteristic to the propagation of the evaluated process on the resulting exponential curve (Figure 1), where similarity was to be seen to the segments of the process implementing innovation. Namely, the initial segment starting the process followed by – the steeply rising part of the curve – the growth section (multiple-phase expansion), the next is the section of maturity (consolidation and saturation) and finally – the steeply declining part – the section of recess and termination. In the next step, we also determined the categories of adaptors to be linked to each segment of the spread. For the calculations we used our statistical database created from the student database and containing the yearly number of adaptors and their cumulative values. Thus, the results gave the thresholds of the sections of the exponential curve describing our innovation process. Based on the resulting values and plots our case entered the next phase of diffusion after reaching a certain category of adaptors (Figure 2).



	innovators	early adaptors	early majority	late majority	laggards
results in the literature	2,50%	13,50%	34%	34%	16%
results of the research	1,23%	14,42%	38,31%	37,16%	7,57%

Figure 2. **Categories of adaptors linked to each segment of innovation**
(Source based on Bakota's own data edited by É Bakota. 2012)

According to our research results described above, the answer to the two main questions is 'yes', i.e., the activity of DGC to create a college course containing new knowledge and cognition spreading by diffusion among adaptors can be considered innovation. In 1992, the year of the initiation of the innovation, not only in Budapest but also in four other cities structural subunits being sub-centres of the distribution of the innovation were created. Geographically these innovation centres were established in a city of a regional unit, and they connected to the system as consultation centres, while they maintained a continuous professional contact with the centre.

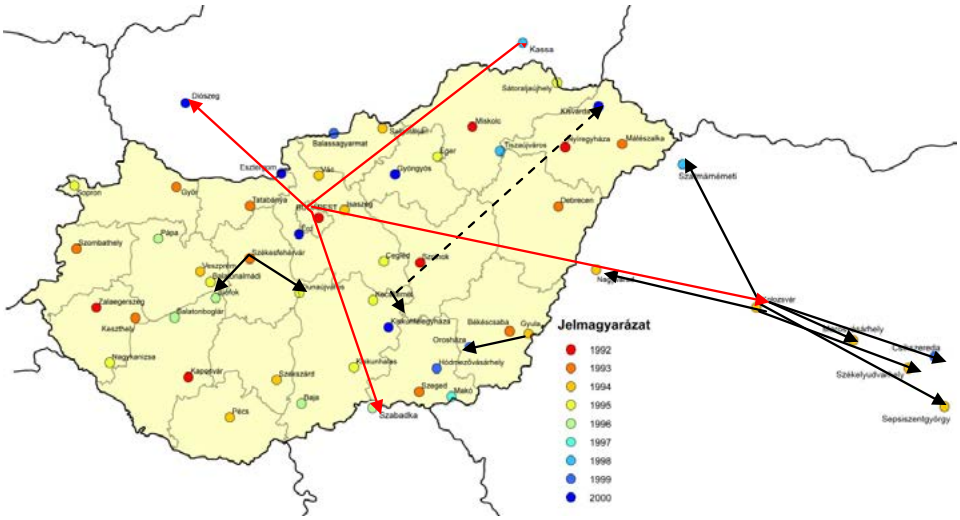


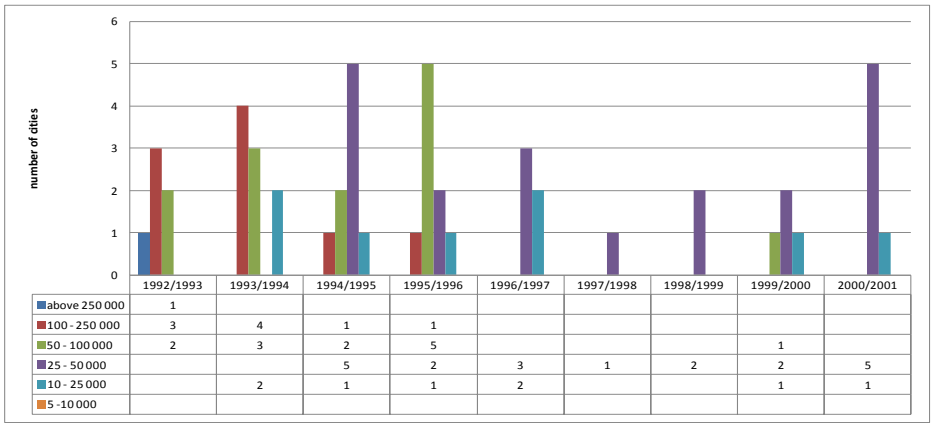
Figure 3. **The network of DGC consultation centres in Hungary and beyond its borders from the academic year of 1992 to 2000**
(Source: edited by Éva Bakota in 2012)

