

The Economic Impacts of Information and Communication Technology In The Hungarian Economy

Peter Sasvari

Institute of Business Sciences, Faculty of Economics, University of Miskolc, Miskolc, Hungary

iitsasi@uni-miskolc.hu

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. After a brief introduction to the theoretical background of the Information Age, the author examines the question of what factors have an effect on their net income is essential for enterprises. First, the potential indicators related to economic sectors were studied, then the author compared those indicators to the net income of the surveyed enterprises. The data resulting from the comparison showed that the growing penetration of electronic marketplaces contributed to the change of the net income of enterprises in various economic sectors to the extent of 37 %. Among all the potential indicators, only the indicator of electronic marketplaces has a direct influence on the net income of enterprises. It was practical to determine two clusters based on the potential indicators.

Keywords- Cluster analysis, Economic sector, Electronic marketplace, ICT, Information society

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].

In this paper, I made an attempt to highlight the economic importance of information and communication systems and proposed an analysis in order to measure their effect on the net income of enterprises. With the help of the suggested methodology, which is based on a statistical approach, it is possible to analyze and assess even the sections, subsections, divisions, groups and classes of a given national economy. Measuring the effect of ICT development levels in the studied economic

sectors also proved to be possible. Beside the economic sectors, company sizes and organization forms can also be studied in the same way.

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 labor 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 labor 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' behavior 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. These teams allow companies to procure the best talent without geographical restrictions and establish new ways of working across boundaries through systems, processes, technology and people [5]. In other words, 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 require 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 centers 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 shown 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 [10]) and international data (Statistical Office of the European Communities [9]) 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.

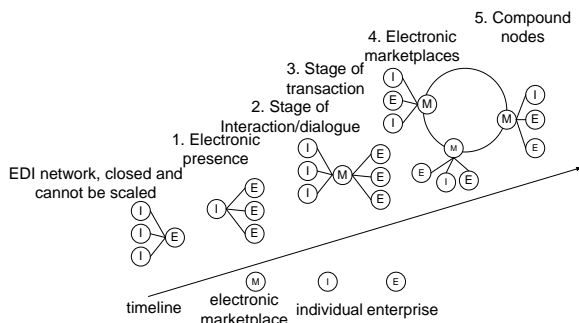


Figure 1. The Development Stages of Information and Communication Technology [2]

These stages are naturally 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

The use of ICT has its own role in every economic sector and in every company regardless of its size but it has a diverse influence in various sectors. That is the reason why an application method is needed for the economy and its participants. For example, the manufacturing industry is highly dependent on information on the procurement and sales side, so this

economic sector is most likely to create values here with the help of ICT at the initial stage. ICT, however, can be used to create values in almost every part of the value chain for companies dealing with financial intermediation, since information flow is always present in the value chain.

Although the most frequent functions for the average users of the internet are still searching for information and e-mailing, new solutions benefiting from the advantages of the cyberspace have started spreading recently. These can help small and medium-sized enterprises in more efficient administration, production, management, cooperation, selling and purchasing, marketing communication, keeping clients and realizing higher profits.

The use of technology hasn't been really unusual for commercial companies. It is quite natural that mobile phones and personal computers have become parts of any commercial activities. At the outset, they performed simpler and limited tasks but later computer manufacturers and software developers, together with telecommunication companies hammered out more complex systems such as product turnover tracking and storage systems, in the hope of new business opportunities. In the end a new, essential element, the network was needed for the operation and development of these systems.

The simple indicators of e-commerce are defined in different ways in various studies and surveys but they have some common denominators that appear in almost every definition. These are the data related to personal computers, mobile phones, wired and wireless telecommunication systems.

