Management information systems. A case study over the last eight years in the Romanian organizations

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The present interest of this paper consists in the powerful impact that IT&C technologies have upon the development of the last 20 years of the Romanian organizations as well as upon the daily life of each individual in the special condition of the Romanian economy and especially Romanian society as a whole. The motivation of the approach is supported by the fact that IT&C industry has had an explosive development during the last 20 years in Romania. Accordingly, this industry represents 10% of Romania's gross domestic product, a quite high percent in case one notices that not long ago it represented only 3%.
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1 Management methods and techniques evolution in the last 60 years

We have started the elaboration of the paper relying upon our own experience of about 20 years in the field of planning and implementing IT systems and mainly upon the experience of training the users of such systems. According to our vision, the importance of management information systems primarily consists in effectively and responsibly understanding the need of adapting to a global informational society by all managers or persons of an organization; the reason of taking the course of such an action is determined by the fact that today informational systems increasingly develop into an indispensable and vital component of the business success of an organization or of an entrepreneur.

While noticing a short overview of the evolution of the main management methods during the last 50 years we have tried to draw out the chapter dealing with the advanced methods used by the management of Romanian organizations. Management methods have witnessed an evolution lately, namely during the period 1990 -2010, strictly connected with the information and communication technologies. Accordingly, while the decade '70 – '80 belonged to the management methods characterized by strategy, leadership or excellence[1], beginning with the '90s, the personalities of management history have proposed, conceptualized, and studied management methods in close connection with information technology. The years '90s and 2000 were strongly influenced, in the field of management methods and techniques, by a series of professors, researchers and scientists belonging to American universities and having an engineering, management, and IT interdisciplinary training. The methods meant for organization's strategy, such as score-card, or for complex management decisions, such as business analyses, represent in our vision the sole solution a business and an organization may adopt in order to enter the decade to come. We consider that in 2010 the category of the advanced management methods should include: *Enterprise Resource Planning, Business Intelligence, Balanced Scorecard, Business Process Reengineering, Business Process Management, and Enterprise Content Management*.

Below, some major management milestones along with the most prominent proponents are presented. The timeline is only

approximate and so is the following discussion. The point is simply to discuss the rapid development of methods and approaches in the 1980s and 1990s and try to identify some connections that can be useful in understanding why the same method can be successful in one company but a failure in another. [6]

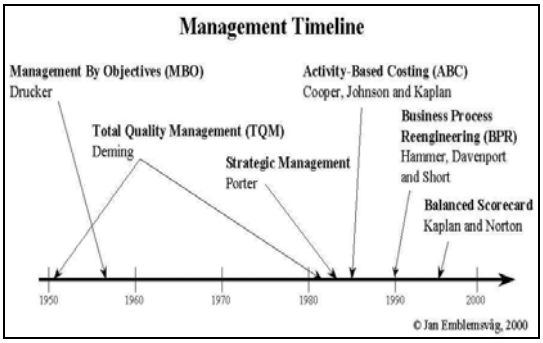


Figure 1. Management Timeline Techniques

(http://www.emblemsvag.com/historic.htm)

Recent Developments in Management Theory comprising works such as Systems Approach, Situational or Contingency theory, Chaos theory, and Team Building approach. Some of the more recent developments include the Theory of Constraints, management by objectives, reengineering, Six Sigma and various information-technology-driven theories such as agile software development, as well as group management theories such as Cog's Ladder.

2. Management Information Systems in the last 20 years in the Romanian Organizations

We consider that the most relevant Information Systems for the Romanian organizations are the Management Information Systems (MIS). Also for historical reasons, many of the different types of Information Systems found in commercial organizations are referred to as "Management Information Systems". However, within our pyramid model, Management Information Systems are management-level systems that are used by middle managers to help ensure the smooth running of the organization in the short to medium term. The highly structured information provided by these systems allows managers to evaluate an organization's performance by comparing current with previous outputs.

The evolution of the MIS in Romania during the last 20 years, is connected with the evolution of database software, from simple and non complex applications, designed by small software companies in Database Development Systems (DDS) such as FoxPro, to applications made in Relational Database Management Systems (RDMS) for Servers by huge software companies such as Oracle, IBM (International Business Machine) and Microsoft in Ms SQL (Structure Query Language) Server, and are reflected in a optimistic manner in the MIS software implemented for business function in Romanian companies. The classical and ordinary database software used in small applications and developed through DDS like FoxPro (1990-1995) are declining in front of new server oriented RDMS, led by Oracle, IBM (using data server DB2) and Microsoft (using Ms SQL Server). This is happening because the servers have become integrant part in a company. These database servers support today ERP and BI software.