To demonstrate that the network of consultation centres covered the entire area of Hungary, and it was also represented in regions beyond the borders, at first we explored the diffusion process of the IT engineer course (Figure 3). In our database, we linked the consultation centre with the name of its hosting city and the date of establishment. The changes in the spatial and temporal propagation of the innovation process can be seen in the configuration map of the establishment of the consultation city centres (clusters). It can be stated that the distance education of the IT engineer knowledge streams to other cities in various regions of the country and territories beyond the border through connections, "bridges" and "clusters" projecting out of the territory of the residence of the college (namely projecting out of the city as a mental space). It has been proven, considering the adaptors of the innovation, that the student basis of the country can be linked to the consultation centres, which also means that the place of adaptation is primarily associated with the consultation centre. Based on our research results it can be stated that the diffusion of the IT engineer course involving regions in Hungary and beyond the borders was realised through the forming network of consultation centres (Figure 3).

Verification of the diffusion characteristics

According to our evaluations, in our case the propagation of the innovation of the "new knowledge" happens with the help of a mixture of expansion and relocation diffusion. While exploring the network structure of the consultation centres'

hosting cities playing a key role in the process, a cascade-type hierarchical diffusion was found to be characteristic of its propagation that initiated from the high-level centre of city-hierarchy (centre of Budapest) and progressed towards cities on the medium and lower hierarchy-levels (Figure 4).



	1992/1993	1993/1994	1994/1995	1995/1996	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001
above 250 000	1								
100 - 250 000	3	4	1	1					
50 - 100 000	2	3	2	5				1	
25 - 50 000			5	2	3	1	2	2	5
10 - 25 000		2	1	1	2			1	1
5 -10 000									

Figure 4. **The population-based distribution of consultation centre hosting cities in the period from the 1992/1993 to the 2000/2001 academic years**
(Source: Bakota's own data based on J. Tóth (1997) edited by É. Bakota 2012)

According to the hierarchical, population number-based analysis of the network of consultation centre cities, the accession of those low hierarchy cities which do not correspond to criteria determining regional dimensions of higher education occurred several times. These low-hierarchy cities (10 000–25 000 inhabitants) are most often connected to the network as sub-centres. It was verified by all sub-centres, that their contribution to the adaptation value of their region is not the broadening of the regional borders of the catchment area, but the improvement of coverage of the consultation centre's catchment area (Figure 5).

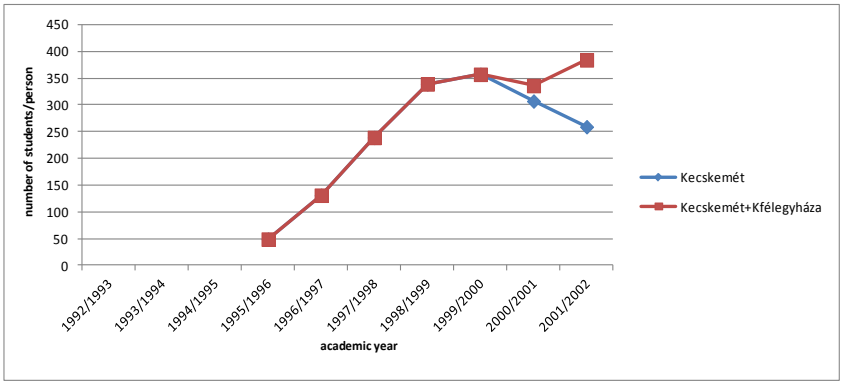


Figure 5. **Life cycles of Kecskemét and its sub-centre Kiskunfélegyháza**
(Source: Bakota's own data edited by É. Bakota in 2012)

The territorial and regional changes in the network formation of diffusion

The territorial and regional configuration of innovation centre networks is completed by the consolidation phase (maturity period of innovation) and the closely related saturation phase of the diffusion process (Figure 6).

