# The Impact Of The Development Of ICT In Several Hungarian Economic Sectors

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*Abstract:*

*As the author could not find a reassuring mathematical and statistical method in the literature for studying the effect of information communication technology on enterprises, the author suggested a new research and analysis method that he also used to study the Hungarian economic sectors. The question of what factors have an effect on their net income is vital for enterprises. At first, the author studied some potential indicators related to economic sectors, then those indicators were compared to the net income of the surveyed enterprises. The resulting data showed that the growing penetration of electronic marketplaces contributed to the change of the net income of enterprises to the greatest extent. Furthermore, among all the potential indicators, it was the only indicator directly influencing the net income of enterprises.*

*With the help of the compound indicator and the financial data of the studied economic sectors, the author made an attempt to find a connection between the development level of ICT and profitability. Profitability and productivity are influenced by a lot of other factors as well. As the effect of the other factors could not be measured, the results – shown in a coordinate system - are not full but informative.*

*The highest increment of specific Gross Value Added was produced by the fields of 'Manufacturing', 'Electricity, gas and water supply', 'Transport, storage and communication' and 'Financial intermediation'. With the exception of 'Electricity, gas and water supply', the other economic sectors belong to the group of underdeveloped branches (below 50 percent).*

*On the other hand, 'Construction', 'Health and social work' and 'Hotels and restaurants' can be seen as laggards, so they got into the lower left part of the coordinate system.*

*'Agriculture, hunting and forestry' can also be classified as a laggard economic sector, but as the effect of the compound indicator on the increment of Gross Value Added was less significant, it can be found in the upper left part of the coordinate system. Drawing a trend line on the points, it can be made clear that it shows a positive gradient, that is, the higher the usage of ICT devices, the higher improvement can be detected in the specific Gross Value Added.*

*Index Terms: Information society, ICT, Economic sector, Electronic marketplace.*

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## I. INTRODUCTION

The current age is often referred to as the Information Age. This concept was first introduced by Manuel Castells, the best-known theoretician of the information society [1]. The information society is a new, special variant of the existing societies in which producing, processing and distributing information can be regarded as a fundamental source in the economy.

According to the related data, the Information Age began in the second half of the 1950s when, for the first time in history, the number of white-collar workers (engineers, administrative employees etc.) exceeded the number of blue-collar workers [7].

One of the main driving forces of the Information Age is the phenomenon called Information and Communication Revolution. Its significance is often compared to the agricultural and industrial revolutions taken place in the history of mankind. In important fields of high-end technology (computer technology and telecommunication) not only the robust growth of quality, quantity and performance parameters can be observed but the approximation of these two fields along with the appearance of compound applications can also be detected. What is more important, these phenomena of the information society cannot only be seen as one of the results of technological development but also a coherent system affecting the society as a whole [3].

## II. THE CHARACTERISTICS AND IMPACTS OF INFORMATION AND COMMUNICATION SYSTEMS

Information and communication technology can be regarded as a universal technological system, which is closely linked to all of the previous systems and creates new, more complex technological systems. ICT's main characterizing function is to assure acquiring, storing, processing, delivering, distributing, handling, controlling, transforming, retrieving and using information. ICT has a different effect on the actors of the economy, including companies, employees and consumers. Nowadays we can experience a change of paradigm in the operation of enterprises. They are becoming a rapidly changing system of independent work groups and project, characterized by flexible operation and demand for flexible labour force. In this new situation, employees have to leave the traditional patterns and are forced to develop a new

kind of mentality. If they want to stay afloat in the labour market, they have to become more flexible as enterprises are no longer strongly interested in improving the professional knowledge of their employees through various trainings. Beside the changes experienced in the attitude of enterprises and employees, consumers' behaviour has also been changed essentially by the effect of ICT. As consumers are freed from their isolation by the Internet, they become active and conscious actors in the economy. As a consequence, the relationship between buyers and sellers has also been transformed, it has become harder for sellers to recognize and influence the trends in demand and consumers now are better informed than ever before.