As a reference, in the Jiu Valley, one of the most important Romanian extractive industry area, we can say that in 1995 the extractive industry was before of a major social restlessness caused by the future dismissal from the system of a great number of employees. The IT activity was coordinated by means of a nucleus, integrated in National Bituminous Coal Company (CNH or RAH), where the investment level was very low. Thus, three hardware systems coexisted together: old generation computers, as the 1980 Independent PDP and Coral category; AS400 from IBM; PC in a disparate structure. That was the moment when

FoxPro took place of older programming languages as Cobol and data processing for a number rather great of employees of RAH in a time of 10 times shorter than before, that was meant an unimaginable gain.

In 1998-1999 because of the governmental requirements a move into another stage has been made, a stage that was considered as visionary, for that moment, and this was outsourcing. In fact, the externalization of IT services for the coal producer took place, by means of the detachment of that activity and the establishment of an independent company. The new economic conditions, corroborated with the technological progress made it possible for the number of PC to increase and then for them to develop into computer networks, easing the work not only of the software developers but also of the end users. AS400 had been used until 2001 only as an archiving system. Software instruments have been permanently developed so that in 2003 DOS application coexisted with the newer Windows applications. So, reports with many graphical elements, became much more accessible. This conditions predicted the development of integrated solutions, fact that was confirmed by the future reality.

In order to demonstrate this 2004 market perspective, we have investigated the main Romanian extractive companies (most important one in coal, metal and salt - natural resources): [4]

We made a managerial research, in 40 branches of these 5 companies through a variety of business functions such as manufacturing, supply chain management, financials, human resources and customer relationship management. In every business function we focus on 4, 5 or 6 important and usually applications.

3. A managerial research in the ERP field, for Romanian 2004 national natural resources companies

Methodology

The instrument used for collecting data was the questionnaire. We used SPSS Statistics 17.0 to operate the answers. Using the sampling data we estimated the parameters of one regression model may be used to identify the determinants for PC and ERP applications used in a company. The managerial research is based on a questionnaire of 33 questions focused on hardware, O/S software, RDMS software endowment and implementation of the business software for five business function (manufacturing, SCM, financial, HRM and CRM). Data computing was based on data obtained from 40 firms, organized in 9 companies (90 % of the Romanian mining companies).

We used regression analysis, as a statistical method to evaluate the relation between one independent variable and another continuous dependent variable. With this analysis tool we have performed a linear regression analysis using the method of the least square in order to plot a line by a set of observations. Thus we have perform the analysis of the dependence and we have appreciated the extent to which the independent variable influence the dependent. With linear regression we output the regression coefficients necessary to predict one variable from the other - that minimize error. Also we used linear regression for drawing a straight line for evaluating the dependency between independent variable called PERS and PERS_MRU, and dependent variable called PC and ACCESS_PERS_MRU. [2]

To this purpose we have use the statistical analysis software SPSS as well as Excel graphs and tables. Thus the method used in data processing where the Excel tools, and the SPSS tools (multiple linear regression and curve estimation of regression lines).

The questionnaire was built on the basis of a study made by professors and specialist of Auburn University of Alabama, study oriented on identifying the differences existing between the use of the information systems in the human resource management

in the public and private sector. In our case the questionnaire was extended over five business functions of a company, and contains eight general questions and five questions for each business function. [8]

Respondents

We have investigated the main national companies (most important one in coal, metal and salt - natural resources): CNH (National Bituminous Coal Company),CNLO (National Brown Coal Company), MINVEST (National Copper, Gold and Iron Company), SALROM (National Salt Company), and REMIN (National Precious Metal and Non-Ferrous Company).

Table 1. National Companies 2004

CNH	**15,800 employees**
CNLO	16,500 employees
MINVEST	4,700 employees
SALROM	1,550 employees
REMIN	5,200 employees

Results

We used an econometrical model to explain the existing situation and the intensity of the link between the variables studied using the correlation analysis, while the regression analysis is used to estimate the value of a dependent variable taking in account the values of other independent variable, and appraise the degree wherein the effect can be explain by cause.

