

# The measurement of organizational capital

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## Abstract

The aim of the authors was to compare the model for measurement of organizational capital created for the Czech Republic with the model designed based on data of 309 businesses in the South-West Cohesion Region. The  $p$ -values of the intercept, the coefficients of tangible fixed assets and personnel expenses lower than 0.05 coming out in both models indicate statistical significance of these regression coefficients and intercepts. Therefore, it is significant at the 0.05 level that both the intercept and two independent variables have influence on the dependent variable in both models. Both models show also the highest  $p$ -value for the coefficient of intangible fixed assets. While this regression coefficient remains to be statistically significant in the model for the entire Czech Republic, it isn't statistically significant for the South-West Cohesion Region. Thus the influence of intangible fixed assets on the dependent variable – revenue – hasn't been proven. This article is a part of the results of the project no. 402/09/2057 “Measurement and management of the intangible assets impact on enterprise performance”, financed by Czech Science Foundation.

**Keywords:** organizational capital, measurement, linear regression model, sales, tangible fixed assets, intangible assets, staff costs

## Introduction

Many authors agree that organizational capital may significantly contribute to increasing the productive capacity of a company. However, there is no consensus on the organizational capital definition, on how to measure it or how to best quantify its contribution to a company output (whether current or future). Unlike with the physical capital, its value is not shown in a company's balance sheet. There is also no organizational capital market that we could use for the measurement of its value and therefore the thesis focuses on finding and describing of relations between available variables for the purposes of the measurement of organizational capital.

Baron and Armstrong (2002) define organizational capital as embedded or institutionalized knowledge that may be retained with the help of information technology on readily accessible and easily extended databases. It can include explicit knowledge that has been recorded on a database or in manuals and standard operating procedures, or tacit knowledge that has been captured, exchanged and, as far as possible, codified. Organizational capital is created by people (human capital) but it is also the outcome of social capital interactions.

Evenson and Westphal (1995) define organizational capital as the knowledge used to combine human skills and physical capital into systems for producing and delivering want-satisfying products.

Black and Lynch (2005) divide organizational capital into three broad components – workforce training, employee voice, and work design. Black and Lynch assume, for the sake of simplicity, that education decisions are primarily individual based and made independently from the employment relationship. But workplace training is a joint decision undertaken by the worker and the firm to invest in additional skills training after an employment relationship has begun. This workforce training, along with the education a worker brings to a job raise the productive capacity of a firm.

The second component of organizational capital is employee voice. By this Black and Lynch mean those organizational structures that give workers input into the decision-making associated with the design of the production process and greater autonomy. Examples of practices in this component include employee suggestion box in the lunch room, employees being consulted individually about their views, individual job enrichment schemes, employees being consulted in groups, self managed teams where production employees work in a semi-autonomous setting.

Third component of organizational capital is work design, including the use of cross-functional processes that result in more flexible allocation and re-allocation of labour in the firm. This component of organizational capital includes practices like reengineering efforts that may involve changing the occupational structure of workplace or benchmarking.

The possibilities of individual authors' approach to the measurement of organizational capital can be noted in research studies. The first approach is quantification of organizational capital using questionnaire survey among companies. This procedure was chosen for instance by Huselid (1995), Delaney and Huselid (1997), Becker and Huselid (1998), Youndt and Snell (2004), Black and Lynch (2005). The second approach is measurement of organizational capital by creating models. Organizational capital is measured in this way for instance by Atkeson and Kehoe (2002), Lev and Radhakrishnan (2003, 2004), Miyagawa and Kim (2008), Ludewig and Sadovski (2009), Fiala and Borůvková (2011a, 2011b).

