

University doctoral (PhD) dissertation abstract

**ENTERPRISE RESOURCE PLANNING SYSTEMS AS
ECONOMIC RESOURCES AND THE REQUIRED LABOUR
COMPETENCES FOR THEIR APPLICATION**

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1. THE ANTECEDENTS, OBJECTIVES, AND HYPOTHESES OF THE RESEARCH

The information system is an instrument to display information in an appropriate place and at an appropriate time. It can be stated that there is a wide supply of enterprise resource planning systems in Hungary therefore companies of different sizes functioning in different field with the most varied demands will find the very information system that suits their expectations and possibilities best.

The actuality of my topic is verified by the following facts:

1. There is a growing number of companies in Hungary which try to maintain or strengthen their market positions with the help of an integrated system or indeed to improve their efficiency. Figure 1 illustrates the number of businesses using enterprise resource planning systems, which shows a continuous growth between 2008 and 2010.

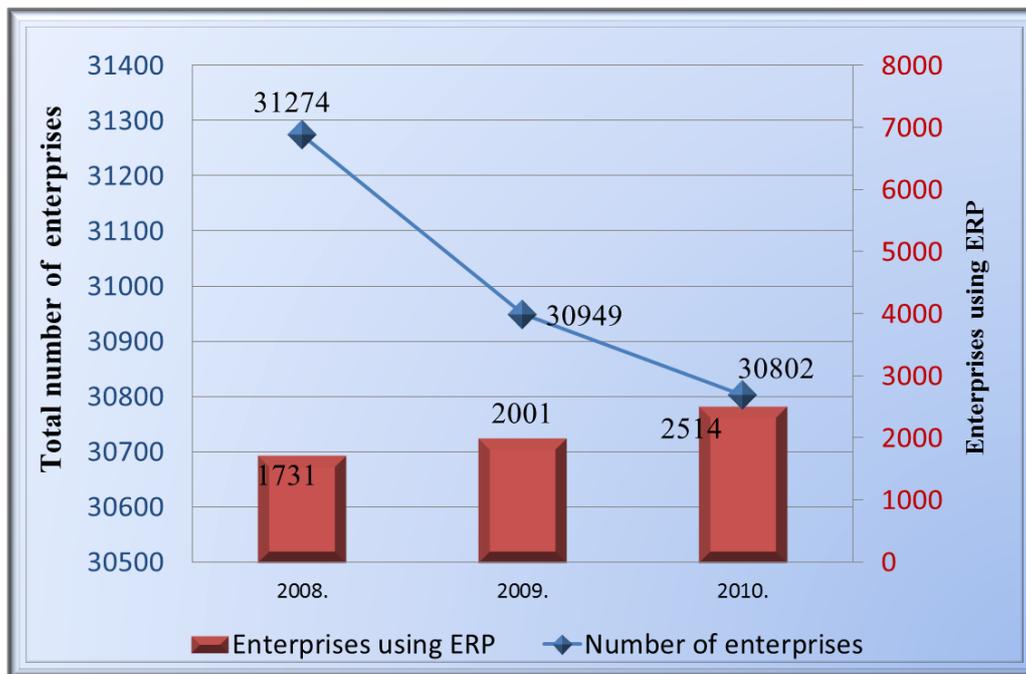


Figure 1. **The number of companies that use integrated enterprise resource planning system in Hungary**

Source: own compilation based on the data of the Hungarian Central Statistics Office

Graduates are increasingly likely to apply to companies where knowledge gained during their higher education years on information management may prove to be necessary. According to data in Figure 1 it is not only the change in the number of companies using enterprise resource planning systems but also its rate is apparent. This also shows a favourable picture as there were almost twice as many companies in 2010 (513 businesses) that installed enterprise resource planning systems as in 2009 (270 businesses).

2. Although the growth of companies using enterprise resource planning systems is not dramatic the number of companies installing ERP systems in 2010 was almost double compared to 2009. It must be taken into consideration that according to EUROSTAT data in 2010 the ratio of companies in Hungary using an ERP system was 8%, which lags far behind the 22% ratio of the European Union, or the 40% ratio measured in Belgium which is characterised by the most significant rate of ERP application. Further growth in this area can be expected as a result of EU application possibilities and because of the expanding choices offered of by the system suppliers.

3. In harmony with the above mentioned facts higher education institutions must also place more emphasis on the practice-oriented teaching of subjects that are in connection with information management. In my opinion an important method of this is to introduce through an enterprise resource planning system enterprise processes (finance, logistics, production, etc.) which principally determine the operation of an organisation.

1.1. Objectives

The currently prevailing process of globalisation, the expansion of the global market, and global trade all result in severe competition. Competitiveness can partially be boosted by enterprise resource planning systems and also by the relevant human resources competences. In order to examine them I formulated the following objectives:

- **The analysis of the economic role of enterprise resource planning systems**, since the ratio of companies in Hungary using integrated systems are behind Western-European countries in any category of company size.
- What sectors do the companies belong to that employ people graduating from the majors of economics of higher education institutions?
- **The exploration of the changes occurring in connection with the installation**, because the installation of an integrated system and the changes occurring in connection with the process- and organisational development may have significant effects on the enterprise.
- **Do the trainings offered at higher education institutions fulfil labour market expectations**, do graduates enter the labour market with the expected skills and competences? According to the opinion of employers graduates face the challenge of using terribly expensive information systems and it quickly turns out that they are not able to operate these systems.

In my opinion **there are expectations not only in connection with the systems providing information** but also in connection with the employees and young graduates who operate these systems. I am convinced that trainings that ignore the expectations of companies cannot possibly contribute to the sustainable improvement of competitiveness.

1.2. Hypotheses

In order to support the actuality of the topic and also to achieve the objectives I formulated my hypotheses which focus on the analysis of factors that I believe to be important.

H1: The labour market actors have well-defined expectations about the graduates' ability to use enterprise resource planning systems.

H2: Employees learn how to use an enterprise resource planning system on their own. Companies support the acquisition of knowledge to a negligible extent.

H3: Some of the reasons why enterprise resource planning systems are introduced are not in connection with certain company characteristics such as size or profit after tax.

H4: The judgement on the effects of the use of enterprise resource planning systems depends on the number of years spent at the workplace – work experience – and also on the position of the employee.

H5: Information is believed to be a more significant resource than classic resources at companies where an enterprise resource planning system is installed.

H6: Higher education institutions in general do not fulfil labour market expectations regarding the teaching of enterprise resource planning systems..

2. THE INTRODUCTION OF THE DATA BASE AND THE APPLIED METHODS

The connections between higher education and the labour market is a research topic which is currently increasingly focused on. It is a common belief that graduates can find a job easier and earn higher salaries than other employees.

