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FACTORS OF THE EARNING FUNCTIONS AND THEIR INFLUENCE ON THE INTELLECTUAL CAPITAL OF AN ORGANIZATION

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Abstract: *This paper tries to consider some earning function as "start point" for the construction of indicators for intellectual capital measure. The analyze combines concepts from Mincer's and Becker theories and intellectual capital definitions currently in use. The correlation, significance and relation between elements are shown using three econometric models.*

Key words: *Intellectual capital; human capital; econometric model; earning function; education; experience; IT*

A. Introduction

A1. Intellectual Capital sense and components.

Intellectual capital was considered in many studies as a no financial value which drives the value of an enterprise.

There are two approaches to define intellectual capital. The first one considers the intellectual capital the sum of three dimensions: **human capital**, structural capital and relational capital.

Many definitions were considered in the analysis of term. For example:

Tom Stewart, in June 1991, article Brain Power - How Intellectual Capital Is Becoming America's Most Valuable Asset, brings IC firmly on to the management agenda.

He defines IC in his article as: „the sum of everything everybody in your company knows that gives you a competitive edge in the market place."

Stewart (1994) defined intellectual capital as the total stocks of the collective knowledge, information, technologies, intellectual property rights, experience, organization learning and competence, team communication systems, customer relations, and brands that are able to create values for a firm.

The first use of the term is thus to describe the dynamic effects of **individuals´** intellect. Tom Stewart makes IC the attribute of an **organization.** Leif Edvinsson, Skandia, and Pat Sullivan define it in European Management Journal (1996 vol 14) as: **„Knowledge that can be converted into value".** And in Laurence Prusak´s, Ernst & Young (later IBM Consulting), definition IC becomes even more "packaged". He defines it in Klein & Prusak 1994, Characterizing Intellectual Capital, as: **„Intellectual material that has been formalized, captured and leveraged to produce a higher-valued asset**"

According to Edvinsson and Malone (1997, p. 3), intellectual capital is **„information, knowledge applied to work to create value"**.

Haanes and Lowendahl (1997) claim that the knowledge within an organization exists at both the individual and the organizational level. On the individual level, **intellectual capital includes knowledge, skills and aptitudes. On the organizational level, intellectual capital includes client specific databases, technology, routines, methods, procedures and organizational culture.**

Sveiby (1997, p. 10) defines human capital as "the capacity to act in a wide variety of situations to create both tangible and intangible assets"; structural capital as "patents, concepts, models, and computer and administrative systems"; and relational capital as "relationships with customers and suppliers". The sum of these three elements is Intellectual Capital of the company.

Also, Klein defined, in 1998, intellectual capital as „**knowledge, experiences, expertise and associated soft assets", rather then the physical and financial capital.**

Mouritsen (1998, p. 462) says that intellectual capital **is a matter of „broad organisational knowledge, unique to a firm, which allows it constantly to adapt to changing conditions".**

Bontis, Crossan, and Hulland (2002) noted conceptual confusion between intellectual capital and organizational learning. They state. **Intellectual capital represents „the stock of knowledge that exists in an organization at a particular point in time".** On the other hand, organizational learning broadens the discussion to incorporate behaviors as well as knowledge and provides a means to understand how the stock changes over time" (p. 440).

In the first part of research period regarding Intellectual Capital the attributes like „knowledge, experience, expertise, information, skills and attitudes etc. where attached to Human Capital Term. Later The Human Capital was extended to Intellectual Capital by including some aspects of relation and organizational skills in and between business participants.

The second approach is exemplified by Saint-Onge (1996) and Knight (1999) who defines the basic dimensions of intellectual capital but do not propose indices to measure them. It is not our goal to develop this approach.

A2. Earning Functions

A big part of human capital literature, with two great pioneers, Becker and Mincer, analyze the earnings function fpr the study of the effects of investments. Willis, in 1986, defined the earning function like „any regression of individual wage rates or earnings on a vector of personal, market and environmental variables thought to influence the wage".