Atkeson and Kehoe (2005) use for measurement of organizational capital U.S. national income and product accounts (NIPA). In the standard growth model, output is accounted for as payments to labour and to psychical capital. Using this growth model to analyze NIPA data on the U.S. manufacturing sector during 1959–1999, the authors find that nearly 9% of the output of

this sector is not accounted for by payments to either of these factors. Cited authors interpret his unaccounted-for output as payments to various forms of unmeasured capital or monopoly rents. Atkeson and Kehoe (2005) find that 4% of output in the U.S. manufacturing sector can be accounted for as payments to organizational capital. Thus, a little less than half of the nearly 9% unaccounted-for output in manufacturing can be accounted for as payments to organizational capital.

Lev and Radhakrishnan (2003, 2004) use following function to estimate organizational capital:

$$SALE_{it} = a_{0it} PPE_{it}^{b_1} EMP_{it}^{b_2} RND_{it}^{b_3} e_{it},$$

where  $SALE_{it}$  is the revenue of firm  $i$  in year  $t$ ,  $a_{0it}$  stands for organizational capital,  $PPE_{it}$  is the net value of plant, property, and equipment,  $EMP_{it}$  is the number of employees,  $RND_{it}$  is the firm's research and development capital and  $e_{it}$  is an error term. Coefficient of determination  $R^2$  for this model was calculated at values 0.625.

Miyagawa and Kim (2008) found that organizational capital is associated with investment in research and development assets and marketing assets. The model of cited authors is based on the firm value approach. They include organizational capital as a production factor in the following production function:

$$Y_{it} = F(B(K_{it}^I, O_{it}), K_{it}^T, L_{it}, M_{it}, H_{it}, \Theta_{it})$$

where  $Y_{it}$  is a gross output of firm  $i$ . In this equation, they assume two kinds of capital goods: one is complementary to organizational capital ( $K_{it}^I$ ) and the other is not ( $K_{it}^T$ ).  $O_{it}$  is organizational capital,  $L_{it}$  is labour input,  $M_{it}$  is intermediate input, and  $\Theta_{it}$  shows the technology of firm  $i$ .  $H_{it}$  represents investment in organizational capital.

Ludewig and Sadovski (2009) use linear regression model of Lev and Radhakrishnan (2003) and measure with the help of Cobb-Douglas production function, which they amend with a term for organizational capital ( $\Omega$ ):

$$Q_{i,t} = A\Omega_{it}^{\beta_1} K_{i,t}^{\beta_2} L_{i,t}^{\beta_3},$$

where  $Q$  denotes the output,  $K$  the capital stock and  $L$  the labour input of establishment  $i$  in period  $t$ . The constant  $A$  represents overall efficiency. Their results indicate that organizational capital has a substantial impact on performance.

Fiala and Borůvková (2011a) designed a model of firms' sales, as a function of their tangible fixed assets, intangible assets, and staff costs, which they used to measure firm organizational capital. Organizational capital of 2796 companies in the Czech Republic was quantified and its correlation with return on equity index, return on sales index, and return on assets index was calculated. A statistically important linear correlation between organizational capital and return on assets (ROA), as well as between organizational capital and return on equity (ROE), has been established.

Fiala and Borůvková (2011b) created three linear regression models for the years 2006, 2007 and 2008 of roughly 270 companies based in the Vysocina region were produced by means of the Forward and Backward Stepwise methods, on the basis of company information.

The aim the article is to compare the model for measurement of organizational capital created for the Czech Republic (Fiala, Borůvková 2011a,) with the model created based on data of businesses in the South-West Cohesion Region.

## Materials and methods

The data based on which the analyses were carried out was obtained from the Creditinfo database, which forms the predominant part of the Albertina Data database. The Creditinfo database ranks among the most comprehensive sources of corporate information on the Czech market. The database contains economic data of individual companies processed on the basis of annual financial statements. It represents about 250 pieces of data per company per year. Apart from basic information on the name, registered office and identification of a company it contains also its objects of business activity, number of employees, legal form and ownership structure. Information about sales is available with about 900 000 companies.

Entries relating to 2008 on companies with more than 20 employees having the seat of their business in the South Bohemia and Pilsen Regions were selected from the database. A total of 320 companies from the South-West Region were selected, of which only 309 were used for the analyses. Values of some variables used in models with the remaining 11 companies from the South-West Region were outliers, and therefore the companies were not included in the model.