The success of research is fundamentally influenced by the correctly chosen method. Therefore besides **implementing the primary and secondary research according to guidelines found in relevant literature** I paid special attention to use the most appropriate statistical methods to analyse the results.

2.1. The methods and the database of the secondary research

I started the analysis of the relationships between the higher education institutions and the labour market by collecting secondary data. After obtaining data from the Hungarian Central Statistical Office I was able to follow up the changes in the number of companies using enterprise resource planning systems in Hungary between 2008 and 2010. The necessary data was provided by the database derived from the so called OSAP 1840 questionnaire “Qualitative and quantitative data on information and communication technology”. The goal of the data collection is to introduce the stock and use of information and communication technologies owned by enterprises. At operation level the coverage of data collection fully complies with the requirements of the European Union.

The database of the National Career Tracking 2010 survey includes the students in Bachelor-, Complementary Bachelor-, and graduate trainings (in all types of training and all forms of financing) who graduated (earned their degree) in 2007 at a nationally recognised higher education institution.

Simple random sampling was used during this survey. The sample is made up of institutional sub-samples for which the list of graduates was supplied by the institutions participating in the survey. Almost all institutions of the given training sphere were included in the sample. Since an almost totally complete list of graduates was available the sample created with simple random sampling represents the national distribution of the graduates of the different teaching areas.

2.2. The primary research and the methods of analysis

During my research activity I completed two questionnaire surveys. The first survey focused on the operation of the enterprise resource planning systems and on the labour market expectations towards fresh graduates. The questions were grouped in the following order:

- **The connections between companies and the higher education system:** this set of questions was designed to find out about how readily higher education institutions and enterprises cooperated, as well as to introduce the expectations of labour market actors on the use of enterprise resource planning systems (Hypothesis 1).
- **The connection between the respondent and the applied enterprise resource planning system:** this set of questions was designed to collect information about the tasks, education, work experience, and knowledge on enterprise resource planning systems of the respondent in order to create samples based on grouping variables. (Hypotheses 2 and 4).
- **Filtering and grouping questions about the company:** they focus on geographical location, size, and the sphere of activity in order to verify that the created sample contains enterprises of certain size category and sectors where integrated systems are widely applied (Hypothesis 3).
- **Questions on the applied enterprise resource planning system:** to find out about the reason of the installation of the enterprise resource planning system (Hypothesis 3).
- **Personal questions concerning the respondent:** of the grouping variables data on position and school qualification can be found amongst the questions (Hypothesis 4).
- **Questions on the operation of the enterprise resource planning system:** these questions represent the effects of enterprise resource planning systems, its role in decreasing the risks of decision making, and the verification of the resource characteristics of information at companies applying integrated systems (Hypothesis 5).

The questionnaire contains a number of types of questions, often the so called Likert scale was used but the ordinal scale was also applied. When creating the scale (5 degree scale) it was important not to enforce the respondent to give a concrete answer when they were not willing to, which means that a neutral answer was possible. As a result of the opinion survey

conducted together with the test questionnaires I established that the respondents did not have enough experience or information to fill in a 7 or 9 degree scale appropriately.

The **second survey** focused primarily on the extent to which the enterprise resource planning systems education in higher education institutions with economics majors can fulfil the expectations of employers. The questionnaires were sent to 29 institutions to heads of institutions and heads of departments who are responsible for subjects connected to enterprise resource planning systems.

Data were analysed by means of Microsoft Excel and SPSS 17.0. The former was used to visualize data as different statistical series (quantitative, qualitative, regional), tables (crosstabs) and figures, while the latter was used to recode, variable calculation, and for statistical tests and analysis.

The collected data was analysed by means of ratios followed by hypothesis testing in order to support statistical conclusions. The hypotheses were formulated in two different forms: as a null hypothesis and an alternative hypothesis. Either the former or the latter was accepted depending on the behaviour of the sample.

Having formulated the hypotheses I set the so called level of significance (α), in which I defined when the null hypothesis can be accepted or rejected. The level of significance corresponds with the professionally accepted limiting value of 5% applied in social and economic research. Parametric tests require the normal distribution of data, while there are no such criteria with non-parametric ones. Therefore the application of non-parametric tests was a viable solution during the research. Of the non-parametric tests I applied the **Kruskal – Wallis test and the Mann – Whitney- Wilcoxon (rank-sum) test**. Apart from these I also used parametric, multi-variable methods as well. The **analysis of variance** was used to compare the expected value of the examined collection and to verify the accuracy of the null hypothesis. The **principal component analysis** is one of the simplest multi-variable statistical methods which I used to find answers about the reasons of the installation of enterprise resource planning systems.

3. THE MOST IMPORTANT RESULTS OF THE DISSERTATION

During my research activity I gained information from a number of databases. Some of these are readily available for the general public through the Internet on the websites of the Hungarian Central Statistical Office, Educatio Ltd., and higher education institutions.

3.1. The penetration of enterprise resource planning systems in Hungary

In order to avoid the disadvantages of isolated solutions at Hungarian enterprises an increasing number of companies decide to install an enterprise resource planning system. The fact that more and more multinational companies established their headquarters, warehouses, plants in Hungary and adopted the best practices in Information technology which proved to be viable abroad also contributed to the spread of the systems to a great extent. The systems introduced were made up of discernible, cooperating sub-systems whose modularity made not only their gradual introduction possible, which is, by far not a disadvantage being aware of the price and the running costs of the systems, but also there was an opportunity to cover the entire corporate structure by applying one software. Figure 2 shows the spread of enterprise resource planning systems.

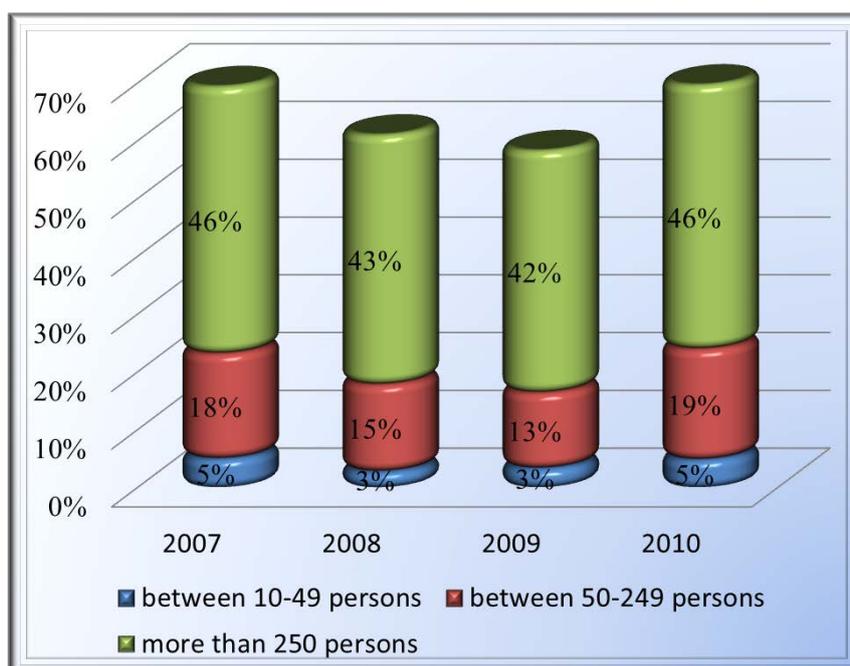


Figure 2. **The number of companies using ERP as a percentage of the total number of companies in Hungary**