Many studies were focused on the function $y = f(s, A, z) + \varepsilon$ where

y represented by income, earning or wage, s is a measuring of school (years completed usually), z is a set of other variables assumed to affect the dependent variable and to be different for each case *i*. The "z" variable could be represented by : years of experience, post school investments, family pattern(parent education), health, satisfaction etc. "u" variable is the measure of residual factors. Residual factors are considered those factors non-mentioned in the model and independent of the z's and also independent of A and s. A is an unobservable variable referring the individual ability, skill of case *i* (used as A_i) .

Other types of functions were proposed by Mincer. For example $y = h(s, x) + \varepsilon$ where:

$s =$ years of schooling

$t =$ age

x represent the experience and it is determined as $t - s - b$ where b is the age of person at first year of school.

In 1974 using as a start point the schooling model $\ln y_x = \beta_0 + \beta_1 s + \varepsilon$. After the development of this model with $y = h(s, x) + \varepsilon$ we had $\ln y_x = \beta_0 + \beta_1 s + \beta_2 x + \beta_3 x^2 + \varepsilon$

Where y_x is the "net earning" after x years of experience. The net earning was calculated as gross earning minus the resources that the person devotes in furthering his jobs skills and acquiring job-related information).

Willis (1985) considers that the model $\ln y_x = \beta_0 + \beta_1 s + \beta_2 x + \beta_3 x^2 + \varepsilon$ "represents a pragmatic method of incorporating some of the major implication of the optimal human capital models into a simple econometric framework, which can be applied to the limited information available data". He offered an alternative of the previous function:

$$\ln y_x = \beta_0 + \beta_1 s + \beta_2 s^2 + \beta_3 x + \beta_4 x^2 + \beta_5 xs + \varepsilon$$

with x and s mentioned before.

Our purpose is to connect these earning function with some variable near *t(age), s(years of schooling)* and *x (experience)* which may also contribute to the evaluation of the intellectual capital.

B. Purpose, data file and variable description

Our purpose is to connect these earning functions with some variable near *t, s* and *x* which may also contribute to the evaluation of the intellectual capital.

Database was published by Open Society Foundation in 2006. The values were all registered from a sample of 1200 respondents with ages between 18 and 80 from Romania and these data have as reference period may 2006. Because of multiple cumulated non-answers (missing or out of range) we decided to delete unavailable cases. Finally the database contains 588 valid cases.

B1. Short description of the variables

Income(in billions lei). In the questionnaire was met the following question: "What was your income in the last month". We had values between 0 and 4,000 lei/month, with an average of 650 lei. Even they have education or other personal skills we had some persons without income. We may consider that those persons were temporarily unemployed and they possibly had no income in the last month.

Education. Information about this variable were obtained analyzing the following question from the research: "Which is your total number of years of education graduated?". The values obtained were between 0 and 22 years of school. There were few persons with low education, less than 2% from total sample. The maximum of 22 years of school graduated represents the "label" for the persons which graduated long PhD courses, perhaps in domain like medicine, engineering and others. The average of numbers of years graduated is close to 12 which has a practical signification. The persons from the sample have in mean a high school graduated.

Experience. This variable was not collected by owner of the study. We determined their values using the following relation. $Experience = Age - Years\,of\ School - 6$. Using this approach we have made some assumption like:

a) The age of beginning school is 6.(In Romania this value is between 6 and 7)

b) We had considered that each person was hired in a short time after he has finished the studies. We "lose" here the experience of the persons who worked during studies. For the future it is recommended to ask if the person worked during the studies and how much. "Age" represents the age in years of the respondent.

Sex. There were selected, using criteria above mentioned, 52% males and 48% females.

Info_TV. This variable was not measured directly in the mentioned study and it was computed using other variables. There were asked in the questionnaire the following questions:

-"How often do you (how interested are you for…) listen radio for education, for personal learning?"