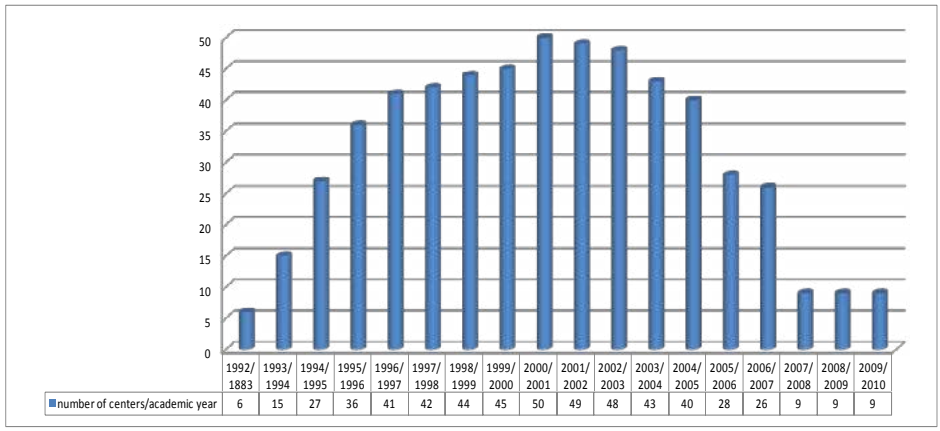


Figure 6. **The number of consultation centres from the academic year of 1992/1993 until 2009/2010**
(Source: data derived from the registry of the DGC edited by É Bakota in 2012)

By the end of the expansion process of the innovation of distance education, the distance education consultation centre network ensuring the access to the knowledge spreading by diffusion is completely established in the entire area of Hungary, including all regions and all of their counties (Figure 6; Figure 7).

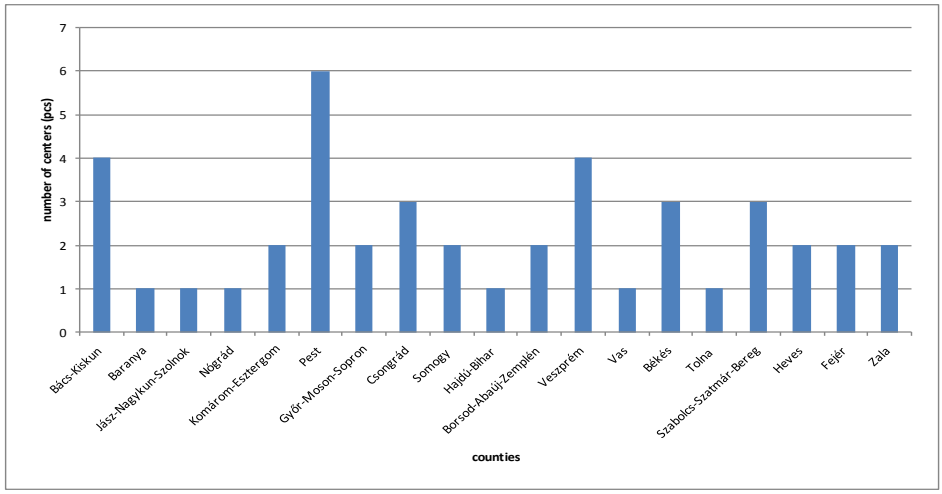


Figure 7. **The number of consultation centres by counties**
(Source: data derived from the registry of the DGC edited by É Bakota in 2012)

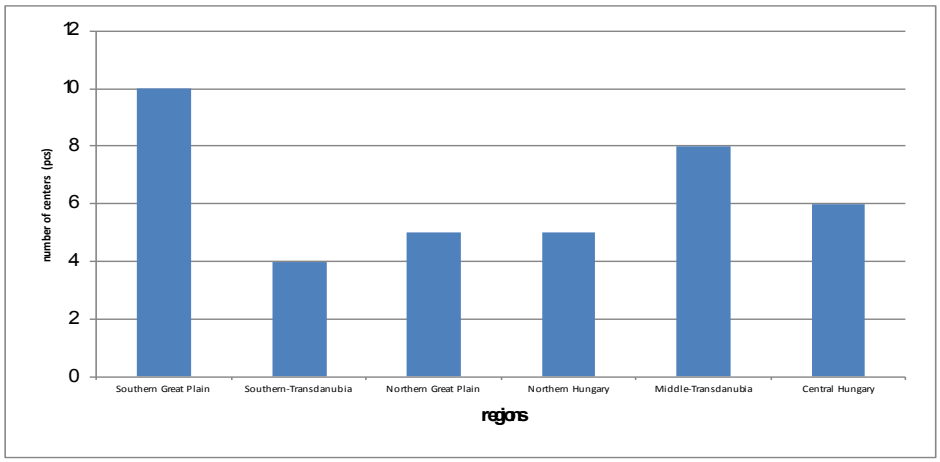


Figure 8. **The number of consultation centres by regions**
(Source: data derived from the registry of the DGC edited by É Bakota in 2012)

The network of consultation centres was formed within quite a short period of time – in the 6th year of innovation the number of consultation centres approximates the maximum value of the maturity period – which is in accordance with the burst-like expansion of diffusion (Figure 8).