Source: own compilation based on the data of the Hungarian Central Statistical Office

Almost every other large company (404 of the 816 companies), while every fifth medium-sized company use an integrated system. It is clearly visible that after the 2009 crisis the number of companies using enterprise resource planning systems grew in every category. The

reason for this growth in my opinion is that the wider range of application possibilities enabled companies to concentrate not only on the improvement of their computer stock but also on integrated systems that facilitate the management of the available resources.

3.2. Employment possibilities of graduates of economics studies

Finding a job quickly may be important to decrease unemployment, but it can also indicate the applicability of the gained knowledge.

In Figure 3 graduates value the teaching activities of their higher education institutions on a five-degree scale.

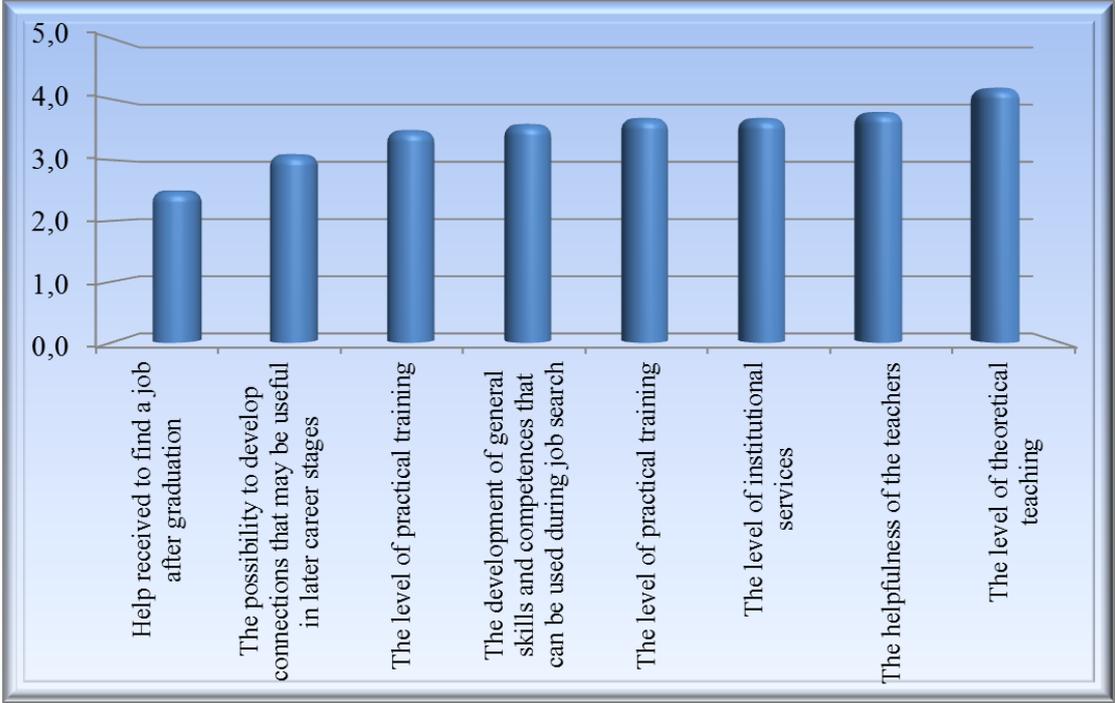


Figure 3. **The opinion of economics and agricultural graduates on the activities and services of the higher education institution**

Source: own edition: database (Educatio Ltd. career tracking database (DPR2010))

The figure clearly reveals that **higher education institutions provide little help** during job search. It must also be pointed out that student expect higher education institutions to **provide more help in developing a connection network**. Besides, ex-students also feel that the theoretical training they received was high quality but **the practical training suffers from shortcomings**.

The sectoral classification of the companies using information systems is depicted in Figure 4. These data are compared to sectoral classification of the graduates’ workplaces.

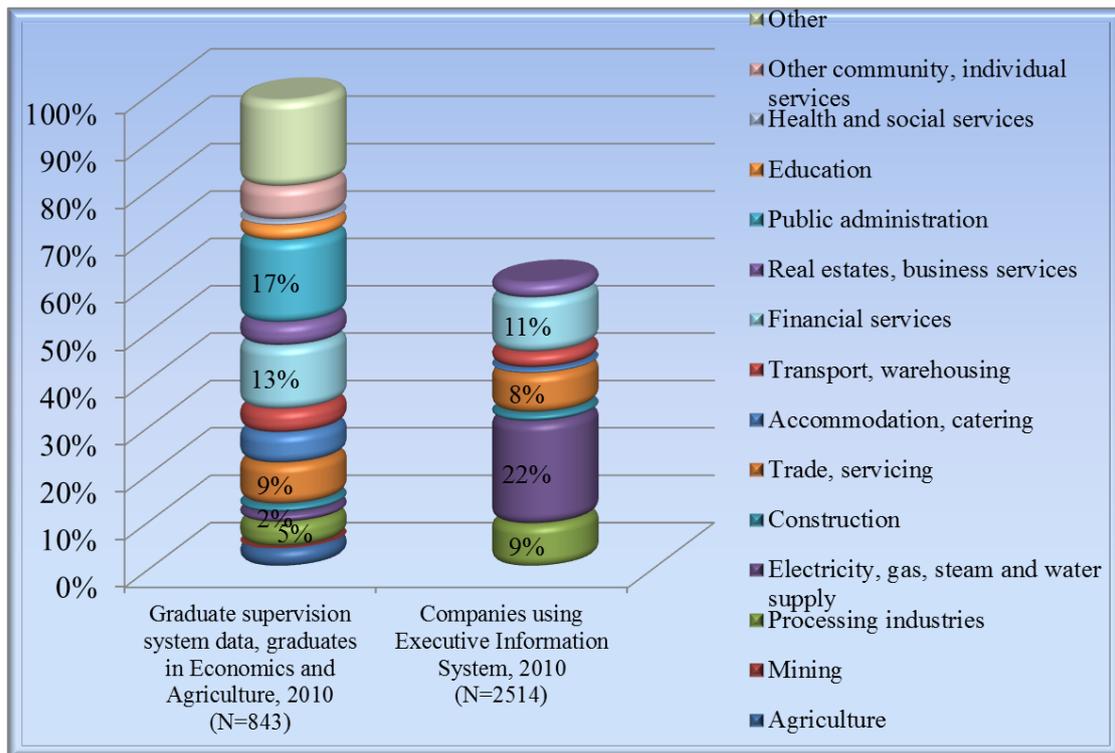


Figure 4. **The sectorial breakdown of companies that use ERP and the sectoral jobs of the graduates from economic programmes**

