INTELLECTUAL CAPITAL COMPONENTS AS DRIVERS OF ROMANIAN SMES PERFORMANCE

Bogdan-Vasile ILEANU[1]
PhD Assistant Professor
Bucharest University of Economic Studies, Department of Statistics and Econometrics

E-mail: bogdan.ileanu@csie.ase.ro

Alexandru ISAIC-MANIU[2]
PhD Professor
Bucharest University of Economic Studies

E-mail: alex.maniu@gmail.com

Claudiu HERTELIU[3]
PhD Professor
Bucharest University of Economic Studies

E-mail: claudiu.herteliu@gmail.com

Tudorel ANDREI[4]
PhD Professor
Bucharest University of Economic Studies

E-mail: andreitudorel@yahoo.com

Abstract:

The paper studies the possibility of evaluation of the intellectual capital in Science, Information and Technology domain from Romania. The analysis is made starting from a base sample of 1400 SMEs. Quantitative methods such as Structural Equation Modelling method are used to determine the group of latent factors used to evaluate the IC components of SME. Due to the particularities of Romanian SMEs and of the indicators used, some findings such as reference age of manager, the role of strong internal organization and structural capital are revealing for the first time some aspects relating the intangible assets and their potential resource for companies' performance. The results are similar to some particular studies made on SMEs from countries with economies in transition.

Key words: Structural Equation Modelling, SMEs, Intellectual Capital, Romania, Science, Technology, Human Capital

Introduction

The whole world is changing in all its forms: nature, human, economy, etc. As a result of the resource reduction there should be find other resources and to use more efficient than those we already have.

The notions of production have had to be revised. Each company has now a valuable but not entire known resource, the intellectual capital. This resource must be well man-

aged and exploited in order to succeed. In order to develop and benefit from Intellectual capital of a company, information must be allowed to circulate. Nowadays it is important that enterprises make access to knowledge easier for their employees, and they enrich the structure of the knowledge and share with partners.

One of the most important long-term goals of European Union is to become the most dynamic and competitive knowledge-based economy goals based also on Small and medium-sized enterprises which are well-known considered the engine of the economies.

It is also important to point that national (Feleaga, L. et al, 2012) and international studies (Storey, J. et al, 2009) claim that 75 to 90% of international market capitalization is attributable to intangible assets. Since the intellectual capital is already a major component of macro and micro economic growth and the economy based on knowledge gives rise to a new type of business, new workers and new professions why this model which have the core based on Intellectual capital(IC) and which function in many countries, shouldn't be followed by Romanian's companies too. To enhance the role of IC in company's management strategies, a brief description of the role of IC and its development is presented in the next paragraph.

I. Literature review

I.1. About intellectual capital

There are different intellectual capital definitions; most of them describe it as an integrated term for intangible factors of organisation work. For example, Annie Brooking defines intellectual capital as the "combined intangible assets which enable the company to function" (Brooking, 1996). A wider determination is given by N. Bontis— "the hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources for wealth creation. These hidden values are the roots for nourishment and the cultivation of future wellbeing" (Bontis, 2004).

The intellectual capital can also be analysed as a mixture of human capital concept and knowledge management ideas: it integrates together knowledge and their parent — individual. Such vision underlines the intellectual capital model presented by Edvinsson and Malone (1997): according to them the intellectual capital is subdivided into the human capital ("the capabilities of the company's employees necessary to provide solutions to customers, to innovate and to renew") and structural capital ("includes the quality and reach of information technology systems, company images, databases, organizational concept and documentation"), and later includes the relational and organizational capital as specificity of external and internal interaction of the company employees.

I.2. Why measure intellectual capital?

Through systematic literature review we were able to identify the main reasons for measuring intellectual capital. These are: to help organizations to formulate their strategy; (2) to assess strategy execution; (3) to assist in diversification and expansion of decisions; (4) to use these as a complementary information and or measure for compensation; and (5) to communicate this key measures to external stakeholders. (Marr, B, 2003). Intellectual capital measure is also useful when the evaluation of company is made. The stakeholders are interested to invest or rather to buy the entire company if they know the values of the most important intangible asset. In many cases a hierarchy between departments, geo-

graphical subsidiaries or even between companies or countries is needed. As many stakeholders want to evaluate the IC, a lot of methods where developed to achieve this goal. At macro-level we think that the achievement of a National Intellectual Capital Index (NICI), as Bontis (2004) named it, will be also helpful to complete relevance of Human Development Index and to establish and maybe control the corruption and shadow economy.