Then we made a managerial research, through a variety of business functions such as manufacturing, supply chain management, financials, human resources and customer relationship management. In every business function we focus on 4, 5 or 6 important and usually applications. This second study was based only on the 4 biggest companies (CNH,CNLO, Minvest and Salrom) [4]

Table 2. Financial and CRM – SCM business function

Company % implement	CNH	CNLO	MINVEST	SALROM
AFC1	0,62	0,31	0,31	0,23
AFC2	0,62	0,31	0,31	0,23
AEC3	0,54	0,31	0,31	0,23
AFC4	0,00	0,00	0,00	0,00

Company % implement	CNH	CNLO	MINVEST	SALROM
AC1	0,46	0,31	0,31	0,23
AC2	0,15	0,23	0,08	0,15
AC3	0,08	0,00	0,15	0,00
AC4	0,31	0,31	0,00	0,08
AC5	0,08	0,00	0,00	0,00

Financials

AFC1	**Accounts Payable and Receivable (Trial Balance, General Ledgers, Stocks)**
AFC2	Business Transactions, Inventory
AFC3	Fixed Assets
AFC4	Others

Customer Relationship Management & Supply Chain Management

AC1	**Invoices and Bills for Customers and Suppliers**
AC2	Customer Management
AC3	Loans
AC4	Contracts
AC5	Others

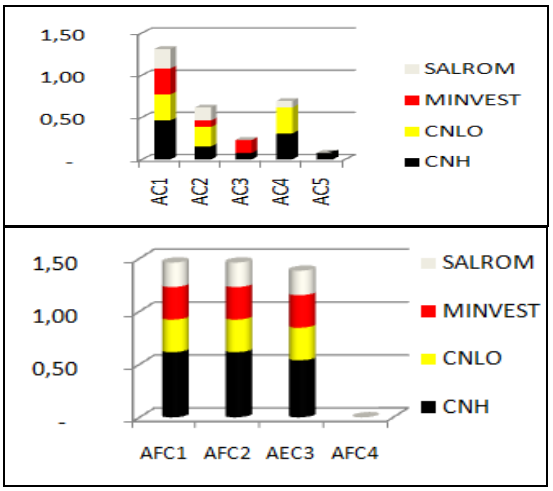


Figure 2. Financial and CRM – SCM business function
for the most important mining companies

Table 3. Manufacturing business function for the most important mining companies

Company % implement	CNH	CNLO	MINVEST	SALROM
AP1	0,62	0,15	0,23	0,15
AP2	0,46	0,08	0,15	0,00
AP3	0,46	0,23	0,23	0,00
AP4	0,46	0,31	0,31	0,23
AP5	0,08	0,15	0,15	0,08
AP6	0,15	0,08	0,00	0,00

Manufacturing (for specific mining activities)
AP1 Pit Exploitation Activities
AP2 Artificial Ventilation Activities
AP3 Electro Mechanical Activities
AP4 Manufacturing Scheduling
AP5 Quality Management Control
AP6 Others

Table 4. Human resource and payroll business function for the most important mining companies

Human Resource (HRM)

ARU1	**Pay Roll, Flow Chart, Job Design**
ARU2	Personal Record Employee
ARU3	Work Book Contract
ARU4	Human Resource Planning and Scheduling
ARU5	Human Resource Training and Learning
ARU6	Others

Payroll (Wage & Remuneration)

AS1	**Work Time Keeping, Time Sheet**
AS2	Grid Wage
AS3	Pay Rise, Weighting
AS4	Job Changes
AS5	Others