At the same time, the increasing number of consultation centres also represents the growth of regions affected by the innovation, it is directly proportional to it. As a result, the leading role of Budapest in the number of students (adaptors) is effaced after the initial period of the innovation process, and it is overtaken by the countryside until the remarkable recess of diffusion (Figure 9).

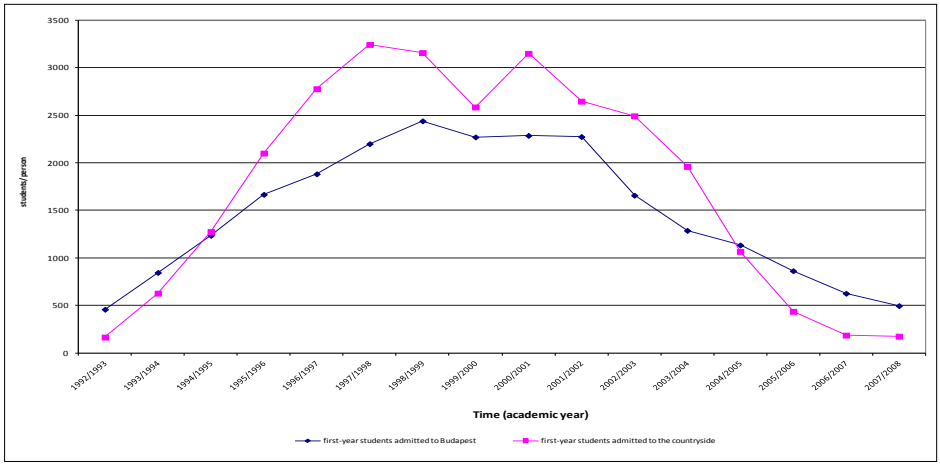


Figure 9. **The yearly number of first-year students admitted to the centres of Budapest and those of the countryside from the academic year of 1992/1993 until 2007/2008**
(Source: data derived from the registry of the DGC edited by É Bakota in 2012)

It has been confirmed that the appearance of distance education in bachelor-level higher education variably but significantly influenced the participation of the inhabitants of a given region in higher education (Figure 10).

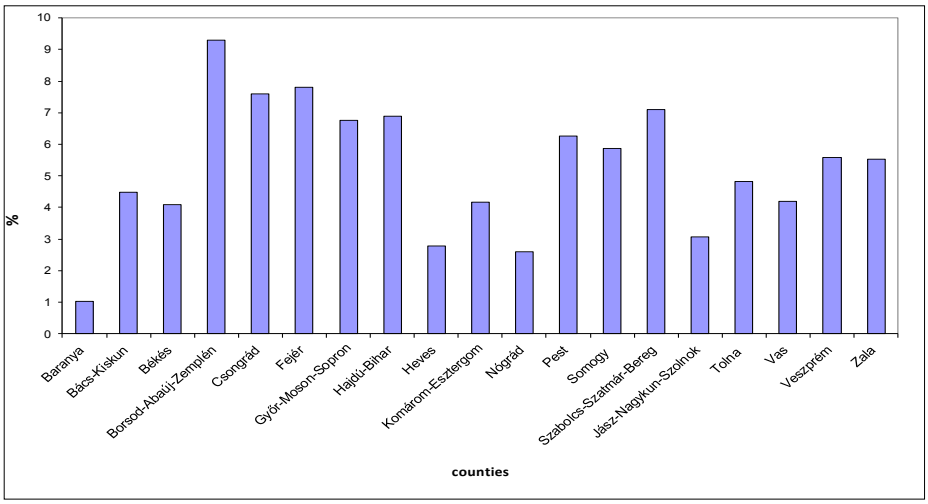


Figure 10. **The ratio of the total number of first-year students represented by counties from the academic year of 1992/1993 to 1999/2000**
(Source: Bakota's own data edited by É Bakota in 2012)

In a given region by the institutionalized possibility to access college-level knowledge, the consultation centre contributed in a measurable way to lessening the regional differences with the help of its city network by providing possibilities for those willing to learn irrespective of geographical location, age or individual life situation. The regional matriculation index, which is correlated to the population number, shows that the leading role of Central Hungary is unchanged in our case, too. The performance of the West-Transdanubia and the Middle-Transdanubia is excellent, and the Southern Great Plain is only slightly beyond them (Figure 11).