Information and communication technology has brought a deep change into the opportunities for consumers compared to the opportunities provided by industrial capitalism. This change is as profound as the one caused by the Industrial Revolution earlier. The new generation of consumers is, first and foremost, well informed, collecting and relying on other consumers' experiences. Companies (especially corporations) previously focused on products and markets, nowadays they concentrate on consumers instead. It is not enough to recognize the problems of consumers, identifying those possible problems in order to solve them is also needed. The opportunities provided by ICT identify actual consumers, based on actual problems that may occur during the use of a product. The best way for companies to keep pace with the speed of the development of ICT is to introduce job enrichment. The requirement of versatility can be met only by employees with high-level general education [4].

The decrease of the number of strict positions together with the changing requirements of the remaining ones allows employees to acquire new skills, however, it also stretches their responsibilities. Cross-trainings are also organized for the group of employees in order to enable them to perform various tasks. Team-based companies are characterized by better problem-solving skills, higher productivity, more efficient use of human resources, more creativity and more innovation when compared to traditional non-team based organizations. Nowadays, when digital information is seen as the chief mean of production, the efficiency of production is highly dependent upon obtaining and processing information. Based on the achievements of ICT, companies have shaped up the infrastructure of obtaining and processing information, and help their employees to co-operate by compressing time and space. The intention of raising efficiency gave room for virtual teams. By being part of a virtual team, employees do not have to work under the same roof and other employees from outside the company can take part in the work performed by a virtual team.

Nowadays, the majority of changes in work organization, decision mechanisms and corporate organization structures requires enhanced flexibility. Flexibility means quick reaction, the removal of strict limits, the frequently

mentioned job enrichment as well as openness for innovation and finding unconventional answers to the newer and newer challenges. The environmental impulses do not affect the operators of the assembly lines or the workers of call centres through a long chain. In the past companies were operated centrally from a single headquarters earlier, nowadays managers and workers try to find answers to the current challenges in many local corporate decision nodes. The coordination of numerous independent units is generated by the company as a self-organizing system, and the company's philosophy is determined by the self-organization of independently operating units based on market principles.

## III. THE AIM OF THE RESEARCH

Based on the considerations presented above, it is not the subject of this paper to answer whether there is a need for ICT or creating the necessary conditions for the information society. The real subject is to measure what economic, social, cultural and environmental effects it has on the society. The rich literature of the information society discusses these aspects in detail. In this paper, the information society is taken as a normative future plan for Hungary, and I am looking for the answer of what progress has been made in building the information society in the Hungarian economic sectors. The following issues are examined here:

– to what extent we can speak about the information society in Hungary nowadays,
– what is the development level of the information society in several economic sectors and company sizes compared to each other and to the member states of the European Union,
– how this development level can be measured and calculated,
– how the development level of information and communication technology increases at certain company sizes,
– what trends can be observed in the development process in the individual economic sectors and company sizes.

The scope of this analysis extends to the static, momentary state of the development level of ICT devices used in the economic sector as well as to their dynamic analysis, expected pace of growth and their qualification. When establishing the aims of the research, there is always the question of how to position the individual parts of the subject. Should they be positioned in a broader subject or should they be selected for further and deeper examination? The former possibility means that we aim to make suggestions by putting the practical analysis into a broader structure. The aim of this research is exactly this, as the information society means a stage representing a new quality, and the changes of the information and communication technology can be observed in every part of our modern life.

## IV. THE METHOD OF THE RESEARCH

Similar problems are raised by the quantification of the various components of the information society as the definition of its concept. There is a wide range of variables that can be measured: a great number of explanatory variables can be listed from the perhaps more easily measurable infrastructural components to the more difficult components related to knowledge and willingness for using information. That is why most analyses use sets of variables along with complex indices as there are no easily measurable (one-dimensional) indices that would characterize the information society. The examination of the subject is interdisciplinary as it has social and scientific references, so a complex approach was needed when I set about processing the literature. In consideration of the complexity of the studied subject, several analytical methods and approaches were selected. In the phase of data collection, I relied on the available Hungarian (related reports issued by the Hungarian Central Statistical Office [9]) and international data (Statistical Office of the European Communities [8]) as well, and managed to process a large amount of secondary information consisting of more than 6.000 items. The actual research was extended to printed as well as electronic publications and artifacts available on the Internet. The reason for conducting a primary research was to reduce some shortcomings originated from secondary data sources. In fact, it covered an empirical survey among Hungarian companies and enterprises. The questionnaire used for collecting data on the subject was filled in by 554 respondents altogether, providing nearly 3.000 data records.

