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Neural Model for Assessing the Value of Social Capital

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Abstract

The paper introduces the neural model for assessing the value of social capital. Algorithms proposed in the literature for such estimations were discussed and their fundamental constraints were indicated. The main purpose of the research was to develop the most efficient model for such estimations. It involved defining and verifying such factors as: number of neurons, activation functions, learning algorithms, error function, etc. The empirical studies allowed also identifying variables most significantly affecting the value of social capital. The paper concludes with discussion about potential users of proposed method and proposals for further research.

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Keywords: neural network model; multilayer perceptron; social capital; IT companies; assessing the value of social capital; fundamental equation; input variables

1. Introduction

The most valuable assets of IT company are its employees: analysts, software developers, testers, software engineers, etc. They constitute the social capital – the key resource of each company operating in broadly understood IT industry, especially in the software sector. As defined by Walukiewicz in [2] social capital means: the formal and informal relations between company employees, i.e. their skills, experience, ability to cooperate, trust, solidarity, mutual loyalty etc. These are very essential features, as the passion, involvement and enthusiasm of programmers developing and creating software are largely decisive for the success of such applications. That is why the appropriate and reliable measurement of the value of such assets should be one of the priorities of the chief executive officers and

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managers. There exists a vast amount of studies in the area of social capital analysis; however the widely accepted method for extrapolating and predicting the values of social capital has not been proposed so far [17].

The most significant achievements in this area have been achieved by Swedes and Americans whose methods have also gained popularity in Poland: Intangible Assets Monitor IAM by Sveiby [3]; Balanced Scorecard BSC by Kaplan and Norton [4] or Skandia Framework – SF by Edvinsson and Malone [5]. These are non-financial models, allowing for the identification and evaluation of the most important intangible factors defining the difference between the market value and the book value of a given company [16].

The instruments proposed in literature, especially those based on financial balance sheets, make the evaluation of intangible assets a laborious and time-consuming process, causing many methodological doubts. Therefore, enterprises hardly ever attempt to properly estimate the value of their social capital. Moreover, the author's empirical research shows that using the existing algorithms carries several other significant problems, the most important of which are:

- impossibility to determine the significance of each variable
- the need to analyze many different sources, e.g. company balance sheets, stock exchange reports, or internal company documents
- the need of in-depth research and taking into account the specificity of economic conditions.

Furthermore, it must be emphasized that those algorithms can only be implemented if the company's return on assets (ROA) is higher than the sector mean. In addition, no tools have been proposed in source literature to estimate the intangible assets of IT companies. IT is a very specific branch of the economy, dynamically developing for many years. The people working in this sector are creative, represent high social capital, and build high values of social capital of individual enterprises and the whole IT industry. Hence, a tool for estimating the value of social capital of IT companies should definitely be dedicated to that industry only. In the author's opinion, the most important disadvantage of the existing algorithms is the impossibility to evaluate the significance of each variable affecting the value of social capital.

The above-mentioned difficulties were the fundamental reasons for attempting a proposal of a new tool for such measurements. The author's idea is to apply soft computing to model, analyze and estimate the value of intangible assets of companies, and first of all, their social capital.

The instrument and environment for the construction of a neural network model and for testing and simulation [15] of the value of IT companies' social capital was the statistical package Statistica (Automated Neural Network). The program was chosen because of its many advantages, e.g.: simple operation and huge analytic power; highly optimized training algorithms based on state-of-the-art solutions (including the conjugate gradient algorithm and the Broyden–Fletcher–Goldfarb–Shanno algorithm, further referred to as BFGS, applied in the developed model); customization of the activation function, error function and network complexity and a wide choice of graphic and statistical tools for interactive exploratory analysis.

2. Selection of input variables

The analysis of literature concerning the estimation of intangible assets led to identification of a set of explanatory variables influencing the social capital of an enterprise. Twelve quantitative input variables were chosen out of them for the preliminary analyses: number of shares, the share price, book value, net income, market value, assets, liabilities, total income, net income, employment, number of customers and profit per employee. The author was aware that the set of variables was too numerous for the analyzed problem. Additionally, a phenomenon of variable redundancy was observed, so it was necessary to reduce some information and only use a certain subset. Literature review shows that a single commonly accepted and applied methodology of optimum selection of input variables has not been proposed yet. Several methods most often used for preliminary analysis and reduction (preprocessing) of input data are described in literature: brute force, removing correlated data, sensitivity analysis, PCA transformation, genetic algorithms etc. [6]. Input variables were selected so as to lower the number of weights that must be determined when training a neural network. Highly correlated data were removed and the method of global sensitivity analysis was applied, which made it possible to choose only those variables that significantly influence the output of the neural network. The choice of these tools was the result of the review of literature, underscoring that such methods are