-"How often do you watch TV for education, for personal learning?"

-"How often do read newspapers, magazines for education, for learning?"

The possible answers were represented on a 1 to 5 scale with 1=very less interested, 5 very interested. These qualitative variables are very hard to be exactly quantified in an econometric model. We choused to sum the three variables from the questionnaire with the following signification: The greater is the value of "info_TV" the more informal education (gained from media sources) has the respondent.

Language. In the study was not computed a variable to measure the quality of language knew. The question was: "Which language do you know except your mother tongue?". Each respondent mentioned the languages knew. We summed this answers in a

variable named "language". For example if the respondent mentioned he speaks English, French and Russian then the value for "language" variable was 3.

Health. Self appreciation of the respondents regarding their health. Their answers should be done on a 1 to 4 scale where 1=not at all satisfied and 4 very satisfied.

IT. This is a binary variable which measures computer literacy. The respondents were asked to answer at the following questions: "Do you know to use computer?". Possible answers 1= Yes 2= No. There are some weaknesses of this variable like:

a) it is a raw method to measure the computer literacy
b) it is not standardized because of "self appreciation"
c) should be detailed for the future

Medium. The earnings are strongly influenced by the place of live of the respondent. Most of the persons are working close to their place of live but of course there are exception. Here perhaps it is good to study in a future study the dependence medium, income and other factors by region of development in Romania.

C. Results

Using the database already mentioned we proposed the following models:

I

$$income = a_0 + a_1 INFO\_TV + a_2 IT + a_3 LANGUAGE + a_4 MEDIU + a_5 SEX + a_6 HEALTH + \\ + a_7 EXPERIENCE + a_8 EDUCATION + \varepsilon$$

II

$$\lg(income) = a_0 + a_1 INFO\_TV + a_2 IT + a_3 LANGUAGE + a_4 MEDIU + a_5 SEX + a_6 HEALTH + \\ + a_7 EXPERIENCE + a_8 EDUCATION + \varepsilon$$

III

$$\sqrt{(income)} = a_0 + a_1 INFO\_TV + a_2 IT + a_3 LANGUAGE + a_4 MEDIU + a_5 SEX + a_6 HEALTH + \\ + a_7 EXPERIENCE + a_8 EDUCATION + \varepsilon$$

After a quick econometric analysis we observe that all the coefficients of the factor variables are statistically significant at levels lower than 0,05 with a single exception in the 3rd model.(Please see the Appendixes).

The models include factors from different categories:

- education factors (formal and informal education) like LANGUAGE, INFO_TV and EDUCATION
- discriminant factors like gender (SEX)
- experience like (EXPERIENCE)
- the medium of location (MEDIU)

and one mixed factor IT which referes to computer literacy as we mentioned before. The analysis shows that the income is a complex "mixture" of many factors. Analyzing all the models we can also see that not only a simple linear model describes best the connection between variables.

From all these variables we'll chose to analyze the third model considered as "the best" model according to econometric criteria presented in the following table:

Table 1.

Model	Performance and validity indicators			
	R^2	*F statistic and significance*	*Inofrmation criteria AIC*	largest level of factor coefficients significance α_{max}
I	0,34	37,43 (0,000)	5,86	0,046
II	0,39	42,75 (0,000)	1,58	0,1383
III	0,41	50,62 (0,000)	2,48	0,0579

The third model already described has the following general form

$$\sqrt{(income)} = a_0 + a_1 INFO\_TV + a_2 IT + a_3 LANGUAGE + a_4 MEDIU + a_5 SEX + \\ + a_6 HEALTH + a_7 EXPERIENCE + a_8 EDUCATION$$

after parameters estimation we have the following results:

$$\sqrt{(income)} = 0,144 + 0,043 * INFO\_TV - 0,256 * IT + 0,125 * LANGUAGE + 0,466 * MEDIU + \\ + 0,132 * SEX + 0,198 * HEALTH + 0,011 * EXPERIENCE + 0,123 * EDUCATION$$

In this study we are less interested about strong test about OLS hypotheses. We are mostly interested in coefficients statistical and practical signification, model in ensemble.