As Figure 1 shows, the literature on the development of ICT distinguishes five development stages.
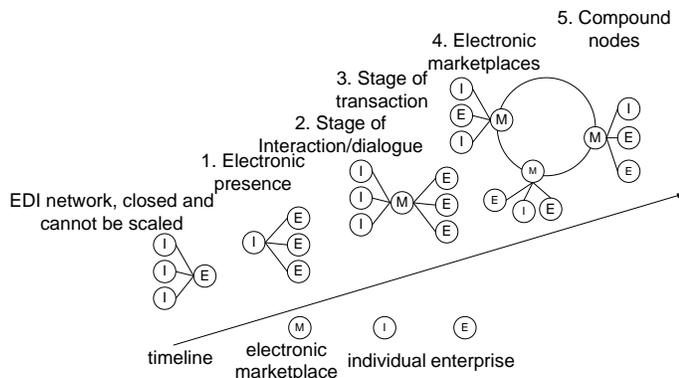


Fig.1. The development stages of information and communication technology [2]

These stages are built upon each other. With the help of the elaborated model, first, the individual development stages were measured. By averaging the data of the first three development stages, I examined the enterprises' willingness for adaptation. With the help of an own model, which comprises five elements, the development and growth of the size categories and economic sectors were analysed.

The steps of this procedure are as follows:
− Processing the data of the primary and secondary research,
− Assigning single indicators to individual development stages, calculating potential indicators,
− Calculating the values of potential indicators from single indicators,
− Studying potential indicators,
− Determining potential indicators at the individual development stages.

Then, with the help of the resulting indicators, a cluster analysis, a compound regression analysis, and finally a discriminant analysis were performed on the surveyed economic sectors.

## V. THE RESULTS OF THE ANALYSIS OF INFORMATION AND COMMUNICATION TECHNOLOGY

Clustering is the assignment of a set of observations into subsets so that observations in the same cluster are similar in some sense. The clustering process is successful when the subsets are similar to each-other and different from the elements of other subsets at the same time. Based on theoretical considerations, groups of economic activity categories were formed from the five previously defined potential indicators.

| 1st cluster | 2nd cluster |
|---|---|
| (A) Agriculture, hunting and forestry<br>(F) Construction<br>(G) Wholesale and retail trade; repair work<br>(H) Hotels and restaurants<br>(K) Real estate, renting and business activities<br>(M) Education<br>(N) Health and social work | (C) Mining and quarrying<br>(D) Manufacturing<br>(E) Electricity, gas and water supply<br>(I) Transport, storage and communication<br>(J) Financial intermediation |
| Underdeveloped | Developed |
| relative | |

Fig.2. Two-cluster model of the national economic sectors

As a summary of the results of the cluster analysis, it can be stated that the sectors "Electricity, gas and water supply", "Transport, storage and communication", "Mining and quarrying", "Manufacturing" and "Financial intermediation" belong to the second cluster by better average values. The results of this analysis are presented in Figure 2.

A path model was applied to study how the potential indicators influenced one another and what direct or indirect effect they had on the average net income of the different economic sectors.
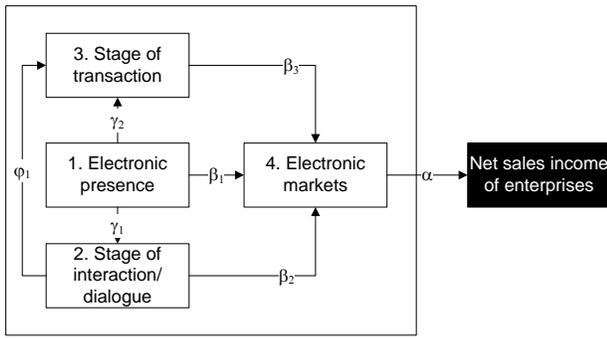
Fig.3. The scheme of the path model of the potential indicators