Source: own compilation: database (Hungarian Central Statistical Office data, Educatio Ltd. career tracking database)

Although the sectoral classifications have different names in the data bases (Hungarian Central Statistical Office, Career Tracking Database) it can be stated that the companies using integrated systems fall into one of four categories. These sectors provide employment for about one third (32%) of the graduates. This ratio indicates that a significant number of fresh graduates are affected by the question of what companies expect of them in order to contribute to the more successful, effective, and profitable operation of the company.

On the whole it can be stated that data provided by the graduate monitoring system present a good opportunity to further monitor the graduates of the rapidly developing Hungarian higher education of economics. I have been able to prove that almost one third of the graduates find employment at a large or medium-sized company in **energetics, trade, the processing industry, or finance where their work is aided by an enterprise resource planning system.**

3.3. The connections between enterprises and the higher education system, expectations towards fresh graduates

159 companies stated to have had links with an education institutions 38 of them have connections with a higher education institutions and 8 have a cooperation agreement. The usefulness of the connection achieved an average value of 4.1 on a five-degree scale.

Respondents expressed their opinion about the areas higher education institutions should concentrate on and also about the importance of a given area. The following results were obtained:

- Strengthening digital literacy 4,0
- Professional language transfer 4,2
- Development of general business skills 4,3
- Modern professional knowledge 4,7
- More practice oriented training 4,8

IT knowledge may be an important factor on the labour market. In order to obtain a good job the prospective applicant must have solid knowledge in their field, must be able to communicate in at least one foreign language, and must have good IT skills as well. The respondents expect the higher education institutions – on the basis of a simple average – to a lesser extent to concentrate on two of the three above mentioned areas. They believe the greatest emphasis should be placed on practice oriented training, which means providing a placement and the organisation of field practices.

Respondents valued the expectations about the use of enterprise resource planning systems on a five-grade scale as follows:

- To know the typical indicators of functional areas 3,2
- Familiarity with the notion of the system and system approach 3,4
- Be familiar in theory with the characteristic processes of the most important functional areas 3,6
- Be able to record master and transaction data 3,6
- Be able to create lists and reports from the recorded data 3,9
- Be able to interpret and analyse the content of lists and reports 4,0

The average values show that the requirements are very similar about the use of the information system. It is expected to a lesser extent that the fresh graduates should be able to record economic event in an unfamiliar system. What is **more important** is that the fresh graduates should **be able to interpret and analyse the content of lists and reports** and to

create such lists and reports. Depending on work experience the same expectations appeared with a 5% margin of error. This is mainly supported by employees who have been working for the given company for 9-15 years.

Hypothesis 1, which is about the expectation of the labour market, has thus been verified.

I also wanted to find out how companies keep their employees up-to-date with the use of enterprise resource planning systems. Knowledge on this subject can be considered a week mediocre since respondents estimated their knowledge on the use of information systems by an average score of 2.7. The data in Table 1 revealed how this value was achieved.

Table 1. The knowledge level of respondents on the use of enterprise resource planning systems, considering the types of further training

Method of knowledge acquisition	Knowledge on the use of enterprise resource planning systems 1=I have very little knowledge, 5=I have wide range of knowledge					Total
	1	2	3	4	5	
Supporting professional diploma			1	1		2
Attending courses			20	20	8	48
Supporting professional diploma+attending courses				1		1
I improve my knowledge from my own resources		6	28	10	8	52
Courses+I improve my knowledge from my own resources		6	2	10		18
We do not need any support, we are maximally familiar with the operation of the system		2	2	6		10
Total:	0	14	54	50	16	131

Source: own edition

It can be observed that companies use a number of methods to enable their employees to take advantage of the possibilities provided by the information system they use. Most people try to acquire the proper use of the system relying on their own resources, but the average score of 2.4 is still behind the average. **Unfortunately supporting the obtainment of a professional degree lags far behind the other alternatives.** In order to change this situation – in my opinion – higher education institutions must consider labour market requirements more carefully when teaching how to use enterprise resource planning systems.

Considering the fact that requirements towards fresh graduates about enterprise resource planning systems can be given in an exact, objective way, the efficiency of training could be

boosted by focusing studies on determined areas of the systems. In order to verify this I examined whether there are any links between the different training methods and the knowledge level on the use of enterprise resource planning systems. Table 2 shows the results of the Kruskal – Wallis Test.

Table 2. **Examination of the relations between the applied training possibilities and the knowledge level on the use of enterprise resource planning systems**

	Test Statistics ^{a,b}		
	Chi-Square	df	Asymp. Sig.
We do not need any support as we are fully familiar with the system we use	1,65	4	0,799
I and my colleagues maintain our knowledge by self-teaching and helping each other	5,74	4	0,219
By means of organised courses	3,73	4	0,444
By supporting efforts to gain a degree (programmer, information system manager, etc.) that is necessary to operate the system	1,61	4	0,806

a. Kruskal – Wallis Test

b. Grouping Variable: Value your knowledge on a 1-5 degree scale about the use of corporate information systems!

Source: own edition

Since the null hypothesis is valid in 21,9-80,6 % we can state that **the ability to use corporate information systems does not depend on the form of teaching**. It follows from this that the necessary skills to use corporate information systems can be gained even individually after the basic skills to use integrated systems – which are adjusted to the expectations of employers – are mastered in higher education institutions.

Overall, I conclude that most people acquire the knowledge of how to use enterprise resource planning systems at courses organised by the suppliers or by self-study. (Verification of Hypothesis 2). In my opinion **tighter connections between higher education institutions and companies are required** to increase support for specialised degrees; both parties must provide information on the requirements and the syllabus respectively.

3.4. The enterprise resource system used by the company

On the basis of the number of full time employees – as an indicator of company size – I examined the differences in the reasons for introducing these systems by Kruskal – Wallis Test (Table 3).