Due to its major importance a lot of methods were developed during years. In the following paragraph we mention the most cited methods in the related literature.

I.3. Brief review of Principal Methods used to measure Intellectual Capital

The methods of measuring intellectual capital started from the micro level analysis for more than 30 years. The most important methods found in literature in the last 25 years, considered also as reference methods, are: The invisible Balance Sheet by Sveiby developpend in 1989, Balance Score Card developped by Kaplan and Norton in 1992, Intangible Asset Monitor, by Sveiby in 1994, Skandia Navigator, by Edvinsson and Malone, 1997, IC-Index, Roos, Roos, Dragonetti & Edvinsson in 1997, Intellectus model, by Sanchez in 2002, EVVICAE by McCutcheon, 2008. Starting from these basic methods many case studies for different regions and countries or for different domains of economic activities can be found.

During the time there were developed also different methods of regional or national intellectual capital measurement. Among them the most well-known are the National Intellectual Capital Index by Nick Bontis, based on Edvinsson's model, Intellectual Capital of Nations by Amidon D.M., and the Intellectual Capital Monitor by Andriessen and Stam which integrates the classic intellectual capital model from "The Intangible Assets Monitor" by Sveiby (1997).

An important regional approach was developed by Schiuma, Lerro and Carlucci in 2008. This method, named RICI, takes into account four perspectives: hardware, Netware, wetware, software.

In the particular case of enterprises, few important research initiatives rather methodologies of measure than methods of measure in the true sense of the word are: 'Wissensbilanz", made in Germany (Edvinsson, L., Kivikas, M., 2007), Danish Guidelines or MERITUM project. These are the pioneers in establishing a set of steps and indicators which should be followed to measure IC of a firm.

Starting of these ideas we try to propose an adapted model for measuring the IC of Romanian SMEs. Before presenting our studies we are briefing few case-studies of SMEs-IC measure met in the international literature.

II. Methodology and Research Study

II.1. Proposed model of study

As it is normal, in every study there are some particularities regarding the evidence or relevance of a particular component of the intellectual capital asset, but during the years many researchers agreed (Stewart, 1999, Sveiby & Buck, 2001, Bontis, 2004, Mertins, K. & all, 2009, Martin, C. et all, 2011, etc.) that the Intellectual Capital of a company could be expressed as a sum of multiple components such as: Human Capital, Organizational Capital (Internal Component) and Relational Capital (External component). These components combined with the financial power of the company are the drivers of the company's performance and of the economy in general.

In Romania, in the case of Science, Technology and Informatics domains, we consider that the hard core of Intellectual Capital is given by human and organizational components, as we previous showed (Ileanu & all, 2011). Similar results, where relational capital has a lower influence on the IC formation than other components, were obtained by Halim, S. (2010) in a study made on the German and few other European countries' SMEs, or by Martin de Castro and Lopez Saez (2008) in a study made on 49 Spanish companies from IT domain, etc.

Since the relational component has a lower influence as some studies showed and we were not able to measure indicators for this component of IC we tested for now the relevance of some indicators and their effects on the main components of IC which could be indirect measured. Before the presentation of the model we briefly present in the next paragraph the data source of the research

II.2. Sample and data preparation

The applied research is done on a representative sample of 1400 small and medium enterprises (SME). Data collection was made during 2010, using face-to-face method by field-work interviewers. All the respondents were specialists in HR. The sample is cross stratified by number of employees, NCAE (domain activity) and regions. Economic theory and practice recommend the analysis within a single domain because of the large heterogeneity of the factors and results. As a result, we took from the base sample only the companies from the Scientific, Information and Technical Activities (SCIT) domains, considering that these are the most appropriate/relevant domains in measuring the intellectual capital. After the data collection, we have cleaned the database by eliminating the cases with many multiple missing answers. In this case the final sample is formed by 162 SMEs from the SCIT domains. The structure of the sample after the data cleaning is the following: 70% micro-enterprises(less than 10 employees) 20% small enterprises (10-49 employees), 10% medium enterprises (over 49 employees).

Taking into account that methodology we need a large number of observations for the SEM, we used two methods for data imputations instead of deleting cases in those cases where there were not multiple variables with missing values on the same case. For the continuous variables we used the mean value method of imputation and the mode value for imputation method for the categorical variables.