The infrastructural background of e-commerce is established for Hungarian corporations, small and medium-sized companies but the same cannot be said in the case of microenterprises. 48 % of the Hungarian microenterprises have local wired network which is 20 % lower than the national average. The penetration of the same network is 70 % among small and medium-sized companies, while 94 % of bigger companies and institutions have local wired networks. If we study the penetration of wired communication in various economic sectors, we can find that it is 100 % in the case of 'Electricity, gas and water supply', which is higher above the average by 30 %. 'Mining and quarrying', 'Public administration and defense', 'Compulsory social security' are also above the national average by 85 and 81 %, 'Agriculture, hunting and forestry' and 'Other community, social and personal service activities' are below the average (44 and 57 %) the rest of the sectors show signs of average penetration. In an international comparison, corporations and 'Electricity, gas and water supply' were around the average but the remaining studied sectors were below the average, ranked only in the 24th place in the European Union.

Studying the following single indicators can give an answer to the question of what existing information and communication technology is used by enterprises:

- reordering systems (stockpiling)
- invoicing and payment systems
- production, logistics and/or service systems
- purchasing systems

- sales systems
- other computer systems

Using electronic invoicing systems showed the greatest penetration among companies, reaching the average of 46 %. All single indicators showed higher levels above the average in the case of large companies and public institutions (17-25 % higher than the average). Microenterprises weren't able to reach the average levels: four indicators showed a level around 10 % (reordering systems 9 %, purchasing systems 8 %, production, logistics and/or service systems 12 %, other computer systems 10.5 %.), one indicator was lower than the average by 5 % (sales systems 3.5 %), and the remaining indicator was higher than the average with 25 % (invoicing systems 27.5 %). 'Transport, storage and communication', 'Electricity, gas and water supply' were above the average, 'Agriculture, hunting and forestry'; 'Public administration and defense', 'Compulsory social security'; and 'Education' were below the average regarding all indicators.

Electronic markets, trade links between business partners need a completely new way of thinking and organizations, while changing and putting the customary production, sales, ordering, purchasing, financial and administration processes on new grounds. The automatization of supply chain processes makes commerce cheaper, faster, simpler and more efficient. Using ICT solutions, savings can be achieved in transaction costs. Thus, the accumulation of capital and tangible assets can be avoided so companies are able to optimize their inventories and they can reduce the time needed for supplying the market. Taking everything into consideration, a new question arises here: what steps or stages are followed by companies to acquire more developed business models, electronic markets, for instance? In the table below, I present five development stages that can be observed in the relationship between the internet and several enterprises.

The individual stages don't only show a development in the timeline but also the extent of exploiting the opportunities provided by the internet.

The first stage can be defined as 'electronic presence' when companies solely use the internet for reaching their marketing goals. They make their own websites where visitors can find some important information on the company, its products and services (product catalogues, services and price lists). They put job offers and product advertisements onto their own sites and onto the banners of other websites as well, thus exploiting the internet as a new channel of advertisement and reducing the time being spent by users searching for information on a given product.

Companies tend to use this electronic channel for a one-way communication. Studying by company size categories and economic activities, it can be observed that corporations and small and medium-sized companies as well as the fields of 'Transport, storage and communication'; 'Financial intermediation'; 'Electricity, gas and water supply', 'Manufacturing', 'Wholesale and retail trade' and 'Real estate, renting and business activities' are well-developed. 'Construction' proved to be an underdeveloped but rapidly expanding sector. 'Agriculture, hunting and forestry'; 'Education', and

'Other community, social and personal service activities' are definitely underdeveloped and their pace of expansion is considerably slow.

In the second stage – which is called the stage of interaction or dialogue – electronic channels are used for cooperation by companies as a means of a two-way communication. The company maintains a two-way communication with its clients, suppliers and partners: receiving and sending e-mails, searching or asking for information, using banking services, conducting electronic taxation, interactive education and training, advertising or performing other marketing tasks, interactive market appraisal, requesting and sending information on products and services, providing after-sales services, purchasing digital products. Microenterprises belong to the category of underdeveloped and fast companies, while corporations, small and medium-sized companies belong to the category of developed and slow. If we examine the economic fields divided by activities, we can see that only 'Agriculture, hunting and forestry' belongs to the category of underdeveloped and slow sectors. (True, the penetration is also high even in this category.) In the category of underdeveloped, rapidly expanding sectors 'Health and social work'; 'Construction' and 'Hotels and restaurants' are present. 'Real estate, renting and business activities' produces high scores both at the level of its expansion and its penetration.