The table reveals that significance is less than 5% –i.e. the null hypothesis is not verified – in case of answers concerning **the acceleration of the flow of information at multinational**

companies, the efficiency of management activity, and the data collection for applications and statistical reports.

Table 3. The reasons for the introduction of enterprise resource planning systems considering the category of size

	Test Statistics ^{a,b}		
	Chi-Square	df	Asymp. Sig.
Increase of the size of the company	0,5111	3	0,9164
Fusion of more companies	2,1975	3	0,5324
Facilitation of the flow of information at a multinational company	12,4062	3	0,0061
Saving time and energy during data record (single administration)	3,5725	3	0,3115
Efficiency of the managerial activity (planning, analysing, supervision, decision preparation, etc.) – for example due to the slow, inefficient supply of information – was not satisfying	12,5339	3	0,0058
Data meaning information about the situation and economic processes of the enterprise were available in several databases, in different structures	5,9003	3	0,1166
Data meaning information about the situation and economic processes of the enterprise were available in several databases, often with different contents	4,1389	3	0,2468
With the help of the system, the processes and the relationships of those can be tracked more easily, their coordination is more efficient	2,5373	3	0,4686
Collection of the information in the appropriate structure necessary for the settlement, statistic registration of tenders might become easier	12,6802	3	0,0054

a. Kruskal – Wallis Test

b. Grouping Variable: Headcount of the full-time employees

Source: own edition

These reasons supported the installation of enterprise resource planning systems more significantly at companies with a larger labour force

I also considered the after-tax profit to find out about the differences for the reason of installation and I obtained the answers which are presented in Table 4.

On the basis of the amount of the after tax profit I divided the sample into three parts and analysed the answers by Kruskal – Wallis Test. Differences between the categories can be set according to three reasons which are below the 5% error level:

- company growth,
- fusion of more companies,
- Data meaning information about the situation and economic processes of the enterprise were available in several databases, often with different contents

The cost of investment of enterprise resource planning systems is about 5-10% of the annual revenue, while the operating costs are around 1% of the annual revenue.

Based on the data of the table, the significance is below 5% - which means that the null hypothesis is not realized – in case of the answers regarding the facilitation of the information flow of multinational companies, the efficiency of the managerial activities and the data collection for tenders and statistic reports.

These reasons were more relevant in case of the larger enterprises – based on the employee numbers – regarding the introduction of the corporate information system.

Examining the differences in the responses regarding the reasons for the introduction based on the taxed result data of the enterprises, I got the results of table 4.

Table 4. The reason for the introduction of the corporate information system based on the taxed results of 2008-2010

	Test Statistics ^{a,b}		
	Chi-Square	df	Asymp. Sig.
Increase of the size of the company	8,29	2	0,016
Fusion of more companies	6,77	2	0,034
Facilitation of the flow of information at a multinational company	2,11	2	0,348
Saving time and energy during data record (single administration)	0,34	2	0,842
Efficiency of the managerial activity (planning, analysing, supervision, decision preparation, etc.) – for example due to the slow, inefficient supply of information – was not satisfying	5,92	2	0,052
Data meaning information about the situation and economic processes of the enterprise were available in several databases, in different structures	3,38	2	0,185
Data meaning information about the situation and economic processes of the enterprise were available in several databases, often with different contents	10,44	2	0,005
With the help of the system, the processes and the relationships of those can be tracked more easily, their coordination is more efficient	3,58	2	0,167
Collection of the information in the appropriate structure necessary for the settlement, statistic registration of tenders might become easier	1,92	2	0,384

a. Kruskal – Wallis Test

b. Grouping Variable: Taxed result categories

Source: own edition

According to the data presented in Table 5 significance level of lower than 5% can be detected and it concerns the fact that information can be found in different databases with different content.

On the basis of both the after tax profit and the revenue the average ranking of smaller companies show higher values, i.e. the respondents of these companies believed that the installation of enterprise resource planning systems was more advantageous.

On the basis of Tables 3, 4, and 5 I came to the conclusion that the general answers about the introduction of integrated systems can be related to different companies or at least they do not depend on company size, revenue, and after tax profit. Accordingly, any company at any

stage of operation may get to the point where the incoordination of the available information and the confusing company processes make the company install an integrated system.

Table 5. Reason for the introduction of the corporate information system based on the revenues of 2008-2010

	Test Statistics ^{a,b}		
	Chi-Square	df	Asymp. Sig.
Increase of the size of the company	2,61	2	0,271
Fusion of more companies	1,43	2	0,49
Facilitation of the flow of information at a multinational company	2,34	2	0,31
Saving time and energy during data record (single administration)	3,39	2	0,183
Efficiency of the managerial activity (planning, analysing, supervision, decision preparation, etc.) – for example due to the slow, inefficient supply of information – was not satisfying	1,82	2	0,403
Data meaning information about the situation and economic processes of the enterprise were available in several databases, in different structures	2,86	2	0,24
Data meaning information about the situation and economic processes of the enterprise were available in several databases, often with different contents	7,88	2	0,019
With the help of the system, the processes and the relationships of those can be tracked more easily, their coordination is more efficient	3,39	2	0,184
Collection of the information in the appropriate structure necessary for the settlement, statistic registration of tenders might become easier	5,83	2	0,054

a. Kruskal – Wallis Test

b. Grouping Variable: Revenue categories

Source: own edition

Overall, I conclude that the following three reasons for the introduction of an integrated system do not depend on company size, revenue, and after tax profit, at the same time they are factors of high priority:

- Time and energy is spared when recording data (one-time data entry).
- Data providing information about the state and internal processes of the company can be found in different data bases in different structure.
- Internal company processes and their relationships can be followed more easily, their coordination may become more efficient.

Therefor I accept Hypothesis 3 since the above mentioned reasons of introduction are not connected to the company characteristics stated in the hypothesis.

3.5. The effects of enterprise resource planning systems on the operations of the company

With the help of the questionnaire I was able to analyse the effects of enterprise resource planning systems from the aspect of whether the time spent at a company might influence

responses. Respondents grouped according to the time they had spent at the company uniformly believe that enterprise resource planning systems have favourable effects on **company processes, faster detection of problems, the speed of information flow, and the availability of information.** The “new” and the “old” employees attach less favourable characteristics to the effects of enterprise resource planning systems on the operations of the company. I was able to demonstrate connections between enterprise resource planning systems and work experience considering the following effects:

- changes in the company structure,
- effects on the number of employees,
- providing better services,
- operation became easier to plant,
- effects on transport and related costs,
- better traceability and evaluation of the performance of employees,
- speed of decision making at higher level of management,
- effects on the accounts of application sources, and on the representation of information necessary to make reports and records in the required structure.