II.3. Description of the variables

The variables used in our study are lying on different ranges, are becoming from different patterns, have distinct units of measure and are measured on different scales. For these reasons they were standardized. The classical method of standardization was applied in this case: $z = \frac{X - Mean(X)}{Standard\ deviation\ (X)} \sim N(0,1)$, where X= the initial variable and Z the transformed(standardized) variable.

In order to make the analysis clearer we kept the letter "z" in front of the variable to reveal that the used variable is standardized.

zangtr represent the percentage of employees in the company which benefit of training during the last year. Its values are lying between zero and one hundred percent. **zwage** is a categorical variable and represent the changes on the employees' salary during the last year comparative to the previous one. It is measured on a scale of nine points. **zperf** represent the performance of the enterprise in the last year compared to the previous year, measured on a

scale of six points describing the performances from very low to very high; **zinvinov** is measuring the percentage of the total investment of the enterprise for developing new products or services, this variable is measured on a scale with six points and has values from zero to over seventy five percent; z**angexp,** defines the percentage of employees which have more than fifteen years of experience in the principal domain of activity of the enterprise. It has values from 0 to 100% unconstrained by predefined classes; **ztrday**, counts the average number of days of training of employees during the last year. This variable is measured on a scale of four points, it cannot be assumed as continuous; **zangsex2**, represents the square of the variable percentage of men employees; z**angedu**, represent the percentage of employees which have high level of education; **zcanewp** is a continuous variable which measures the percentage from turnover gained from new products developed in the last year; **zvrstman2** measures the square of age of the manager, it is assumed as continuous variable and it has a mean equal with 40. **Zcatr** represents a continuous variable calculated as a report between the amount of money allocated for employees training and the turnover of the company. As endogenous result variable we took a six-scaled variable named **zperf**, which measures the performance of an analysed company.

II.4 Description of the quantitative method used in analysis.

Many quantitative methods were used to evaluate the IC of a company. The most frequent methods used in this domain are: Data Envelopment Analysis (Campisi, D, 2008, Matei, M, 2010, Yang, C.,2010) Principal Component Analysis (Ileanu,B., 2010, Yang, C, 2010), Structural Equation Models (SEM) with latent variables (Bontis, 2004, Martinez-Torres,M.R., 2006, Carrington, D. and Tayles, M, 2011, etc). We decided to use SEM because is the most appropriate method in our case. Some of the reasons are:

SEM is a better method because it can show the relation between variables as they are in the reality.

SEM approach doesn't alter the practical significance of the variable as PCA does it. DEA require in general relevant inputs or outputs and searches an efficient frontier and efficient companies. In our case it is possible that the companies are not efficient even if they invest in Intellectual Capital.

SEM is defined as multiple equations model in which the response variable in one regression equation can appear as an explanatory variable in other equation SEM has the ability to test the specified models by economic theory including unobservable (latent) variables. The latent variables can be measured indirectly through their effects (indicators), or sometimes through their observable causes.

SEM can be modelled using two components: structural equation model and the measurement model.

The structural Equation model:

This model describes the relations between the exogenous and endogenous latent variables. A formal representation is the following:

$\eta_y = a + B\eta_y + \Gamma\eta_x + \varepsilon$, where η_y is vector of endogenous latent variables (given by IC-variable) in our case), η_x is the vector of exogenous latent variables and ε the vector of residual components, assumed as white noises.

The measurement model describes the relations between the exogenous and endogenous observed or latent variables. A formal representation could be:

$$y = \alpha + L_y\eta_y + w$$
$$x = \beta + L_x\eta_x + u$$

, where y is a vector of endogenous observed variables, and x vector of exogenous observed variables, *u* and *w* are error vectors having the same properties like ε

Estimation.

According to Schumacker R.E., and Lomax G.R (2010, p.217) when the observed variables are from small or medium samples, normal distributed, with no many missing values, Maximum Likelihood(ML) and Generalized Least Square(GLS) are recommended. In case of large samples with non-normality Weighted Least Square (WLS) is recommended. According to Kline (2011, p.176) in cases of severely non-normality the GLS as part of WLS family methods can be used.

In order to apply the most suitable method for parameters estimation we have verified the normality distribution of the variables using Jarque–Bera test (Jarque, C.M, Bera, A.K, 1980). Principal descriptive characteristics of the variables are present below in the Table 1.