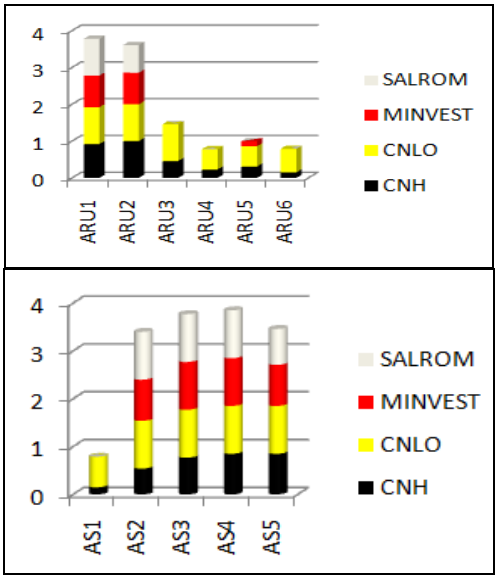
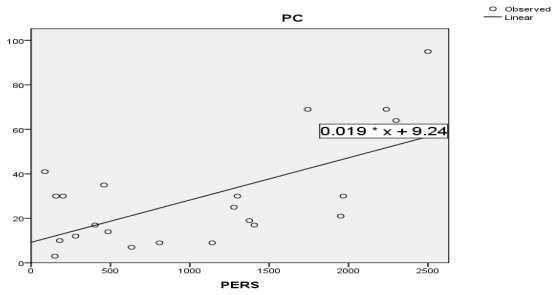


Figure 3. Human resource and payroll business function for the most important mining companies

The research was focused on HRM and as we also predicted the payroll is almost 100 % implemented, but in the general HRM only the the most usual applications are implemented. [4]

For most significant 22 firms (of 40), we have studied the correlation (R) between the independent variable PERS (the personal number of the firms), and the dependent variable PC (the number of personal computers owned by the firms). The following figure shows the evolution of linear regression computed through correlations and square average deviations. [2]



Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
,652	,424	,396	18,778

The independent variable is PERS.

Figure 4. Linear regression analysis between an independent variable called PERS and a dependent variable called PC

The quotient used for the statistical analysis shows a functional dependency between the two variable, in fact the correlation is 0.652 and the adjusted R square is 0.424. We can conclude that a linear correlation exist and the additional statistics parameter are estimates "constant" A=0.019 , and "slope" B=9.24, and the equation is linear. [2]

The research has finally revealed the global IT and specific ERP implementing level in the Romanian natural resource companies as well as some problems that are country-wide valid. As we have supposed the financial business function through using ERP is

almost 100% implemented in every company, the new concepts of CRM and SCM have a very poor implementation (under 30%), the payroll of HRM is almost 100 % implemented, but in the general HRM only the most usual applications are implemented, and there is a relationship between computers and database software as a basis for the ERP software.

The year of 2005 meant a growth of the institutional needs as far as information providing concern. In Romania had already been implemented the tax records system which forced large agencies to migrate to integrated solutions. The availability of ERP solution implementation in the coal companies was low because of the organizational structure and of the aging technique. Another element that leads to that was the permanent perspective of the closing of coalmines and of the reorganization of activity, details that virtually blocked all the investment of the kind.

However even in those given conditions the software instruments, following the natural course of development, was modernized and they have been developed into integrated system (human resources, financial, manufacturing, maintenance), the perspective being that of a dedicated ERP integration for the mining activity.

4. Research over the use of SIVECO ERP and BI software in Romanian 2010 organizations

Methodology

Subsequent in 2010 we have made a second study that set sights on Romanian organizations which implemented a SIVECO ERP and BI software, and data were collected through 13 representative organizations. The instruments used for collecting data were a quantitative questionnaire, an qualitative one and an interview. The research based on the quantitative questionnaire was structured on 27 questions focused on hardware and software endowment (8 questions), implementation of the ERP business software for five business function such as manufacturing, SCM, financial, HRM and CRM (6 questions), other 6 questions were dedicated only to Human Resource Management function and the last 7 questions were dedicated to BI management methods such as Dashboard, Query and Reporting, Data Mining, Score Cards, Data Warehouse, Data Marts, Master Data. [5]

We have analyzed the level of implementing of ERP applications in the functions of the enterprise through SIVECO Applications (SA), and that the implementation of analytical and managerial decision tools through SIVECO Business Analyzer (SBA). We found out that only the dimension of the organization and the number of installed computers are of equal average according to the type of property. There is also a good link between the above mentioned characteristics. One the other hand, concerning the role played by the ERP applications, in the private sector, considered by us more performing, their isn't a strong link between dimension and the role of the ERP applications, although the correlate coefficient is good. When using advanced methods, of BI type, and analyzing their effect on organizations management the situation is discouraging as there is no good connection even in the private sector, but on the other hand there is an strong link between dimension and the implementation of the ERP an BI mix in private organizations. [3]

Also we have concluded that the increasing of average clear profit is equal to the type of property. Regarding the link between the degree of implementation of ERP applications on the functions of an organization, and the effect induced by the increase in profit in these organizations have noted that there is a good link.