As it is indicated in Figure 3, the variables presented in the path model are linked with arrows to one another, showing the direction of their relationships. It was assumed in the causal model that the potential indicator of electronic presence was the exogenous variable. Based on the arrows starting from it, the potential indicator of electronic presence has an effect on the other potential indicators, also having an indirect effect on the average net income of enterprises in several economic sectors. These paths are called indirect paths by the literature and in this path model they show how the effect of the potential indicator of electronic presence takes place through the potential indicators of interaction/dialogue, transaction and electronic markets. The potential indicators of interaction/dialogue and transaction became endogenous variables. Endogenous variables are variables with causal links leading to them from other variables in the model. In other words, endogenous variables have explicit causes within the model. The dependent variable in the drawn-up model is the average net income of enterprises in economic sectors, the arrows starting from the other variables point at this one but it has no arrow or link pointing back at the other variables.

The aim of setting up a path model was to divide the zero linear correlation between the independent and the dependent variables into two parts. The first part is the effect that the independent variable directly has on the dependent variable, while the second part shows the effect being had on the dependent variable caused by the independent variable through another endogenous variable.

It turned out that only the potential indicator of electronic markets had a direct effect on the average net income of enterprises as it is illustrated in Figure 4. However, the effect of the potential indicator of electronic presence is significant as it influences the potential indicator of electronic markets to a great deal. The value of the indirect effect of electronic presence was (87.4%*60.5%) 56.2%. In the table below, a new arrow also appears with a value of 70%, showing the effect of non-specified variables from outside the model on the average net income of enterprises.
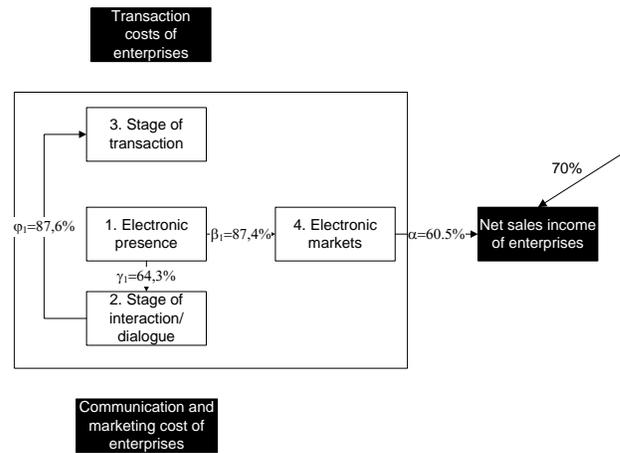


Fig.4. The final path model of the potential indicators

Electronic presence has no direct effect on the potential indicator of transaction. The value of the strength of its indirect effect was (64.3%*87.6%) 56.3%, according to the calculation. The model eventually verified the hypothesis according to which electronic presence largely determines interaction/dialogue, it has an indirect effect on transaction and it has the strongest correlation with electronic markets. Before creating the model, it was assumed that there was a direct correlation between transaction and electronic markets but the existence of this relationship could not be verified in the end. However, the new result of the research was that there was a direct correlation between electronic markets and the average net income of enterprises.

In the early phase of the research, there was a problem that could not be avoided: there were no explanatory variables in the typology created by cluster analysis. Typologies, different clusters are of a low measurement level, so the explanation of their development status is impossible with the formerly used techniques. Discriminant analysis is a useful method to explain a low measurement level variable with another variable of high measurement level. Discriminant analysis is a technique where dependent variables are not metric and are classified between two or more categories whereas independent variables (predictors) are measured on a metric scale. The summary of the methods used together with discriminant analysis is shown in Figure 5.



