

CORRELATION BETWEEN INTELLECTUAL CAPITAL AND WEB TRENDS OF TOP 30 COMPANIES IN TURKEY

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—Abstract —

This study focuses on the correlation between intellectual capital and web trends of the index bist-30, which holds the top 30 companies in Istanbul Stock Market (BIST). The trends of web sites and companies are collected separately via web tools. Also, intellectual capital is studied and measured based on two methods, which are Market Value / Book Value and Value Added Intellectual Coefficient (VAIC) techniques. Data required for studying, measuring and accounting intellectual capital is gathered from web sites, firm annual reports, company financial statements and Public Disclosure Platform (www.kap.gov.tr) published by the BIST administration.

Keywords: Intellectual Capital, Stock Market Analysis, Data Mining, Time Series Analysis, Financial Reporting.

JEL Classification: M4, M5, M15

1. INTRODUCTION

Intellectual capital is a widely discussed and eye-catching concept in today's business world. The former years witnessed firms valued only by their physical and tangible assets. However, information age nowadays proves that a much better evaluation and analysis is required to have a better understanding of

companies. Considering firms with their physical and tangible assets is no longer valid. That is actually where intellectual capital comes to the scene. (Agndal, and Nilsson,2006:91)

Intellectual capital serves as a guide to the governments for making decisions about firms. Also, entrepreneurs need to know about the intellectual capital of organizations for merger, acquisition and privatization actions. Furthermore, banks are able to give credits with better options and lower interest rates for the firms, which have strong intellectual capital. Managers have the opportunity to take necessary actions and give a better direction to their enterprises in case they are informed about their organization's intellectual capital. In other words, intellectual capital provides them the big picture and serves as an essential part of firm strategy. Investors and shareholders can also give more wise decisions when they purchase the stocks of organizations listed in stock exchange.

Definitely, intellectual capital enlightens investors and shareholders with a broader perspective about the growth and improvement trend as well as potential of an organization. Accounting, reporting and measuring intellectual capital has thus become an important requirement for companies and the related stakeholders today. It is not a luxury or an additional feature in such a rapid progressing information age. (Alipour,2012:53) That is the main reason this study investigates intellectual capital of top thirty companies in Turkey.

The research especially concentrates on the mentioned top thirty, since these firms are very influential in the market. In other words, they have the power to give a general direction to Turkish economy. Moreover, the web trends component is integrated to this study, since technology is tightly related with the concept of intellectual capital. Considering the three components of intellectual capital, web trends of top thirty companies in Turkey are more specifically concerned with their relational capital and structural capital. (Joia,2007)

This study is built on web statistics of the companies on BIST30, which are the top companies listed on Istanbul Stock Market as previously mentioned. Intellectual capitals of firms are analyzed by taking advantage of company annual reports and firm financial statements such as the balance sheet and income statement. These are shared and viewed on company web sites, since the emphasized firms are publicly traded companies. Additionally, public

enlightenment platform powered by BIST administration also makes it a necessity to share financial and accounting information with the public. Furthermore, according to the new commercial law, all firms regardless of their size and structure are required to be completely transparent by making their financial statements public and establishing firm websites.