When creating models and selecting variables the article authors tried to proceed from models that have been described in literature so far – Hall (2000), Lev and Radhakrishnan (2003, 2004). However, it has proven that the available data was either unsuitable for the multiplicative model or no statistically significant coefficients came out in such model types. Therefore the authors used multiple linear regressions for sales modelling, while using the technique of regression model building via stepwise regression.

The created linear regression model contains three independent variables: *tangible fixed assets (TFA)*, *intangible assets (IA)* and *staff costs (SC)*. *Sales* represent a dependent variable and the model was designed based on information about 309 companies from the South Bohemia and Pilsen Regions.

According to Synek (2007) tangible fixed assets serve to a company for a longer period of time and are subject to gradual wear and tear (e.g. plant, machines, buildings, equipment, vehicles) or are used for a longer period of time without devaluation (e.g. property, works of art). According to Synek (2007) intangible assets consist of various authorizations, such as patents, licences, copyright and publishing rights obtained against consideration, as well as software, trademarks or goodwill. Staff costs include labour costs, social security and health insurance contributions, remuneration of a company or

cooperative executives and social expenses. For the purposes of the article the sales include also revenues from sales of goods and services. Table 1 shows basic characteristics (sample size, mean, median, minimum, maximum, standard deviation) describing selected variables in the model describing the situation in the South-West Region.

Table 1: Descriptive Statistics (South-West Region)

|                                     | N   | Mean        | Median    | Minimum | Maximum   | Std. Dev. |
|-------------------------------------|-----|-------------|-----------|---------|-----------|-----------|
| Intangible assets<br>(CZK thousand) | 309 | 57.7        | 53.0      | 1.0     | 145.0     | 40.1      |
| Tangible assets<br>(CZK thousand)   | 309 | 53 614.9    | 20 406.0  | 84.0    | 842 577.0 | 97 003.0  |
| Staff costs<br>(CZK thousand)       | 309 | 2 875 415.0 | 17 849.0  | 833.0   | 245 227.0 | 29 617.4  |
| Sales<br>(CZK thousand)             | 309 | 166 563.6   | 100 885.0 | 2 134.0 | 904 374.0 | 174 163.2 |

Source: own calculation

The aim of the regression model is to measure partial effects on dependent variable  $Y$  by independent variables (in our case variables  $X_1$ ,  $X_2$  and  $X_3$ ), by means of the relation  $y = b_0 + b_1x_1 + b_2x_2 + b_3x_3$ .

The designed model is therefore trying to respond to the question: “How are sales (explained variable  $Y$ ) dependent on

- intangible assets (independent variable, predictor  $X_1$ ),
- tangible fixed assets (independent variable, predictor  $X_2$ ),
- staff costs (independent variable, predictor  $X_3$ )?”

If we standardize all variables prior to the analysis, relative contribution of predictor  $X_j$  to variable  $Y$  prediction can be assessed according to standardized regression coefficients  $\beta_j$ .

A prerequisite for the creation of a correct linear model are linear relations between predictors and the dependent variable. Individual predictors should, on the contrary, be correlated as little as possible.

Coefficient of determination  $R^2$ , which represents a quotient of variability explained by the model and total variability, equals the part of the variability of variable sales, which is explained by predictors of  $TFA$ ,  $IA$  and  $SC$ .

Such designed linear regression model was further used for an estimate of the model intercept for each individual company. The authors of the contribution suppose, based on considerations and calculations made by Lev and Radhakrishnan (2004) that the intercept value corresponds to a company’s organizational capital.

Spearman’s correlation coefficients between the calculated intercept values (i.e. a company’s organizational capital) and return on sales (ROS), return on assets (ROA) and return on equity (ROE) were calculated, which measure the degree of dependence between these variables. Due to efforts at eliminating the

consequences of tax optimization, profit before tax was used in the calculation of return indicators.

Statistica software was used for all analyses.