Fig.5. Partial summary of the methods used for structure analysis, along with discriminant analysis [5]

After completing the cluster analysis, it was found that the surveyed economic sectors could be classified into two, then four ICT development levels or clusters. The resulting four-cluster model is illustrated in Figure 6.

| 1.2 cluster | 2.2 cluster |
|---|---|
| (G) Wholesale and retail trade; repair work<br>(K) Real estate, renting and business activities<br>(M) Education | (D) Manufacturing<br>(E) Electricity, gas and water supply<br>(I) Transport, storage and communication<br>(J) Financial intermediation |
| **1.1 cluster** | **2.1 cluster** |
| (A) Agriculture, hunting and forestry<br>(F) Construction<br>(H) Hotels and restaurants<br>(N) Health and social work | (C) Mining and quarrying |
| Underdeveloped | Developed |
| relative | |

Fig.6. Four-cluster model of the national economic sectors

The following four economic sectors got into Cluster 1.1: 'Agriculture, hunting and forestry', 'Construction', 'Hotels and restaurants' and 'Health and social work'. The average of the potential indicators to electronic presence, interaction/dialogue, transaction and electronic markets was the lowest in the four clusters.

Four economic sectors were classified into Cluster 1.2 as well: 'Wholesale and retail trade; repair work', 'Real estate, renting and business activities', 'Education' and 'Other community, social and personal service activities'. Examining the data of this cluster, it could be observed that its average values were higher than those of Cluster 1.1 but were lower than the average values of the other two clusters.

Only the 'Mining and quarrying' sector was classified into the Cluster 2.1. In terms of electronic presence and electronic markets, this sector was the most developed compared to the other sectors. This cluster produced the second highest ICT values based on the values of the other potential indicators.

'Manufacturing', 'Electricity, gas and water supply', 'Transport, storage and communication' and 'Financial intermediation' could be found in Cluster 2.2. The values of interaction/dialogue and transaction were the highest in this cluster comparing to the other ones.

The aim was to know more about the human resource demand of enterprises (the number of the employees regularly using computers), the cost of ICT services or availability (cost of computer-related services), and the amount of money spent on professional training (the total expenditure on professional training). These three explanatory variables jointly indicate the different ICT development stages, in this case discriminant analysis predicts whether an enterprise belongs to a specific development stage or not. Based on the primary research, it can be stated that education expenses have a more significant effect on belonging to various clusters. As the aim of the discriminant analysis is the classification of cases into groups, the classification table is one of the most important results of the analysis. The table below consists of two parts: the first presents the scores before the grouping took place. The chance of being classified into a cluster is 25% in each group and each cluster weight was different.

TABLE 1

CLASSIFICATION RESULTS

| Cluster | Prior | Cases Used in Analysis | |
|---|---|---|---|
| | | Unweighted | Weighted |
| 1.1 | ,250 | 36 | 36,0 |
| 1.2 | ,250 | 4 | 4,0 |
| 2.1 | ,250 | 58 | 58,0 |
| 2.2 | ,250 | 82 | 82,0 |
| Total | 1,000 | 180 | 180,0 |

| | | Cluster | Predicted Group Membership | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | Total |
| **Original** | **Count** | 1.1 | 19 | 0 | 0 | 17 | 36 |
| | | 2.1 | 2 | 1 | 0 | 1 | 4 |
| | | 2.2 | 24 | 0 | 4 | 30 | 58 |
| | | 1.2 | 30 | 1 | 0 | 51 | 82 |
| | **Percent** | 1.1 | 52,8 | ,0 | ,0 | 47,2 | 100,0 |
| | | 2.1 | 50,0 | 25,0 | ,0 | 25,0 | 100,0 |
| | | 2.2 | 41,4 | ,0 | 6,9 | 51,7 | 100,0 |
| | | 1.2 | 36,6 | 1,2 | ,0 | 62,2 | 100,0 |
| **Cross-validateda** | **Count** | 1.1 | 16 | 0 | 1 | 19 | 36 |
| | | 2.1 | 2 | 0 | 0 | 2 | 4 |
| | | 2.2 | 24 | 1 | 3 | 30 | 58 |
| | | 1.2 | 32 | 1 | 1 | 48 | 82 |
| | **Percent** | 1.1 | 44,4 | ,0 | 2,8 | 52,8 | 100,0 |
| | | 2.1 | 50,0 | ,0 | ,0 | 50,0 | 100,0 |
| | | 2.2 | 41,4 | 1,7 | 5,2 | 51,7 | 100,0 |
| | | 1.2 | 39,0 | 1,2 | 1,2 | 58,5 | 100,0 |

The actual hit ratio can be seen in the second part, it is given in percentage, its value ranging from 0 to 100. Instead of the lowest possible value, it needs to be compared to the expected hit ratio. The expected hit ratio means the hit ratio resulting from random categorization, its value is 25% in the case of the specified four groups.