In the next step, companies start using and advertising their web pages as sales and trading channel. Products and services marketed on the internet can also be ordered online, the company has the chance of latching on to the e-commerce system by purchasing and selling products and services, customizing its web page for its frequent or regular customers, purchasing online digital products, making it possible to pay online, providing internet connection through mobile phones, providing platforms for safe financial transactions etc. Because at this level of business applications no third party can be found in the trading process, this is the stage of transaction or partnership. With the exception of 'Health and social work', and the category of microenterprises, the expansion of all the other sectors is low, only 'Financial intermediation' and 'Transport, storage and communication' showed a 20 % higher penetration, along with the category of corporations.

The fourth stage of e-commerce between companies is evolving nowadays. At this stage, partners are linked to each-other and organized into communities (Community Commerce) by a third party or mediator. This mediator is called e-marketplace, which eliminates the majority of traditional middlemen and brokers from the transaction and plays a huge role in coordinating and serving business partners as well as supporting several business processes. The advantage of this form of transaction is the ability to integrate a large number of potential business partners. Enterprises head for acquiring a trading model based on cooperation and partnership. System approach is inevitable for cooperation, therefore those companies are ready to accept this new technology that have already introduced reordering systems (stockpiling), invoicing and payment systems, production, logistics and/or service systems, purchasing systems, sales systems, other computer systems and digital signature. Nevertheless, we

need to emphasize that – as it is a new, evolving technology – it was only possible to measure the existence of the necessary conditions for introducing and using it. In this regard, all studied sectors proved to be underdeveloped. The penetration of this new technology was below 40 % in the field of ‘Electricity, gas and water supply’, ‘Transportation, storage and communication’ and ‘Mining and quarrying’. Regarding company size, corporations reached a remarkable 49 %. More rapid growth could only be established in the case of ‘Agriculture, hunting and forestry’, ‘Health and social work’, ‘Real estate, renting and business activities’ and ‘Other community, social and personal service activities’.

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.

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

Figure 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.

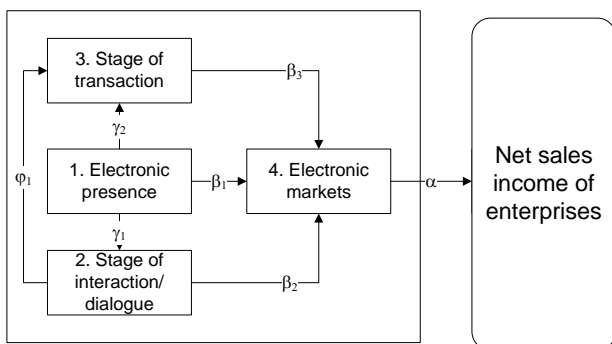


Figure 3. The Scheme of the Path Model of the Potential Indicators

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 [6]. 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.

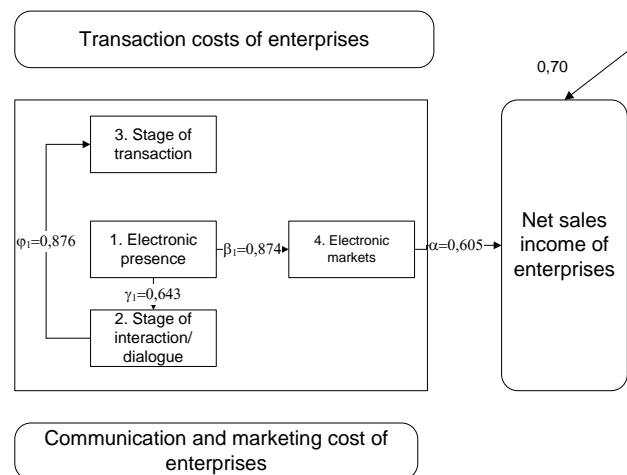


Figure 4. The Final Path Model of The Potential Indicators

Electronic presence has no direct effect on the potential indicator of transaction. The value of the strength of its

indirect effect was $(64.3 \times 87.6) 56.3\%$, 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 the 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 the discriminant analysis is shown in Figure 5.