The a_0 term which is 0,144 billions lei shows that in mean a person without any qualification, without experience or other knowledge/skills mentioned in the model will receive an income of 144.000 lei (approximately 4 eur./month). In this case if we considered only the persons involved in some activities in the last month we may consider that this income is specific for a peasant which has an income only from their own activity. Could be this category that one which works only few days. Moreover we have to consider that this person is at beginning of work (no experience no school). Practically this category is very isolated and it is represented by a very small number of persons.

The a_1 term, equal with 0,043, allows us to say that an increase of informal education index with 1 unit will increase in mean the income with 0,043 billions lei. This relation is normal. Even if most researcher proved that preferences of the free time spent is dependent of income we may consider that technical information got from specific t.v. programs, book, reviews or other information consist an added value of the human capital in particular and of the intellectual capital of the person and his organization in the extended mode.

Coefficient for ***IT*** factor has a negative value. This value implies that a person without any IT knowledge has in mean an income with 0,256 billions lower than a person with few knowledge. Practically we are in the era of technology and communication and this result mentioned is normal for current state of life. Personal IT literacy competence doesn't not represent only a personal skill. This skill is a base on the whole IT management structure of the company. Many organization invested in IT development and for their employees training. The results were successfully. The productivity grew, the organization progressed the results were seen also in the personal income. As many studies consider IT development

capital as part of Intellectual capital of an organization[2] then every person even if it is client, employee or in other relation becomes a part of this complex system.

Coefficient of ***LANGUAGE*** factor shows also a positive relation. An increase of this Index increase the income of languages owner. This indicator is very important in relational capital side of any organization. Now, when there is no limit in communication possibilities the gaps are done by languages and IT channels. A better trained (as quality and number of qualification) person with languages a better results will be achieved.

Two variable used as discriminate variable are **medium** and **sex**. Gender discrimination was met in all the domains. It looks in our research like in others that women have a lower income than mans have. In our case in mean a mean has an monthly income greater than a women with 0,132 billions lei. This result already knew is an important indicator for Brand Image of an organization. If there is a discrimination with a high gap, this will affect the image of the organization and this implies a lower value of intellectual capital.

The medium variable is also important for the companies. The possibilities to relocate or to give externalization in the rural areas with a goal of cost minimization also contributes to brand expansion, stronger relation etc. As negative thing in general we get less skilled persons from rural area.

Experience, Health and Education are the most important factors of human capital even if his considered as part of intellectual capital or not. Better skilled employees, more experienced and healthier better results will be achieved. The results are seen first in company values and after that in the income value as we can saw in the three models analyzed.

We analyzed also the impact "life satisfaction" but this indicator is strongly correlated with "health satisfaction" and we renounced at it. In general in Romania if a person is healthy than the overall satisfaction (except the influence of income) of that person has a good value.

These factors mentioned are not only the factors of the human capital of a company. Because of multiple connections made by employees their skills considered as "raw human capital" contributes directly to the organizational, structural and relational capital.

D. Conclusions

As we can see in Table 1. those mentioned factors explains only 41% of total income variation. This complex of factors could be completed with many others. Even if they are correlated each other we can add factors like : climate of enterprise, organizational management, type of activity, concurrency, and other personal skills like (experience in domain, management skill, natural skills or talent, not only the quantity of education but quality etc.). Also there are some macroeconomics factors which are not measured in the earning function like (GDP, current economy power and sustainability, dummy variable like crisis or not etc).

We mentioned these variables because as they are reflected in a model of an earning function in the same manner this variables affect the intellectual capital measure of an organization.