The classification table is suitable for the evaluation of the results of the discriminant analysis as it shows the ratio of the adequately categorized group membership. The rows make up the categories of the dependent variables and their initially observed values, while the columns of the table constitute the values predicted by the independent variables. The table can be divided into two parts: the upper part of it shows the initial analysis, while its lower part presents the cross validation values. The data are presented in the same way in both parts of the table, they are expressed either in absolute value or in percentage. When analysing the absolute values of the table, it can be observed that only 19 cases got into Cluster 1.1 from its original 36 cases, while 17 of them got into Cluster 1.2. Expressing this data in percentage means that the rate of the adequately categorized cases is 52.8% in Cluster 1.1, 25% in Cluster 2.1, 6.9% in Cluster 2.2 and 62.2% in Cluster 1.2. Consequently, the procedure was successful only in the cases of Clusters 1.1 and 1.2. SPSS identifies values as adequate hit ratio on the diagonal: if the prediction equals the value of the initial sets of observations then the prediction is perfect and

every value is situated on the diagonal. Enterprises were adequately categorized in 41.7% of the cases and 37.2% of the predictions based on the given variables.

In summary, it can be stated that the first and the fourth clusters are significantly different from the other two clusters, as their hit ratio is above 50% in the case of three independent variables. Examining the results, it can also be observed that these two clusters can hardly be divided in the case of three independent variables.

## VI. THE MACROECONOMIC EFFECT OF THE INFORMATION AND COMMUNICATION TECHNOLOGY

ICT devices contribute to the improvement of productivity, the economic growth or the acceleration of the economy in several areas. As far as macroeconomic effects are concerned, the technological development is very rapid alongside with the productivity and the total factor productivity (TFP) in the economic sectors producing ICT devices. On the one hand, this process increases the national average in itself, especially when its share tends to grow in the GDP; on the other hand it makes other economic sectors more dynamic by the technological and economic links throughout the whole economic system.

| (D) Manufacturing | (G) Wholesale and retail trade; repair work | (I) Transport, storage and communication | (K) Real estate, renting and business activities |
|---|---|---|---|
| Manufacture of business machines 3001 Manufacture of computers 3002 Manufacture of industrial electronics 3220 Manufacture of consumer electronics 3230 | Wholesale trade of softwares and computers 5164 | Telecommunication 6420 | Software publishing services 7221, Other software consultation services 7222, Lending office machinery and computers 7133, Hardware consultancy services 7210, Data processing services 7230, Data bank services 7240, Office machinery and computer repair services 7250, Other computer related services 7260 |

Fig.7. Economic activities classified as ICT activities according to TEÁOR-NACE

Profits gained with the help of the rapid technological development and the improvement of productivity was eroded by the dropping ICT prices. Countries producing ICT devices lost a part of their profits realized from production because of the deteriorating swap ratio.

The source of productivity and growth benefits from capital deepening (it describes an economy where the amount of capital per worker is increasing), that is the growing rate of using ICT devices, which is stimulated by the huge decrease in ICT prices. These benefits appear in the form of the increased output of existing products and services,

manufacturing new products or providing new services, fulfilling customer needs more efficiently and decreasing transition costs etc. As the effect of ICT devices on increased productivity and more dynamic growth are connected to capital deepening, it can be seen that the countries and businesses using these new technologies have benefited more from the revolution of information technology, than the countries producing them.