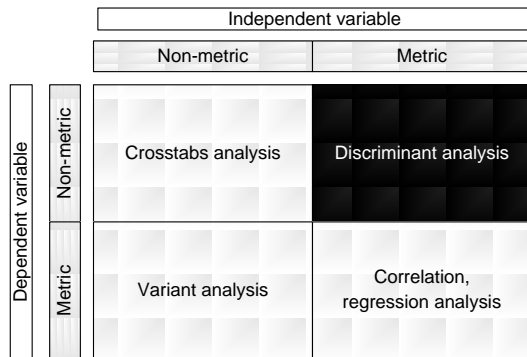


Figure 5. Partial Summary of the Methods Used for Structure Analysis, Along with Discriminant Analysis [5]

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 (K) Real estate, renting and business activities (M) Education (O) Other community, social and personal service activities	(D) Manufacturing (E) Electricity, gas and water supply (I) Transport, storage and communication (J) Financial intermediation
1.1 cluster	2.1 cluster
(A) Agriculture, hunting and forestry (F) Construction (H) Hotels and restaurants (N) Health and social work	(C) Mining and quarrying
Underdeveloped	Developed
relative	

Figure 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 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 I. 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
	%	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
	%	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 and its value ranges 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. Analyzing 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 the Cluster 1.2. Expressing this data in percentage it means that the rate of the adequately categorized cases is 52.8 % in the 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 cases and 37.2 % of 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. 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 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. Although only Hungarian enterprises were studied in this paper, the existence of the defined ICT development levels can be detected in the economies of other countries as well.

The secondary possibility for utilization lies in following certain patterns. The development of ICT is different in several countries, regions and economic sectors. Therefore, 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.

VII. ACKNOWLEDGMENT

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REFERENCES

- [1] M. Castells, "The Information Age", Gondolat- Infonia, 2000.
- [2] A. Kápolnai, A. Nemeslaki, R. Pataki, "eBusiness stratégia vállalati felsővezetőknek" (E-business strategies for senior management), Aula, 2002.
- [3] Z. L. Karvalics, "Információ, társadalom, történelem, Válogatott írások", (Information, society, history, Selected works), Typotex Kiadó, 2003.
- [4] Z. L. Karvalics, "Információs társadalom – mi az? Egy kifejezés jelentése, története és fogalomkörnyezete" (Information Society – what is it exactly? The meaning, history and conceptual framework of an expression), Az információs társadalom, Az elmélettől a politikai gyakorlatig (The Information Society, From theory to political practice), Gondolat – Új Mandátum, Budapest, 2007, pp. 29-47
- [5] Deborah L. Duarte, Nancy Tennant Snyder, "Mastering virtual teams: strategies, tools, and techniques that succeed", Jossey Bass, San Francisco, 2006
- [6] Everitt, B. S., & Dunn, G., "Applied multivariate data analysis", London, Edward Arnold, 1991
- [7] L. Sajtos, A. Mitev, "SPSS kutatási és adatelemzési kézikönyv," (The handbook of SPSS research and data analysis), Alinea Kiadó, Budapest, 2007.
- [8] P. A. Samuelson, W. D. Nordhaus, "Közgazdaságtan," (Economics), Akadémiai Kiadó, 1998.
- [9] K. Szabó, B. Hámori, "Információgazdaság," (Information Economy) Akadémiai Kiadó, Budapest, 2006.
- [10] Eurostat, Your key to European statistics, Available: <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>
- [11] Hungarian Central Statistical Office, Available: <http://www.ksh.hu>