## Results and discussion

Table 2 shows Spearman's correlation coefficients between the variables of tangible fixed assets, intangible assets, staff costs and sales. The highlighted values (bold type) are statistically significant with level of significance higher than  $p = 0.05$ .

Table 2: Spearman correlation coefficients

|                                         | Intangible<br>assets<br>(CZK<br>thousand) | Tangible<br>fixed assets<br>(CZK<br>thousand) | Staff<br>costs<br>(CZK<br>thousand) | Sales<br>(CZK<br>thousand) |
|-----------------------------------------|-------------------------------------------|-----------------------------------------------|-------------------------------------|----------------------------|
| Intangible assets<br>(CZK thousand)     | 1.000000                                  | 0.055805                                      | 0.054119                            | 0.092075                   |
| Tangible fixed assets<br>(CZK thousand) | 0.055805                                  | 1.000000                                      | <b>0.541466</b>                     | <b>0.512951</b>            |
| Staff costs<br>(CZK thousand)           | 0.054119                                  | <b>0.541466</b>                               | 1.000000                            | <b>0.707399</b>            |
| Sales<br>(CZK thousand)                 | 0.092075                                  | <b>0.512951</b>                               | <b>0.707399</b>                     | 1.000000                   |

Source: own calculation

It is desirable that statistically insignificant or at least weak correlations existed between the independent variables of tangible fixed assets, intangible assets and staff costs. It is also desirable that the correlation coefficients were high and statistically significant between the dependent variable and individual independent variables. Table 2 shows that these prerequisites were not fully complied with – the correlation coefficient between the dependent variable (sales) and independent variable of intangible assets is not statistically significant and the correlation between the independent variables of staff costs and tangible fixed assets is statistically significant and medium strong.

The designed linear regression model, unlike the model designed for the entire Czech Republic (Fiala, Borůvková 2011a) and Vysocina Region (Fiala, Borůvková 2011b), does not include all independent variables and  $p$ -values show that only two regression coefficients and the intercept are statistically significant. Therefore, we have not succeeded in proving at the 0.05 significance level that the *IA* regressor has an influence on the independent variable *sales*.

Table 3 shows values of regression coefficients and it is obvious that the regression equation for *sales* has the following shape:

$$sales = 45809,82 + 174.17 IA + 0.41 TFA + 3.08 SC$$

Table 3: Linear regression model

|                                         | Param.   | Std. Err. | <i>t</i> | <i>p</i>        | Beta $\beta$ |
|-----------------------------------------|----------|-----------|----------|-----------------|--------------|
| Intercept                               | 45809.82 | 14332.54  | 3.196210 | <b>0.001538</b> | -            |
| Intangible assets<br>(CZK thousand)     | 174.17   | 179.46    | 0.970529 | 0.332552        | 0.040121     |
| Tangible fixed assets<br>(CZK thousand) | 0.41     | 0.09      | 4.356552 | <b>0.000018</b> | 0.229403     |
| Staff costs<br>(CZK thousand)           | 3.08     | 0.31      | 9.953069 | <b>0.000000</b> | 0.524099     |

Source: own calculation

where *IA* stands for intangible assets, *TFA* for tangible fixed assets and *SC* for staff costs. However, the coefficient showing a value of 174.17 is not statistically significant. Due to this reason the model was re-calculated for two independent variables – *TFA* and *SC*. The regression equation has then the following shape:

$$sales = 55742 + 0.41 TFA + 3.08 SC$$

Coefficients occurring in the model are very easy to interpret: if *TFA* increase by one unit, sales increase by 0.41 units and if *SC* increase by one unit, sales increase by 3.08 units.

Coefficients  $\beta$ , which are shown in Table 3, serve for the assessment of relative contribution of predictors. These coefficients were calculated by standardizing the data prior to the model designing. It is obvious from the values of coefficients  $\beta$  that *SC* variable has the biggest and *IA* variable has the smallest influence on the dependent variable *sales*. After recalculating the model for two independent variables the  $\beta$  coefficients change only slightly and so we can say that the *SC* predictor contributes relatively higher than the *TFA* predictor.