Fig.8. Technological development elongates the production curve [6]

ICT devices also increase the total factor productivity, that is they improve the degree of utilization of capital and labour force. The total factor productivity (TFP) is applied to express the overall effect on the savings of economies of scale, management skills, production externalities and other, non-traditional factors influencing productivity. The significance of the growing total factor productivity is that it accelerates the pace of economic growth without any additional costs as well as without having to increase the quantity input. Capital deepening is a necessary but not sufficient condition for improving productivity. It can only unfold in its fullest form when the potential efficiency surplus of ICT devices is exploited. A more dynamic TFP automatically accelerates the pace of labour productivity, thus it helps to boost economic performance.

Using ICT devices also improves productivity and makes economic growth more dynamic because information technology cannot be regarded as capital goods in the traditional sense of the word. The installation of a new information technology device raises the value of other existing devices as well. As a consequence, network effects may occur within companies, moreover they may appear between industrial sectors, and they may necessitate shaping new forms of cooperation (outsourcing).

As it was stated above, ICT devices increase productivity and output by capital deepening, improved total factor productivity and network externalities at the microeconomic level. The advantages of using ICT devices at the macroeconomic level come from all the advantages of the companies' improved productivity and from the network

advantages based on the feature of reducing transition costs and accelerating innovation. The network advantage does not depend on the operation of a given company and its business strategy.

However, the effects of ICT devices on the productivity of companies cannot be measured unequivocally at the microeconomic level because of certain statistical and methodological imperfections, the difficulties in measuring network effect at a business level and the lack of data enabling to make international comparisons. Furthermore, the effects of ICT devices on productivity appear at a later time, as they are preceded by a longer or shorter learning process. The productivity paradox has started to vanish by now. It has become clear that statistics cannot or just partially show the secondary effects of using ICT devices in the economy (faster information processing, improvement of productivity in producing knowledge, for instance).

In countries where competition is fierce in the market, enterprises using ICT devices are not necessarily the main winners of capital deepening, it is the customers who can benefit from it by getting lower prices, better quality or more convenience.

It is not necessarily true in countries where competition is weak. Here, companies are able to realize a greater part of benefits coming from capital deepening. But it has its own price as the secondary effects of using ICT devices are more limited in the economy.

With the help of the compound indicator and the financial data of the studied economic sectors, an attempt was made in the research to find a connection between the development levels of ICT and their profitability. Profitability and productivity are influenced by a lot of other factors as well. As it was not possible to measure and show the effect of those other factors, the results are not full but informative.

Based on the statistical connection between the compound indicator and the increment of the Gross Value Added per worker, the correlation coefficient is 0.13, while the gradient of the regression trend line is 0.17. Both numbers show a positive connection between the compound indicator and profitability.

Then, using a coordinate system, the connection between the changes of the specific indicators of the studied economic sectors and the development level of those sectors was illustrated. The Y axis shows the growth pace of Gross Value Added per capita in the economic activities between 2003 and 2006. The X axis shows the compound indicator that was created for measurement purposes. The points defined by the two values show clearly where a given economic sector can be found in the coordinate system, what groups can be constituted, and what tendency can be observed.

The highest increment of specific Gross Value Added was produced by the sectors 'Manufacturing', 'Electricity, gas and water supply', 'Transport, storage and communication' and 'Financial intermediation'. With the exception of 'Electricity,

gas and water supply', all of these economic activities belong to the group of underdeveloped sectors (below 50%).

High (but still not reaching the developed status) compound indicators were shown by the sectors 'Mining and quarrying' and 'Wholesale and retail trade; repair work', as they produced an increment of Gross Value Added below the average, these economic sectors can be found in the lower right part of the coordinate system.

The sectors 'Construction', 'Health and social work' and 'Hotels and restaurants' can be seen as laggards, so they got into the lower left part of the coordinate system.

The 'Agriculture, hunting and forestry' sector can also be classified as a laggard economic activity, but as the effect of the compound indicator on the increment of Gross Value Added was less significant, it can be found in the upper left part of the coordinate system.