Table 1. Descriptive characteristics of the sample variables

	ZINVINOV	ZVRSTMAN	ZANGTR	ZCATR	ZTRDAY	ZWAGE	ZANGEDU	ZANGEXP	ZCANEWP
Mean	0	0	0	0	0	0	0	0	0
Median	-0.27011	-0.06818	-0.64238	-0.45085	-0.81549	-0.70711	0.56017	0.01194	-0.32673
Maximum	2.19508	2.25217	1.62594	5.61669	2.07741	2.47487	0.828100	3.15430	1.99988
Minimum	-0.88640	-1.83164	-0.89442	-0.52247	-0.81549	-0.70710	-1.851200	-0.87437	-0.90838
Std. Dev.	1	1	1	1	1	1	1	1	1
Skewness	0.82844	0.27045	0.75887	3.23927	0.94836	1.06229	-0.722280	1.71194	0.67474
Kurtosis	2.42056	2.07226	1.83010	14.3990	2.62066	2.56200	1.868188	5.84658	2.07261
Jarque-Bera (JB)	20.7970	7.78470	24.7876	1160.38	25.2547	31.7636	22.73233	133.825	18.09771
Probability (JB)	**0.00003**	**0.02039**	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.000012**	**0.000000**	**0.000118**
Observations	162	162	162	162	162	162	162	162	162

In the present case, the most appropriate estimation method for this system is the GLS method, taking into account that we have a medium sized sample, some continuous and ordinal but assumed as continuous variables and non-normal distributed (Probability of JB-Test is less than critical level of significance).

The estimation using GLS implies the minimization of the discrepancy function $G(\theta) = G(S;\Sigma)$ where S =the sample covariance of the observed variables and Σ is the theoretical covariance; The general form of the minimization function is:

$$G(\theta) = (s - f(\theta)^t)W(s - f(\theta))$$

where, **s** = vector containing the variances and co-variances of the observed variables**;**

$f(\theta)$ = a specified function of an unknown parameter, in most of the cases this function is linear

W = weight matrix which corresponds in the above function to the estimation method chosen. **W** is chosen to minimize **G**, and G(N-1) gives the fitting function, in most

cases a χ^2 distributed statistic. The performance of the χ^2 is affected by sample size, error distribution, factor distribution, and the assumption that factors and errors are independent (Ullman, 2003).

The function G in GLS case is equivalent with

$G_{GLS} = \frac{1}{2} tr\{[S - \sum(\theta)]W^{-1}\}^2$. According to Bollen (1989) in most of the cases, $W = S^{-1}$ is a matrix which determines consistent estimators.

In order to achieve significant parameters and a best fit we imposed some constraints taking into account some findings met in the international literature.

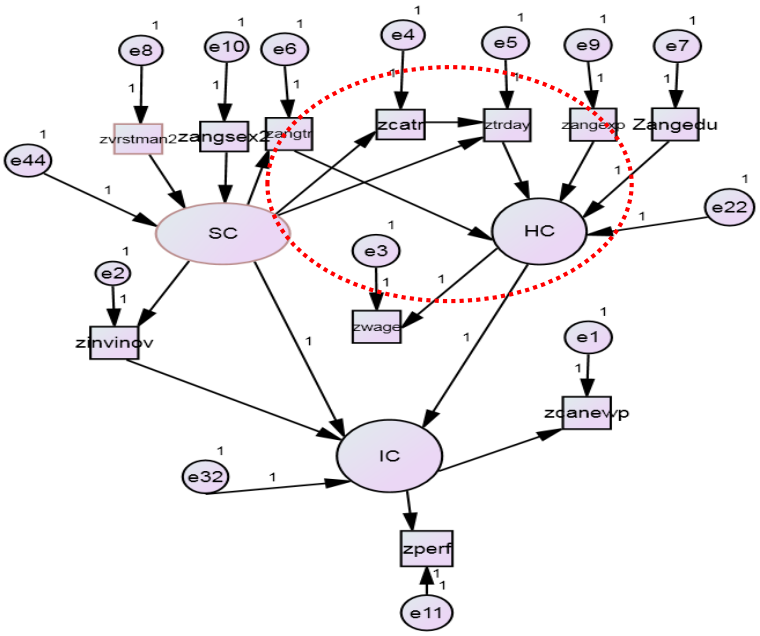
For example we imposed that IC is the simple sum of HC and SC. We also imposed that education strongly influence human capital and finally we imposed the fact that human capital increase is seen in the increase in wages, hypothesis empirical tested before by Ileanu and Tanasoiu (2008).