Figure-1: Overview of Study

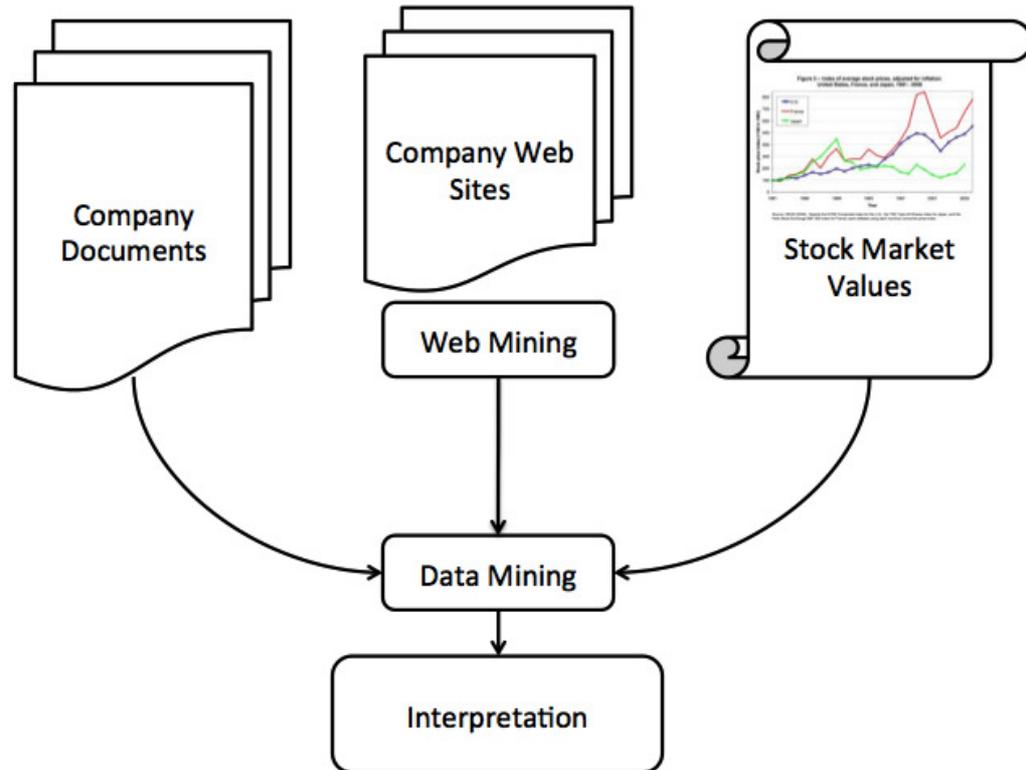


Figure 1 demonstrates an overview of data collection and correlation steps. The company documents such as annual reports and financial statements are publicly available and law mandated information, published by each of the companies. Official company documents, annual reports and financial statements are used to obtain several information such as the market value, book value, value added, tangible capital, financial capital, human capital, structural capital, capital employed, human capital efficiency, structural capital efficiency and capital employed efficiency. These information also helps to calculate Market / Book

Value ratios and Value Added Intellectual Coefficient (VAIC). (Madinios, et., 2011) This paper continues with the literature review, data and methodology, statistical and accounting analysis, results, conclusion and recommendations for future studies in the following sections.

2. LITERATURE REVIEW

Despite the growing popularity of intellectual capital and the increasing number of firms with high intangibles, non-standard and insufficient implementations concerning accounting, reporting and measurement of intellectual capital still remains as a leading problem. (Moolman,2011:2) In other words, disclosing and sharing intellectual capital as well as reflecting innovation and knowledge to financial statements continues to be a barrier. Accounting-finance academicians and practitioners go on to debate how to explain profits arising from intangible assets on balance sheets and income statements. (Holland,2006:281) Traditional financial statements are still based on book values of firms, ignoring the market values. Although the market value may not always equal to intellectual capital, (Stewart,2001:184) the difference between book value and market value is important to emphasize the existence and impact of intellectual capital. (Rodov and Lelieart,2002:324) The debates and history of intellectual capital dates back to 1960s and the debate on human capital investments dates back to 1990s. However, several question marks are not yet answered. (Marr and Moustaghfir,2005:1120)

Unfortunately, the current strict requirements by International Accounting Standards also causes the mentioned questions to remain unanswered. Accounting is based on objectivity, consistency, verifiability and comparability principles. Moreover, subjectivity and manipulation of financial-accounting information by managers are never allowed by accounting. On the other hand, there is a great need to report intangibles and reflect the real value of organizations to investors and other stakeholders. (Moolman,2011:6) Accounting is currently under pressure to report the exact value of firms on financial statements such as the balance sheet and income statement. (Roslender and Fincham,2004:178)

The economy has evolved from an industrial economy to a knowledge based economy since the basic factors of production are no longer valid. As well known, the traditional factors of production stand for capital, land and labor. However, today's business world additionally includes knowledge as a factor of production.

This is definitely reflected to higher educated and higher cost personnel. Employing a high number of personnel has replaced by employing talented personnel, who have a low turnover ratio. Thus, managing intangible assets is an eye-catching characteristic in today's business world. (Seetharaman and et.,2002:128)

Intellectual capital is also known as a network of inter-relations in a specific company. This means that, coordinating intangible resources, creativity and feedback as well as turning those to value is critically significant in regards to intellectual capital. In other words, intellectual capital helps to harmonize these elements and initiate the efficiency process in firms.