Respondents

Even data were collected only from 14 organizations, these are representative for the 2010 Romanian economy, because in

this economical moment Romania has only 5,000 companies that need an ERP and a BI software instrument as a advanced management method. So we have only 2,000 big companies having more than 250 employees which can afford to implement a SAP, Oracle or SIVECO ERP software. But these 2,000 companies generate incomes two times higher than the other 10,000 SMB, and equal those of the 500,000 small Romanian companies, that have under 50 employees. From these 2,000 big organizations most of them are branches from trans-national companies, and have mostly implemented ERP existing in their main organization, usually SAP or Oracle. So, are likely to be investigated public organizations and private Romanian capital organizations. These two categories have a hundred percent Romanian management, and had to optimize it. [5] [7]

Results

Research Hypothesis

H_{01} The number of employees in an organization influences the role of the ERP applications within the respective organizations. The organization dimension is directly connected with the role of the ERP applications within the respective organization.

H_{02} The implementation of the ERP applications in all the organizations departments leads to the transformation of IT into a strategic organization resource.

Testing the Hypothesis

For H_{01}

We used regression analysis, as a statistical method to evaluate the relation between one independent variable (personal - size of organization) and another continuous dependent variable (ERP_BI given to the ERP and BI level of implementation). With this analysis tool we have performed a linear regression analysis using the method of the least square in order to plot a line by a set of observations. Thus we have perform the analysis of the dependence and we have appreciated the extent to which the independent variable influence the dependent. With linear regression we output the regression coefficients necessary to predict one variable ERP_BI from the other personal. The model has been confirmed to be valid because the F test value were 49,35, with significant sig. <0,05 (0,02). The regression coefficient R=0,980 shows a very strong link between the variable ERP_BI given to the ERP and BI level of implementation and the independent variable personal showing the size of the organization, for the private sector. The model explains 96,1% from the total variation of the variable personal (R^2= 0,961). The rest of 3,9% is influenced by other residual factors not included in the model.

In conclusion hypothesis H_{01} has been confirmed.

But in BI methods we found a weak link (R=0,167) and also for the private sector we found R=0593<063. This regression coefficient R=0,593 shows an intermediate link in these case. [5]

Table 5. Linear regression analysis between an independent variable called personal and a dependent variable called ERP_BI for private cases (proprietate=1)

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,172	1	,172	49,352	,020[a]
	Residual	,007	2	,003		
	Total	,179	3			

a. Predictors: (Constant), personal

b. Dependent Variable: ERP_BI

c. Selecting only cases for which proprietate = 1

Table 6. Linear regression analysis between an independent variable called personal and a dependent variable called BI for private cases (proprietate=1)

Model Summary

Model	R proprietate = 1 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,593[a]	,352	,028	,36973

a. Predictors: (Constant), personal

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,148	1	,148	1,086	,407[a]
	Residual	,273	2	,137		
	Total	,422	3			

a. Predictors: (Constant), personal

b. Dependent Variable: BI

c. Selecting only cases for which proprietate = 1

For H_{02}

We used the effects induced by ERP implementation in all the organizations department through the clear profit. In these research we have focused over eight organizations. We used regression analysis, as a statistical method to evaluate the relation between one independent variable (the ERP level of implementation in the business department of the organization) and another continuous dependent variable (clear profit of the organization influenced by the ERP implementation). The model has been confirmed to be valid because the F test value were 6,843, with significant sig. <0.05 (0,04). The regression coefficient R=0,73 shows a functional dependency between the two variable, between the variable PN_efect showing the clear profit of the organization influenced by the ERP implementation in the years after, and the independent variable ERP_Mediu given to the ERP level of implementation in the business function of the company. In fact the correlation is 0,73 and the adjusted R square is 0,53. So the model explains only 53 % from the total variation of the variable personal (R^2= 0,53). The rest of 47 % is influenced by other residual factors not included in the model.[5]

Table 7. Linear regression analysis between an independent variable called ERP_Mediu and a dependent variable called PN_efect

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,730[a]	,533	,455	,76035

a. Predictors: (Constant), ERP_Mediu

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,956	1	3,956	6,843	,040[a]
	Residual	3,469	6	,578		
	Total	7,425	7			

a. Predictors: (Constant), ERP_Mediu

b. Dependent Variable: PN_efect

As a general conclusion we would say that public organizations successfully implement ERP applications and the private one are already focused on the implementation of BI applications. In this context the basic concepts of computer system provides the technical and behaviour-al foundation that helps applications such as ERP and decision-making process for building a company's strategic advantage over competitors. IT systems is reflected by the structure and IT hardware equipment and base software. Using the IT systems and their applications in operational management, can develop a competitive advantage for the organization at local, national and up to forms of electronic commerce and information exchange level.