The results of estimation, made with specific software (AMOS) are presented in the next paragraph.

III. Results

Using the SPSS module AMOS we have made the graphical representation of the relations between the variables as the management theory and previous empirical studies sustain its. This representation could be seen in the figure presented below. The variables e_1, e_2, …, e_{44} represent standardized normal white noises.

Figure 1 The Model of IC analysis



After the estimation using SEM in AMOS we achieved the values of the standardized coefficients of the models included in the system.

Most of the coefficients are significant at levels around 0.05 as it can be seen in the table below.

Table 2. Estimated values and significance tests of the SEM model

			Estimate	α(risk)	Standardized coefficients
SC	<---	zvrstman2	-,570	,014	-,487
SC	<---	zangsex2	-,217	,242	-,185
zcatr	<---	SC	,191	,050	,218
zangtr	<---	SC	,311	,003	,343
ztrday	<---	SC	,298	,003	,316
ztrday	<---	zcatr	,236	***	,219
HC	<---	zangexp	,138	,042	,097
HC	<---	zangtr	,031	,589	,023
HC	<---	ztrday	,150	,004	,115
HC	<---	Zangedu	1,000		,699
zinvinov	<---	SC	,283	,004	,315
IC	<---	SC	1,000		,441
IC	<---	HC	1,000		,539
IC	<---	zinvinov	1,161	***	,461
zperf	<---	IC	,016	,042	,042
zcanewp	<---	IC	,207	***	,481
zwage	<---	HC	1,000		

*Note: *** estimated coefficient is significant at level lower than 1%*

IV. Findings

Most of the coefficients are positive and are showing the direct contribution of the factors on the growth of the enterprise's Intellectual Capital. The human component is based on training investment and the effects of investment in trainings are seen by the increase of training days number.

An increase by 1 % of the percentage allocated for employees training will have positive effects (increase by 0,236 %) in the average number of days of training. An increase of the average number of days of training will generate an increase of the human capital. Here can also be observed the positive and indirect effect given by the percentage of turnover (zcatr) allocated for training on the human component.

Human capital in the case of Romanian SMEs from SCIT domain is based on education, training allocation funds and effort of training. In these evidences there are some hidden factors which contribute to the increase of HC even if they are not represented in the current model. Some examples could be: the capacity of trainers, the abilities of trainers, and the structure by age of trained persons, and job satisfaction for about some studies are showing that motivator factors are influencing employee level of satisfaction, and then the

employee job satisfaction contributes to employee engagement (Akinbobola, 2011, Brown,1996) and finally SC and HC development.

The red circle marks the connection between SC component and factors of HC. In the vision of Bontis (2001) SC "deals with the mechanisms and structures of the organization that can help support employees in their quest for optimum intellectual performance and therefore overall business performance. An individual can have a high level of intellect, but if the organization has poor systems and procedures by which to track his or her actions, the overall intellectual capital will not reach its fullest potential". In conclusion, good strategies and good abilities of the decisional factors will determine efficient allocation of funds and the effects will be seen in the increase of HC, IC and finally on the increase of company performances, outputs.

The share of trained employees is not significant (the risk=0,589>0,05). This thing takes into account that the SCIT activities in Romania are relatively recent formed. Most of employees are young and above average skilled due to the nature of activity and its requirements. Also a larger offer than demand of labor force in this domain is influencing the structure and qualification of the employees in the current domains. Most of them are working in direct production so the percentage of trained person should not count. In order to have a significant influence, this problem should be treated using a binary variable for a larger group. For example could be obtained different results if this variable is categorized as follows: "trained most of them or all vs. and only few or non-of them are trained".

The structural capital is influenced by employees distribution by gender and by the age=experience of the manager. Since the model is estimated using standardized variables and the relationships between SC and manager's age and between SC and the structure by gender are parabolic with negative quotients, the maximum of SC is reached when the initial variables are equal with their sample means. In this case the sample mean is given by the 56.6% of male proportion. Gender structure, used as human capital component was also found as significant in other studies, eg. Li J. et al (2008).