Differences in the opinion of employees with different work experience can mostly be observed about the effects on the **changes of the company structure.** As a result of my survey I can declare that the effects of enterprise resource planning systems on the company structure were asserted by the employees who had been working for the company for 9-15 years. This group differs significantly from all the other groups considering the average rating values. The reason for this may be that this group is more familiar with the structure of the company than the ones with less work experience therefore they can observe changes more rapidly.

It is an overt goal of companies that besides making the enterprise more profitable and effective they also intend to decrease the risks of decision making by installing enterprise resource planning systems. The role of integrated systems in decreasing the risks of decision making was judged to be a strong medium on a five-degree scale by the respondents. They believe this can be realised as follows:

- the information is available on time (average: 3,6),
- decreased time for preparing alternative decisions (average: 3,7),
- providing continuous plan-fact comparison possibility (average: 3,8).

In summary I conclude that enterprise resource planning systems **make their effects felt in a number of areas of successful operation of the company** thus accelerating the possibility

of its spread. The most important changes are in connection with **speed, temporality, and better traceability of processes**. Besides, **the judgement on the effects of the use of integrated systems depends on work experience**. **Hypothesis 4 thus has been verified**.

It can be heard with increased frequency that information should be regarded as a resource. In the following stages I intended to find out whether the users of integrated systems attach more importance to information than to resources in the classical sense considering its effects on the success of the company. On the basis of the following data I can declare that the availability of information is believed to have the least influencing power according to the respondents.

- Information 3,6
- Entrepreneurial skills 3,7
- Material, technical resources 3,8
- Financial resources 4,0
- Human resources 4,1

The most influencing factor is human resources management. It is interesting not only because the availability of information could not overtake entrepreneurial skills but also because earlier at the analysis of the effects of enterprise resource planning systems on competitiveness the module in connection with human resources management achieved the lowest score. In my opinion the reason for this may be that in certain systems the human resources module is only used to record personal data of employees or maybe for payroll tasks. The true managerial function that influence the operations of the company (e.g. job competency, personal competence handling) is not available.

In summary I conclude that the verification of information as a resource at companies using enterprise resource planning systems (Hypothesis 5) could not be verified, because respondents could not really sense effects on success and efficiency. Human resources was named to be the most important resource.

3.6. Examination of the educational structure of higher education institutions

Out of 81 Higher education institutions in Hungary 29 offers courses in economics at BSc and 20 at MSc level. I suppose the teaching of enterprise resource planning system appears in the syllabus of these institutions.

As a result of the survey 21 institutions that offer courses on economics filled in the questionnaire. Table 6 shows the number of institutions teaching enterprise resource planning system in certain majors.

Table 6. The number of institutions teaching enterprise resource planning system in certain majors

	Subject	Number of institutions teaching the given subject	of which teaches ESP	Percentage of institutions teaching the subject, %
BSc	Business trainer	2	0	0
	Public services	8	1 (1 n.a.)	13
	International management	15	1 (3 n.a.)	7
	Human resources management	8	6 (1 n.a.)	75
	Economic analysis	2	1	50
	Applied economics	5	1	20
	Business and management	25	16 (4 n.a.)	64
	Trade and marketing	17	6	35
	Finance and accountancy	17	11 (3 n.a.)	65
Tourism and hoptality	16	5	31	
MSc	Economics analysis	4	3 (1 n.a.)	75
	Master of business administration	4	1	25
	Marketing	8	2 (2 n.a.)	25
	International Business and management	7	2 (1 n.a.)	29
	Finance	7	3 (2 n.a.)	43
	Regional and environmental economics	8	1	13
	Accountancy	6	2	33
	Tourism-management	5	1	20
	Enterprise development	8	6	75
	Management and leadership	10	8	80
	Public management and policy	3	1	33
	Insurance and finance mathematics	1	0	0
Business mathematics analyst	1	0	0	
Logistics management	6	5	83	

Source: own edition, n. a. = not available

I can conclude on the basis of the data included in this table that in the case of the two majors that are most strongly linked to the field of management sciences and that are regularly offered by schools of economics (Business and management and Finance and accountancy) great emphasis is placed on the teaching of information management by means of the introduction of information systems.

In my opinion the syllabus and the curriculum should be **revised at BSc level of Trade and marketing and the Tourism and hospitality majors as well as at MSc level of Marketing and Tourism management majors** because on the basis of the collected data a large percentage of service providers in trade, commerce and hospitality use enterprise resource planning systems. A larger proportion of graduates find employment at this kind of companies.

I have been able to prove that almost half of the respondents stated that the assigned time to learn about these systems was hardly enough. Therefore the question may arise whether the application of these systems are taught in case of subjects that are not directly connected to information management. The responding higher education institutions “smuggle” the teaching of enterprise resource planning systems in subjects such as business economics, controlling, marketing, accountancy, quantitative methods, and e-business. Figure 5 shows why it is difficult to introduce the teaching of integrated systems in other subjects.