Drawing a trend line on the points, it is clear that the line shows a positive gradient, that is, the higher the usage of ICT devices, the higher improvement can be detected in the specific Gross Value Added.
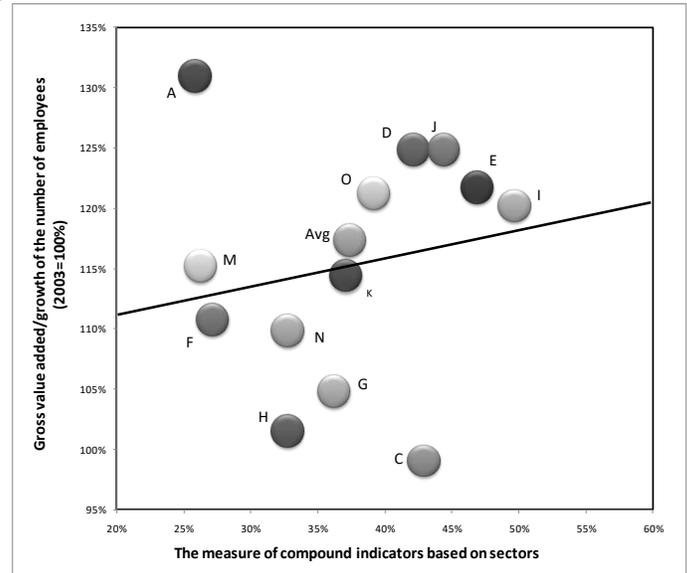


Fig.9. Connection between the growth of gross value added and the development level of information and communication technology in several economic activities[1]

## VII. CONCLUSIONS AND SUGGESTIONS FOR THE PRACTICAL USE OF RESEARCH FINDINGS

The most important step of the cluster analysis is to determine the number of clusters. The data show that it is expedient to form two clusters based on the potential indicators. The first cluster comprises eight, while the second one comprises five economic activities. As a consequence, those economic sectors that use ICT devices less frequently

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[1] A=Agriculture, hunting and forestry, C=Mining and quarrying, D=Manufacturing, E=Electricity, gas and water supply, F=Construction, G=Wholesale and retail trade; repair work, H=Hotels and restaurants, I= Transport, storage and communication, J=Financial intermediation, K=Real estate, renting and business activities, M=Education, N=Health and social work, O=Other community, social and personal service activities.

than the national average belong to the first cluster, while the second cluster contains those economic sectors that can be seen as developed ICT-users.

The multiple regression analysis is the series of regression models built upon each other. Using the regression model, the direct and indirect effect of the potential indicators on each other and the companies' net income in several economic sectors were studied more closely. It was found that the only potential indicator affecting a company's net income was the indicator of electronic marketplaces. However, the effect of the electronic presence is also significant, since it has a great influence on the potential indicator of electronic marketplaces. During the primary research, it was revealed that the effect of the non-specified variables out of the regression model on a company's net income was 70%.

The typology carried out by cluster analysis does not contain independent variables. The discrimination analysis helps to explain the values of dependent variables with the help of independent variables. With the clusters showing the given development stages, the aim was to get a better idea on the companies' needs of human resources and on how much money was spent on training and ICT services by the given company. It turned out that training expenses had a more significant effect on which cluster a company belonged to. It was possible to classify the companies into clusters based on the three independent variables in 42% of the cases.

The primary possibility of utilizing the proposed method appears in situation report. The following development levels were measured successfully by this paper: the relative (economic sectors correlated to each other) and the absolute (economic sectors correlated to the same ones in a different country) development level of the information communication technology with the help of creating development stages, quality categories and the willingness for adaptation belonging to the given development stages.

The secondary possibility for utilization lies in following patterns. The development of ICT is different in several countries, regions and economic sectors. The European Union proposed a strategic framework for its member countries. The main aims of establishing a strategic framework are:

– a single European information space;
– boosting investment and innovation in ICT researches;
– establishing a receptive European information society.

The economy of the United States is regarded as a model economy where two-third of the employees were dealing with information process during working hours in 2000. One of the causes of the massive economic performance in the United States is the highly-developed information processing. If it is possible to measure this level of development, a strategy can be formulated in the European Union together with the individual member states in order to catch up with the most developed countries.

The object of the study is generally the national economy of a given country. With the help of the method I have worked out, it is possible to analyse and assess the sections, subsections, divisions, groups and classes of a given national economy. Beside the economic sectors, company sizes and organization forms can also be studied the same way.

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