Generally, intellectual capital is categorized as human capital, structural capital and relational (customer) capital. (Ordóñez,2004:629) Human capital means the capacity of employees to provide solutions for their customers. Also, human capital refers to personal knowledge stock of organizations represented by their employees. Thus, investing in human capital is very significant in terms of financial results and innovation. (Riahi-Belkaouri,2003:217) One drawback about human capital is that, it can only be rented since employees of any organization take their skills, knowledge and experiences with them when they leave the organization.¹ Structural capital is the component, which changes know-how into the property of the group. So, structural capital helps human capital to become more productive and is a supporter in the value creation process. (Steward,1997:5) Then, customer capital enables relations with clients of a firm to continue successfully. (Swart,2006:137) Customer capital is really hard to identify since it is related to customer loyalty, relationship with suppliers, agreements and sponsorships. (Cañibano and Marr,2005:42)

¹ Flamholtz, E. G, Bullen, M. L. And Hua, W. (2002), "Human resource accounting: historical perspective and future implications", *Management decision*, 40 (10), pp. 947–954.

Figure-2: Intellectual Capital Performance Criteria

Human capital	Structural capital	Relational capital
<ul style="list-style-type: none"> • Personnel cost/revenue • Revenue/ employee • Staff turnover rate • Recruitment, training and development spent per employee 	<ul style="list-style-type: none"> • Research and development expenditure/revenue • Intellectual property/total assets 	<ul style="list-style-type: none"> • Marketing, selling and distribution costs/revenue • Business segments level • Geographical segments level • Market share • Market growth

Source: Vergauwen and Oirban,2007:1163.

3. DATA MINING

During this study, C4.5 Tree is implemented for data mining phase to find out the correlation between the web trends and the intellectual capital. C4.5 method (Qureshi, Mirza, & Arif, 2006) is a decision tree based classification algorithm. The tree is built by using the information gain of each feature in the feature vector. The algorithm starts with a training data set S , where $S = \{ s_1, s_2, \dots, s_n \}$ where each sample s_i has a p dimensional feature vector (FV). For each sample s_i , $FV = \{ x_{1i}, x_{2i}, \dots, x_{pi} \}$ and the information gain of each values would be $IG = \{ ig(x_{1i}), ig(x_{2i}), \dots, ig(x_{pi}) \}$. The algorithm creates a decision tree where each node defines a decision to either side.

The highest information gain value is selected for the top most decision node and the second is get the decision criteria on the next level. Let $ig(x_{ik}) > ig(x_{im})$ for the Figure-1. The tree is constructed by following the similar approach for the next levels. Finally at the leaves, the samples are placed after the training. In the

time of testing, the features extracted from test samples are questioned via the decision nodes in the tree from root to leaves. The final leaf is accepted as the class of the test sample. C4.5 has an advantage on other decision trees, since it uses the information gain and normalization and also it uses the pruning for the time performance.

4. DATA SET AND DATA MINING

This section covers the details of the data set collected from the web mining of intellectual capital values and stock market values. For each 30 companies in BIST 30 list, we have collected data for last 3 consecutive years which are 2010, 2011 and 2012. The parameters collected for the intellectual capital calculations can be listed as below:

- Year of the value collected
- Market Value
- Book Value
- Value Added
- Tangible Capital
- Financial Capital
- Human Capital
- Human Capital Efficiency
- Structural Capital
- Structural Capital Efficiency
- Capital Employed
- Capital Employed Efficiency

The correlation has been research among the below parameters.

- Market Value / Book Value
- Value Added Intellectual Coefficient
- Google Trends.

The correlation value after implementing the C4.5 tree classification is about 42% and the details are given below. Properties of the data set are provided in Table 1.

Table-1

Property	Value
Number of Web Sites	30
Number of Web Sites after 3 years checking	90
Average market value / Book value	1.86
Average VAIC	4.98
Average Google Trends	45.47
Stdandard Deviation of Market Value / Book Value	2.71
Std. Dev. Of VAIC	10.40
Standard Deviation of Google Trends	24.52
Correlation Rate	41.58%
RMSE	0.682
RAE	1.021

The correlation rate indicates that there is a close correlation between the web site trend and the unemployment rate of the country where the web page is originated. It is also a two way operator where the correlation can be interpreted as predictability. So from the unemployment rate of the country the web traffic of the job oriented web sites can be predicted or vice versa. The RMSE (Ocak and Seker,2013) stands for root mean square error and RAE (Ocak and Seker,2013) stands for root absolute error rates which are given to indicate the error rates on the given data mining study.

5. CONCLUSION

The correlation value between the intellectual capital and web trends for top 30 companies in Turkish stock market (BIST30) indicates a satisfactory correlation. The correlation indicates that the intellectual capital is affecting the stock values and vice versa.

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