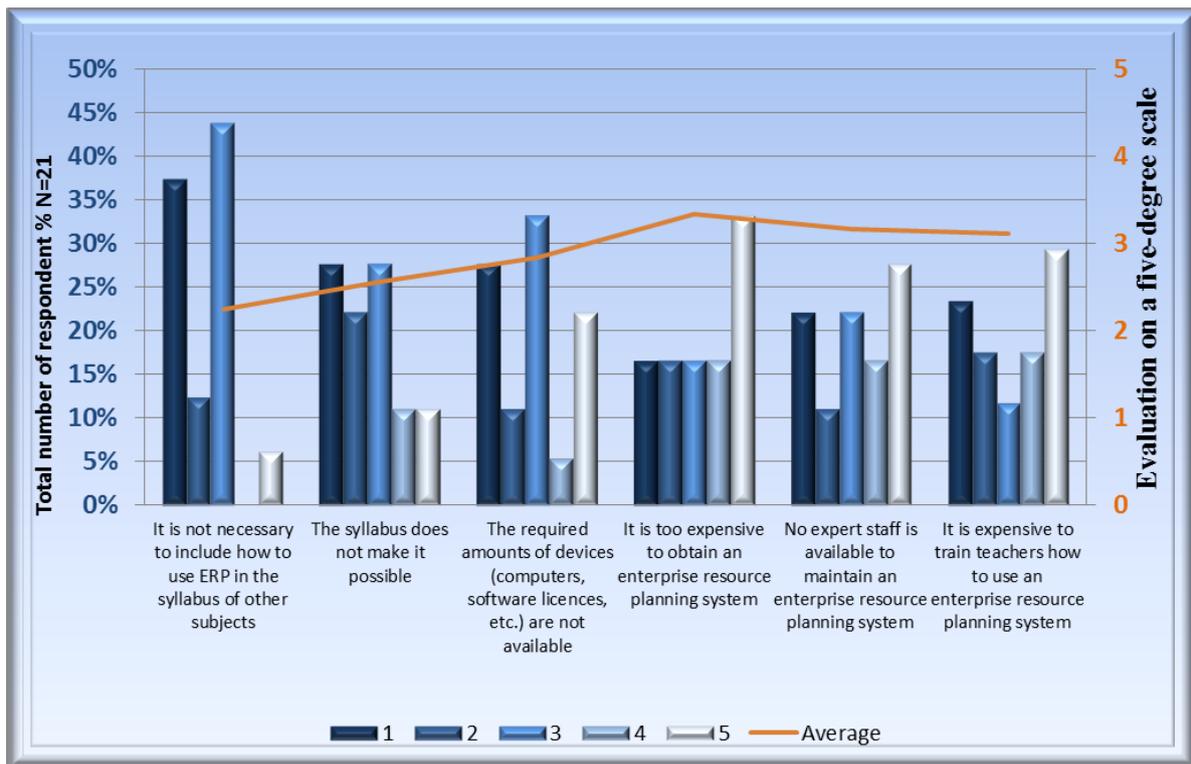


Figure 5. **The difficulties of the practice oriented teaching of subjects not directly connected to enterprise resource planning systems**

Source: own edition

On the basis of the assessment of the questions given on a five-degree scale I can declare that all the presented problems uniformly have an approximately midrange effect on the fact that the teaching of enterprise resource planning systems is not involved in the syllabus of other subjects. Considering the question of whether it is really necessary 38% of the respondents provides maximum support while 44% agree to a moderate extent. Only one respondent disagreed with my proposal. On the basis of the textual justifications the respondents supported the integration of these systems into other subjects. The following advantages were suggested:

- The possibility to improve system oriented thinking,
- gaining hands-on experience,

- acclimatisation to a prospective workplace with the help of the introduction of application possibilities,
- the given subject may become more interesting.

Table 7 includes the subjects in which labour market expectations are fulfilled in connection with practice oriented training.

Table 7. **Matching enterprise resource planning systems to the most important requirements**

Insti- tution	List-, report creation realised		Analysis realised	
	Subject	Major	Subject	Major
1.	Integrated corporate information systems	Business development, Logistics	Business systems integration	Business informatics
2.	Logistical information systems, Integrated information systems	Logistics	Corporate information systems, Financial planning, analysing software	Business and management, Finance and accountancy
3.	SAP fundamentals	Not applicable	SAP fundamentals	No answer available about the major
4.	Corporate information systems, Financial planning, analysing software	Business and management, Finance and accountancy	Quantitative methods	No answer available about the major
5.	Production management	Logistics	Integrated information systems	No answer available about the major
6.	Finance - accountancy informatics	Finance and accountancy		
7.	Business information management, Business systems configuration	Business informatics, Engineer informatics		

Source: own edition

Only in 7 institutions and in case of 10 subjects is the requirement list creation fulfilled, while analytical skills are focused on in 5 institutions and in case of 6 subjects.

In summary I can state that the practice oriented teaching of enterprise resource planning systems is an important factor for most respondents. Higher education institutions highlighted the costs of the systems as a limiting factor in connection with implementation. The syllabus and the curriculum should be **revised at BSc level of Trade and marketing and the Tourism and hospitality majors as well as at MSc level of Marketing and Tourism management majors** because only one third of the institutions at BSc level and only one fourth of them at MSc level place emphasis on the teaching of enterprise resource planning systems. It is disturbing because companies operating in the

above mention areas widely use integrate systems, what is more these companies are popular with graduated job seekers.

In order to adjust the knowledge level of undergraduates to expectations – considering the fact that 40% of the respondents claimed that the number of lessons was not enough – other possibilities to widen specific knowledge must be grasped. I can see a possibility in this respect to include the teaching of enterprise resource planning systems in the syllabus of not directly linked subjects. Hypothesis 6 was partially verified.

3.7. The practice oriented teaching model of an enterprise resource planning system

The teaching of information management must have an important role in the practice oriented training of undergraduates of economics studies. With the help of this model students may become familiar with the operation of a modern enterprise resource planning system used by a number of companies. Undergraduates can learn to manage a currently very important resource – information – and they become familiar with economic processes and their different stages. This database and teaching material facilitates the development of a system- and process oriented thinking.

Figure 6 depicts the structure of the model.