These variables mentioned are all strongly recommended to be used as factor in index or indicator developed for intellectual measure. The importance shown in the models should help to split and combine variables with type of each element of intellectual capital of an organization. As we mentioned for example experience is not only a human capital factor it is also a source of relational capital, of development and innovational capital if experience is combined with other factors like education, IT, management skills etc.

In the end, we consider that personal income and their factor of influence should be balanced with intellectual capital and his components.

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Appendixes

Dependent Variable: INCOME, **model I**				
Method: Least Squares				
Sample: 1 588				
Included observations: 588				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFO_TV	0.162728	0.067108	2.424871	0.0156
IT	-1.402811	0.479175	-2.927552	0.0036
LANGUAGE	0.824294	0.317146	2.599098	0.0096
MEDIU	1.526773	0.436609	3.496887	0.0005
SEX	1.096454	0.379913	2.886069	0.0040
HEALTH	0.836789	0.419089	1.996685	0.0463

EXPERIENCE	0.077850	0.018649	4.174441	0.0000
EDUCATION	0.603783	0.077055	7.835761	0.0000
C	-3.841138	1.517058	-2.531965	0.0116
R-squared	0.340915	Mean dependent var		6.496190
Adjusted R-squared	0.331809	S.D. dependent var		5.523969
S.E. of regression	4.515455	Akaike info criterion		5.868077
Sum squared resid	11805.43	Schwarz criterion		5.935068
Log likelihood	-1716.215	F-statistic		37.43640
Durbin-Watson stat	1.746429	Prob(F-statistic)		0.000000

Dependent Variable: LOG(INCOME), **model II**				
Method: Least Squares				
Sample: 1 588				
Included observations: 541				
Excluded observations: 47				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EDUCATION	0.080806	0.009663	8.362464	0.0000
EXPERIENCE	0.010859	0.002339	4.642949	0.0000
INFO_TV	0.022406	0.008338	2.687396	0.0074
LANGUAGE	0.055830	0.037609	1.484476	0.1383
MEDIU	0.245732	0.054520	4.507181	0.0000
SEX	0.145123	0.046558	3.117020	0.0019
HEALTH	0.135176	0.051528	2.623370	0.0090
IT	-0.228832	0.057839	-3.956324	0.0001
C	0.343209	0.188173	1.823900	0.0687
R-squared	0.391345	Mean dependent var		1.729132
Adjusted R-squared	0.382192	S.D. dependent var		0.676081
S.E. of regression	0.531404	Akaike info criterion		1.589909
Sum squared resid	150.2318	Schwarz criterion		1.661334
Log likelihood	-421.0704	F-statistic		42.75730
Durbin-Watson stat	1.570052	Prob(F-statistic)		0.000000

Dependent Variable: SQR(INCOME), **model III**				
Method: Least Squares				
Sample: 1 588				
Included observations: 588				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFO_TV	0.042847	0.012353	3.468462	0.0006
IT	-0.256123	0.088206	-2.903688	0.0038
LANGUAGE	0.125281	0.058380	2.145957	0.0323
MEDIU	0.466660	0.080371	5.806352	0.0000
SEX	0.132892	0.069934	1.900251	0.0579
HEALTH	0.198389	0.077146	2.571624	0.0104
EXPERIENCE	0.011093	0.003433	3.231414	0.0013
EDUCATION	0.123068	0.014184	8.676429	0.0000
C	0.144812	0.279259	0.518560	0.6043
R-squared	0.411563	Mean dependent var		2.310853
Adjusted R-squared	0.403432	S.D. dependent var		1.076159
S.E. of regression	0.831201	Akaike info criterion		2.483298
Sum squared resid	400.0286	Schwarz criterion		2.550289
Log likelihood	-721.0897	F-statistic		50.62027
Durbin-Watson stat	1.583584	Prob(F-statistic)		0.000000

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[2] See Skandia Navigator for Example