In Jiu Valley as it was predicted, since previous years, the moment of the profound reorganization of the mining industry in Romania, are about to take place in 2012-2018. So in the 2012 year, almost 50% of the units of extractive industry in operation, are about to be closed. Taking that into account, the evolution of software products will remain at the same very slow rate, but with the accomplishment of all the requirements imposed by the needs of performance and by the needs of the state. It remains a challenge to the management, to combine the closing activity with the development of the newer activity, maybe un welcomed but imposed fact.

It has been announced that the viable part of the CNH to be integrated in an energetic complex. This energetic giant will sum the

coal production capacity and two capacities of electric energy production. A heterogeneous system will result, a system that will have to function then to perform. Because the economic crisis that began in 2009 showed that on the market only those efficient, which keep their expenses under control can survive, it goes without saying that in our case, the future energetic complex, will be forced to do the same. The possibilities are limited or it seems to be that way for the moment. From the three entities, which will be part of the whole, one has a SIVECO ERP and the other two use more or less developed software products. Thus, or the experience of SIVECO will be extended, or another appropriate software product for the new created company will be implemented.

We conclude that no matter which will be the choice of the top management of the energetic complex, that can only be only in the sense of the optimization and control.

Conclusions

We have chosen this research topic due to the fact that under the present social and economic circumstances the conceptualization and use of certain advanced management methods represent one of the main coordinates owing to which management asserts itself as a fundamental element of organizational culture. The period we face, places organizations in an unpredictable and instable environment; the solution of coping with such circumstances can only be provided by a performing management. Meanwhile, IT&C definitely influences the existing organizations, and management methods become decisive for the organization's evolution. Consequently, we consider as necessary a radiography of Romanian society regarding the implementation of the advanced management methods based upon information technology capable of offering both an overall view of the implementation level of these methods within Romanian organizations and a prefigure of what it is going to be done in Romanian society at the level of modernizing the organizations' management.

References

[1] Drucker P.F., "The practice of Management", *Harper Paperbacks, New York*, 1954.

[2]Edelhauser E., Ionică A., "Enterprise Resource Planning through Structural Founds in the Romanian Economy", *Proceedings of 6th International Conference Managment Technological Changes,* 3-5 September 2009, Greece, pp. 485-488, IDS Number BMO93

[3]Edelhauser E., Ionica A., "A Business Intelligence Software Made in Romania, a Solution for Romanian Companies During the Economic Crisis", *Lectures on Modeling and Simulation 2010, Advances in Modelling and Analysis A Journal,* 1258-5769, Publisher AMSE Press, Vol. 11, Issue 1, pp. 69-78

[4]Edelhauser E., Lupu-Dima L., "Enterprise Resource Planning used in Romanian Mining Companies", *Revista Minelor,* No. 4, Infomin Publishing House Deva, 2010

[5]Edelhauser E., Ionică A., Lupu C., "Enterprise Resource Planning and Business Intelligence, Advanced Management Methods for Romanian Companies", *Proceedings of the 1st Management Conference: Twenty Years After, How Management Theory Works*, 16-18 September 2010, Technical University of Cluj Napoca, Todesco Publishing House, pp. 63-72

[6]Emblemsvag J., Bras B., "Process Thinking - A New Paradigm for Science and Engineering", *Futures,* Vol. 32, No. 7, 2000, pp. 635 – 654, 2000.

[7] Hurbean L., Danaiata D., Hurbean C., "Enterprise Applications Implementation in Romanian SME's", 2008.

[8] Sharma R.R.K., Sharma A., "ERP implementation in defenders and its

influence on manager's job: a case study.(Enterprise resource planning)", *International Journal of Business Research*, March 1, 2007.

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