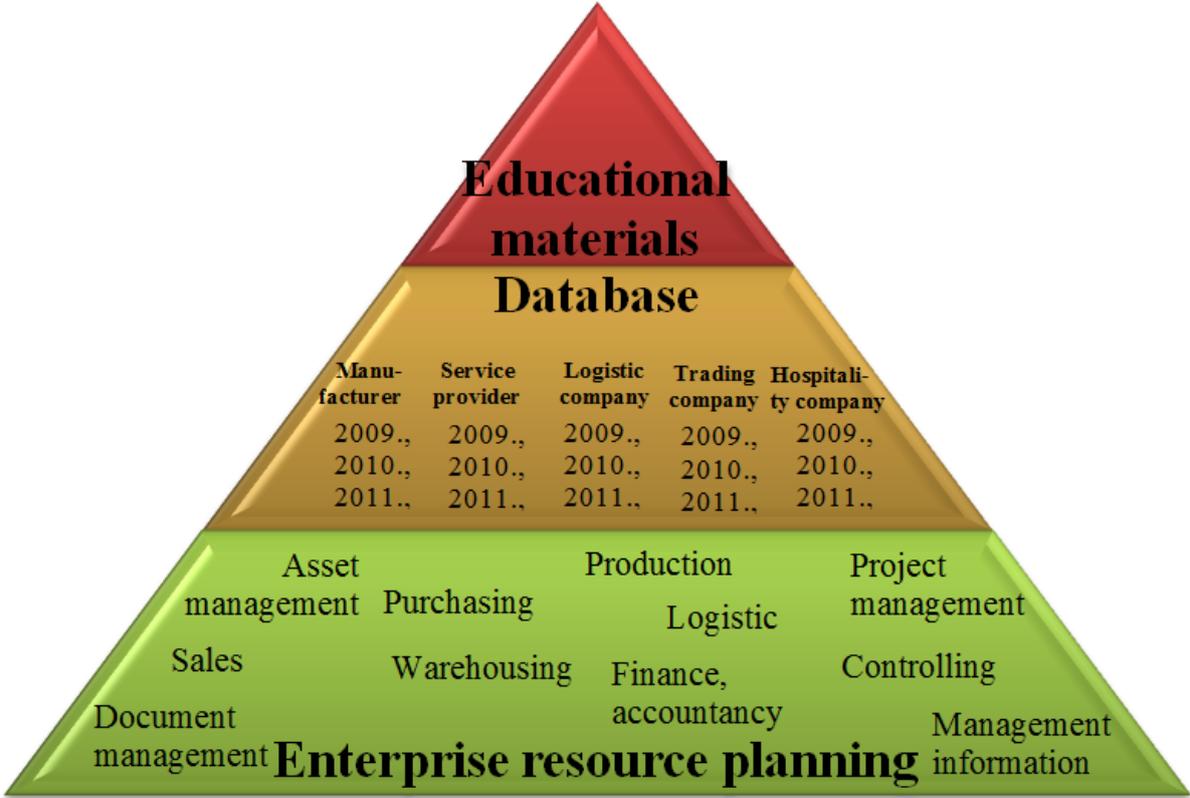


Figure 6. The structure of the teaching model

Source: own edition

The basis of the model is an ERP system which includes the modules covering the economic processes of the following areas: **sales, purchasing, asset management, project management, production, logistics, document management, finance, accountancy, controlling, management information, warehousing.**

The next level of the model is made up of the **database of the ERP system** which contains the core and transactional data of five companies operating in different fields. I paid attention to the fields of activity where enterprise resource planning systems are widely used and also the types of companies that graduates of economics studies prefer when selecting job opportunities.

The databases contain the companies' economic data of three consecutive years (2009, 2010, 2011) making the completion of analysis and plans possible and also enables the analysis and visualisation of management information in the forms of statements, lists, and reports. The teaching material is based on these individualised databases and includes the following elements:

- case study depicting an economic situation,
- users' manual, educational auxiliary material,
- E-learning auxiliary material.

The case studies contain on the one hand the presentation of reoccurring, characteristic situations which are connected to a company active in a given field, and on the other sample task systems.

The content of case studies:

- punctual depiction of the situation,
- the place where auxiliary materials can be found,
- test question connected to the situation.

Case studies reveal which company's database is necessary to solve the problem. Emphasis is based not only on data recording but rather on creating information from the given data, decision making preparation, and problem solving. At the end of the case studies there are a number of problems to be solved at three levels of difficulty. This way the use of enterprise resource planning systems can be integrated – even within the framework of one case study – into the practice oriented training of a number of subjects.

The following skills and competences can be developed by answering the questions: autonomous decision making, business approach, information gathering, information production, information management, communication skills, problem solving, cognitive and methodological competences.

With the help of the tasks students can give answer in a modelled corporate environment to questions which they are likely to encounter later on in their profession. The integrated enterprise resource planning system makes the topics more vividly descriptive on the one hand, and on the other undergraduates become familiar with a technology with which they are increasingly likely to encounter in their job.

THE MOST IMPORTANT CONCLUSIONS OF THE DISSERTATION, NEW AND NOVEL SCIENTIFIC RESULTS

On the basis of the hypotheses formulated at the beginning of my research activity I assert the following.

1. It has been verified that graduates are **expected** to be able to create **lists, reports, and statements, as well as to be familiar with the processes of functional areas and to track in the enterprise resource planning system.** Accordingly, a system and process-oriented thinking is required. **I accept Hypothesis 1.**
2. As a result of my surveys I state **that in most cases the use of an enterprise resource planning system is learned at the courses of forwarding companies and by self-study.** Employers support the obtainment of skills necessary to operate enterprise resource planning systems by means of a specialised degree only to a minimal extent. **Hypothesis 2 has been verified.**
3. Of the reasons that advocate the installation of such a system the following **do not depend on the size of the company, revenue, and profit after tax:**
 - Time and energy is spared when recording data (one-time data entry), **demand for time management.**
 - Data providing information about the state and internal processes of the company can be found in different data bases in different structure, **there is a need for storing data in a uniformly structured way.**
 - Internal company processes and their relationships can be followed more easily, their coordination may become more efficient, **there is a need to coordinate processes.**
 - Besides, **all three facts have high priority** in the ranks for the reasons of installation. It shows that **should the above mentioned needs arise the management will decide to install the system and will find a way to finance the installation of an integrated system. I consider hypothesis 3 to be proved.**
4. As a result of the survey I declare that judgement on the effects of an enterprise resource planning system is influenced by work experience. **The impact on corporate structure can be highlighted on the basis of the respondents who have been employed at the company for 9-15 years. Hypothesis 4 has been verified.**

5. At the beginning of my research **I supposed** that at companies where an information system is used **access to information is an important factor** preceding a number of other resources in a classical sense. As a result of my survey I can state that **although information is not believed to be as important** as say financial resources or human resources it does not fall behind either of them considering it as a factor that can influence success. **Hypothesis 5 is rejected.**
6. **The syllabus of 39 different subjects** includes the teaching of enterprise resource planning systems at **29** economics oriented **educational institutions**. According to the respondents **7 institutions in 10 subjects pay special attention to creating reports thus fulfilling labour market expectations**. When this result is compared to the fact that **the lack of experts is indicated in case of data providing problems with enterprise resource planning systems**, we can say that educational institutions must consider the teaching of integrated systems as an important factor.
Since most respondents – altogether about 80% – believes it is possible to teach enterprise resource planning systems not only in subjects in connection with corporate information management, I consider this fact as an important breakout point. **Hypothesis 6 has been verified.**

Besides the above mentioned statements with the application of the educational model **students become familiar with problems occurring in real life situations** through case studies and pre-planned situations. In order to solve these problems they must use a modern integrated management system that covers the whole company structure. These tasks **contribute** not only towards practice oriented training but also towards the **improvement of competences** set in the Training and Graduation Requirements and also towards the **fulfilment of labour market requirements**.

THE PRACTICAL USEFULNESS OF THE RESULTS

In connection with my research activity the following results of practical usefulness must be emphasized. I would like to present them from the point of view of the participants of the survey:

- Higher education institutions receive help in interpreting what the practice oriented teaching of enterprise resource planning systems mean from the point of view of the labour market.
- By considering the two suggestions about practice oriented training – teaching enterprise resource planning systems in other subjects and using companies as a venue for practical placements to a greater – higher education institutions could get closer to labour market expectations.
- By providing placements companies could get more involved in the teaching and research activities of institutions – use of social capital –, thus have graduates trained according to their own specifications.
- Suppliers of enterprise resource planning systems now know which sectors of the national economy represent a market niche in the market of these systems.
- A new teaching model has been shaped in which student can try to find answers in a pre-modelled business environment to questions that are likely to arise in real life situations.

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