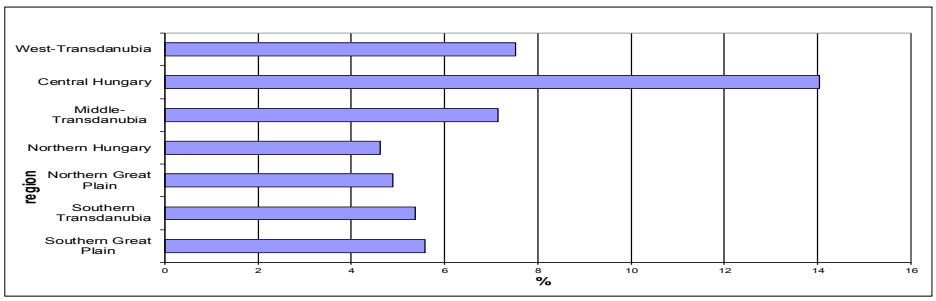


Figure 11. **The number of first-year students as a percentage of the region's population from the academic year 1992/1993 to 2001/2002**
(Source: Bakota's own data edited by É Bakota in 2012)

Evaluating the cause–effect relationship between the population-based hierarchical order of regions and the number of users of the educational service, direct and indirect proportions were both found (Figure 12).

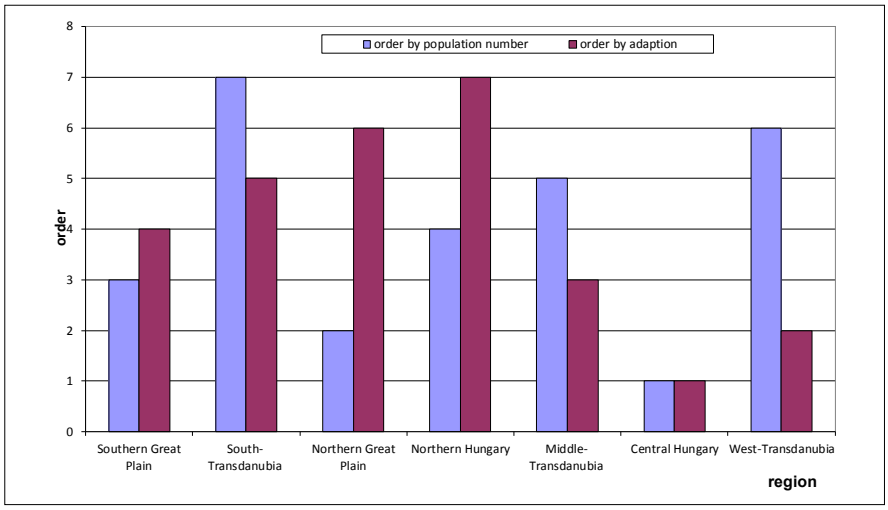


Figure 12. **The relationship of the population of a region and the number of adaptors**
(Source: Bakota' own data edited by É Bakota in 2012)

Summary

In the field of education geography, we can consider the innovative activity of the DGC as a significant achievement of innovation and its executive process, the diffusion. This innovative activity successfully maintained the Hungarian distance education on the tertiary educational bachelor-level, despite the fact that it was without any known former educational traditions or history on this level. It was also confirmed, that among the methods of lifetime learning, distance education is one of the successful training alternatives in adulthood.

According to our viewpoint, as a summary of the educational activity of the DGC it can be stated that the adaptation of the IT engineer course by distance education methods is an achievement of outstanding significance of Hungary and the Carpathian Basin, not only in the field of technological science, but also in that of science history, cultural and education geography. DGC was the first to apply distance education as a new training element in the Hungarian higher education and later it introduced e-learning, which made (in the aspect of content and didactics) outstanding teaching materials widely accessible and applicable, irrespective of the distance of the region of application (even over the borders) from the residence of the college. We explored the propagation of the "new knowledge" among its users through the education geographical evaluation of the spatial and temporal dimensions of diffusion and its relationship to the geographical space and its spatial drifts interpreted according to the geographical aspects of the effects of educational innovation. The interpretation was supported

by those factors which were of decisive significance for the characteristics of the drifts, spatial structures, city network connections and the relations of their roles, the root causes and their motivating forces.

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