According to descriptive statistics presented in the **Table** 1 combined with the regression results from Table 2, the efficiency of the SC is achieved when the mean age is around 40, and when the distribution by gender is equilibrated (around 50%-50%). These results are normal are proving that the stability and efficiency is given by equilibrium and experience. Since we deal with SMEs, most of them being close to micro-enterprises, and where the highest importance on the company future is given by the manager' decision, the age of 40 is the most appropriate to increase the organizational degree and to improve in the end the HC and Intellectual capital.

The results of this study sustain the hypothesis regarding the theory that the performance of enterprises is directly influenced by IC. In the Table 2, the coefficient which relates IC and companies performances is positive and its standardized value shows that for an increase of IC by 1% the enterprise performance will rise by 0,04%. This weak association reveals also that the increase of IC is not time synchronized with performance. The increase of company's performance could be seen in few years. Another element which should be noted is that allocated funds for innovation have a strong influence on the intellectual capital development. As the results show it an increase of the funds for innovation and research by 1% will determine an increase of the IC by 0, 46%.

Conclusions and future researches

Providing the importance and contributions of intangible assets on the companies' performances, using local empirical studies and many international similar examples, this study gives strengths and trust among the SME leaders in understanding, discovering and driving the intangible assets that are important value for their own businesses. Since active SMEs represent a driver in sustainable regional development and in particular for development poles (Davidescu & Strat, 2014), perhaps the key factor of these results is represented by the way of how we measure and exploit the SMEs IC.

Furthermore discovering and correctly driving the SMEs IC Such awareness is essential in particular in all countries, where SMEs make up a significant proportion of business and employment.

After the experiment regarding the evaluation of IC, at least in the case of SMEs from Romania it is necessarily to verify methodology on larger samples. Due to high heterogeneity degree it is recommended to take into account the particularities of economic domain.

In the future, this study should be improved by including more indicators especially those that could reveal the relational factor. This study could be also applied on all major domains from Romanian economy to analyse the differences and particularities found in each branch

It is necessary to improve the model on a panel data set of companies in order to facilitate the asynchronous analysis due to distance in time between efforts and effects. However, even if the model has enough possibilities of development, it can be considered a pilot study, or a start point on the complex process of IC measurement and evaluation, being also the first detailed quantitative study applied on SMEs.

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[1] Bogdan-Vasile Ileanu is Assistant Professor of Statistics and Econometrics in The Academy of Economic Studies Bucharest, Department of Statistics and Econometrics. He earned his PhD degree in September 2012. His research objectives are connected with human and intellectual capital measure, regional analysis, statistical analysis, labour economics, etc. Bogdan is author or co-author of more than 20 studies presented at important international conferences or published in journals.

[2] Alexandru Isaic-Maniu is Professor in the Academy of Economic Studies Bucharest, Department of Statistics and Econometrics. In a long career of more than 35 years he published more than 300 articles or studies with national and international relevance. Also Professor Isaic-Maniu is author or co-author of more than 10 books and member of more than 20 research projects. His main domains of interest are: Statistics, Econometrics, Human Capital and Financial Evaluation etc.

[3] Claudiu Herteliu currently holds the position of professor within the Chair of Statistics and Econometrics, at the Bucharest Academy of Economic Studies. In 2007, he earned his PhD degree at the same university. His main areas of academic interest are: theoretical and macroeconomic statistics, religion statistics, education statistics, and econometrics. He attended many scientific conferences both in Romania and abroad (USA, Germany, Holland, France, Italy, Hungary, etc.) He published (as co-author and single author) over 20 articles in scientific journals, and contributed to a number of four books published in Romania.

[4] Tudorel Andrei is Professor of Econometrics at the Department of Statistics and Econometrics of the Bucharest Academy of Economic Studies, Romania. He is specialized in economic statistics and structural modelling. During 2008 he was invited Professor at the Dauphine University of Paris, France, where he presented his results on the quantitative analysis of the corruption in the public sector in Romania. He has published more than 40 scientific papers in national an international reviews like Higher Education, The International Journal of Economic Development, Economic Computation and Economic Cybernetics Studies and Research, etc. He was Fellowship Researcher to NATO, Brussels, during 2000–2002 working in the field of quantitative models for the cost of integration in NATO for aspiring countries. He participated with scientific papers in more than 20 international conferences in U.S.A., France, Denmark, Italy, Romania, etc. He has been involved in Public Administration Reform projects in Romania and acted as Director of the Central Unit for Public Administration Reform in the Romanian Government, during 2001