A coefficient of determination  $R^2$  was further calculated, which is statistically significant and reaches values higher than 0.477, which can be interpreted in a way that the designed model explains more than 47% of variability of the dependent variable.

Suitability of the applied model is also indicated by *F*-statistics and its *p*-value ( $p = 0.00$ ). In this case we obtain a statistically significant value that also proves suitability of the applied model.

## Conclusion

In this article the authors proceeded from the linear regression models designed in previous papers (Fiala, Borůvková, 2011a, 2011b), which contain the variables *IA*, *TFA* and *SC* and in which is significant at the 0.05 level that all three regressors and the intercept have influence on the dependent variable *sales*. Selection of the dependent variable and independent variables in the model

for the entire Czech Republic is based on the paper by Lev and Radhakrishnan (2003).

Unlike the model created in previous papers (Fiala, Borůvková 2011a, 2011b), does not include all independent variables and  $p$ -values show that only two regression coefficients ( $TFA$ ,  $SC$ ) and the intercept are statistically significant. We have not succeeded in proving at the 0.05 significance level that the  $IA$  regressor has influence on the independent variable  $sales$ .

A linear regression model for companies from the South-West Cohesion Region was designed in this article, which has the following shape:

$$sales = 55742 + 0.41 TFA + 3.08 SC$$

where  $TFA$  stands for tangible fixed assets and  $SC$  for staff costs. It follows from the model that if  $TFA$  is changed by one unit, sales increase by 0.41 units and if  $SC$  is changed by one unit,  $sales$  increase by 3.08 units. The coefficient of determination is statistically significant and reaches an amount higher than 0.477.

Similarly as in the model for the entire Czech Republic coefficients are significant at the 0.05 level so that the  $TFA$  and  $SC$  regressors and the intercept have influence on the dependent variable  $sales$ . On the contrary, the influence of the  $IA$  regressor on the dependent variable sales has not been proven and therefore the model for South-West does not contain (unlike the model for the entire Czech Republic) the independent variable  $IA$ .

The calculations have not confirmed correlation between organizational capital and firm performance (return on equity and return on assets) unlike the previous study (Fiala, Borůvková 2011), where this correlation has been proven on the model for the entire Czech Republic. Coefficients of determination came out also higher in the previous studies (focusing on the entire Czech Republic) from 2011 (Fiala, Borůvková 2011a, 2011b). Therefore it was proved that the method is more suitable for bigger units such as the whole Czech Republic.

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## Měření organizačního kapitálu

Cílem autorů bylo porovnání modelu pro měření organizačního kapitálu vytvořený pro ČR s modelem zkonstruovaným na základě dat 309 podniků z regionu soudržnosti Jihozápad. V obou modelech vycházející p-hodnoty pro absolutní členy i koeficienty u dlouhodobého hmotného majetku i osobních nákladů menší než 0,05, což ukazuje na statistickou významnost těchto regresních koeficientů i absolutních členů. Na hladině významnosti 0,05 bylo tedy prokázáno, že absolutní člen i dva regresory mají v obou modelech vliv na závisle proměnnou. V obou modelech rovněž vychází nejvyšší p-hodnota pro koeficient u dlouhodobého nehmotného majetku. Zatímco však v modelu pro celou ČR je tento regresní koeficient stále statisticky významný, v modelu pro region soudržnosti Jihozápad již statisticky významný není, tedy nebyl prokázán vliv dlouhodobého nehmotného majetku na závisle proměnnou – tržby. Tento článek je součástí výsledků projektu č. 402/09/2057 „Měření a řízení dopadu nehmotných aktiv na výkonnost podniku“ financovaného Grantovou agenturou České republiky.

**Klíčová slova:** organizační kapitál, měření, lineární regresní model, tržby, dlouhodobý hmotný majetek, dlouhodobý nehmotný majetek, osobní náklady

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