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Factors Affecting the Value of Software Companies: A Practical Approach on NASDAQ Listed Software Companies*

Yazılım Firmalarının Değerini Etkileyen Faktörler: NASDAQ'da İşlem Gören Yazılım Firmaları Üzerine Uygulamalı Bir Yaklaşım

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ÖZ

Bu çalışmada, modern yazılım firmalarının değerlemesini etkileyen faktörlerin belirlenmesi amaçlanmaktadır. Bu doğrultuda, NASDAQ'da işlem gören ve yazılım sektöründe faaliyet gösteren 97 şirket üzerinde bir analiz gerçekleştirilmiştir. Çalışma kapsamında gerekli verilerin tespit edilmesi amacıyla öncelikle bir soru seti oluşturulmuş ve bu soruların yanıtlarına ulaşmak için nitel araştırma yöntemlerinden içerik analizi yöntemi kullanılmıştır. Bu süreçte, belirlenen şirketlerin resmi internet siteleri, faaliyet raporları, finansal raporları ve sürdürülebilirlik raporları detaylı bir şekilde incelenmiştir. Araştırmanın analiz aşamasında ise çoklu doğrusal regresyon yöntemi uygulanmıştır. Analiz bulgularına göre, bağımsız değişkenler arasında yer alan çalışan sayısındaki artış, mühendis kadrosu, teknolojik yetkinlik, maddi olmayan duran varlıklar, personel gelişim kalitesi, büyüme stratejisi, risk yönetimi çalışmaları, bağış ve sosyal sorumluluk faaliyetleri, satış büyümesi ve net kâr artışı gibi unsurların yazılım firmalarının değerini anlamlı bir şekilde etkilediği belirlenmiştir.

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ABSTRACT

This study aims to determine the factors affecting the valuation of modern software companies. In this direction, an analysis was carried out on 97 companies traded on NASDAQ and operating in the software industry. To determine the necessary data within the scope of the study, a set of questions was first created and the content analysis method, one of the qualitative research methods, was used to reach the answers to these questions. In this process, the official websites, annual reports, financial reports and sustainability reports of the identified companies were analyzed in detail. In the analysis phase of the research, the multiple linear regression method was applied. According to the findings of the analysis, it was determined that the increase in the number of employees, engineer staff, technological competence, intangible fixed assets, staff development quality, growth strategy, risk management activities, donation and social responsibility activities, sales growth and net profit increase, which are among the independent variables, significantly affect the value of software companies.

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1. Introduction

Valuation means the allocation of value by the valuation subject in most cases in the form of a monetary value (Matschke et al., 2010:3). Valuation, on the other side, is briefly the process of predicting the market's prices. In other words, valuation is the process of a series of analytical procedures used to determine the value of the object subject to valuation (Ho et al., 2011:2097). Here, the object subject to valuation is for the valuation process. In a broader sense, to reach the most accurate result possible as a result of the valuation process, it is necessary to identify the dynamic drivers in the market of the object subject to valuation (Gilbertson & Preston, 2005:126).

Companies are organizations combining different sources and assets to improve, produce, to sell their products. As well as monetary assets such as property, facility to equipment, it also consisted of intangible assets such as information assets, customer networks, brands, patents, etc. (Sandner, 2010:35). What cannot be measured cannot be managed (Kamath, 2015:108). To manage companies effectively, it is obligatory to determine their value. Firm valuation is the process by which the value of the firm is determined, with the buyer and seller determining the value of the firm, with certain pressures that drive them to buy and sell, which is based on their value judgments and skills as negotiators (Corelli, 2017:3). To obtain the best results while determining the value of the firm, it is necessary to take consider in monetary and intangible assets of the firm. In the age of information informatics, the main actors of production are no longer land and capital. The most important production actors of the age are information and technique. With the emergence of the information economy, intangible assets have started to be defined as the elements that enable economic growth for companies and core value creators (Jorgenson & Stiroh, 2000; Oliner & Sichel, 2000).

The recently published literature shows that productivity growth in companies is dependent on intangible assets rather than material assets (Corrado et al., 2009; Corrado et al., 2016; Marrano et al., 2009; Dal Borgo et al., 2012; Jona-Lasinio et al., 2011; Inklaar et al., 2005). For this reason, having information and keeping it under control is very important for businesses in economic terms (Bingol, 2016). The importance of intangible asset valuation has increased at the same rate due to the importance of intangible assets in recent years for enterprises. King and Henry (1999) point out that big banks give loans more easily to companies that are secured by trade names and patents, not by the traditional assets of corporations.

Within the scope of the research, the valuation of software types among intangible asset types has been focused. In all sectors of today's economy, software has a very important place. Software can be bought and used from outside as needed and can be produced within the company. In the research, it is included to determine the factors that affect the economic values of the companies producing the software. These companies can use the software they produce both in their own bodies and sell it commercially. For this reason, accounting standards for the processing of software costs are important.

Unlike machines that weaken and wear out due to their use, the strengthening of software over time reveals special situations in their accounting. In other words, it gets stronger as software is used, and it evolves as the number of users increases (this concept is commonly referred to as the network effect). Therefore, the critical parameter for strengthening software is not only time but also features associated with its use contrary to what current accounting standards predict.

Brooks (1995) says that fixing a flaw in software has an important chance (20-50%) to uncover or fix another flaw. Lehman (1996) stresses that the software used must be constantly adapted otherwise it becomes less and less satisfactory. This dilemma between Brooks and Lehman about the software market is paradoxical. One argues that if the system is not changed, the system will lose its functionality over time; the other argues that when changes are made, functionality increases but the system wears out. (Ben‐Menachem & Gavious, 2007:121).

As mentioned earlier, valuing software is crucial for a company's financial well-being. While the literature contains numerous sources on assessing intangible assets, studies specifically focusing on software valuation remain scarce. This research aims to identify the key factors influencing software valuation. To achieve this, a dataset was compiled using content analysis, a qualitative research method. The first section of the study provides a theoretical examination of internet-based companies and the factors considered in their valuation. The second section presents the analysis and findings derived from the data set created within the scope of the research.

2. Internet Based Companies and Valuation

Since the second half of the 1990s, with the increasing importance of the internet, many researchers and practitioners have emphasized that the "new economy" era has begun (Stiroh, 1999; Damodaran, 2001; Kettel, 2002; Jansen & Perotti, 2002; Core et al., 2003). As can be seen, the new economy paradigm is not an idea put forward by a single author, and there is a wide range of ideas under the title of new economy. According to the literature, the most distinctive feature of the new economy is its focus on globalization and expanding information technology. Basically, the new economy has three distinguishing features compared to the traditional economy. These are (Herzenberg et al., 2000:2);

- Globality
- Intangible assets (ideas, information, relationships...)
- A dense connection.

These three characteristics create a new type of marketplace

and society. In the new marketplaces created by the new economy, internet companies have become the structures that shape the economy. An Internet company is the company that derives most or a significant portion of its revenues from the internet or conducts its basic activity over the internet. Typical examples of this kind of companies are businesses that sell goods over the internet and organizations that offer various services over the internet (Zarzecki, 2010:106). It is not easy to distinguish between internet companies. In order to distinguish internet companies from other new economy companies (telecommunications, etc.), the following method has been preferred in the USA. According to this method, a company must generate at least 51% of its revenues from the Internet in order to be included in the Internet Stock Index (ISDEX), which is traded on the US stock exchanges.The purpose of this preferred method is to distinguish between companies that can survive without the internet and companies that cannot (Anbar, 2007:71).

In the literature, there are many valuation methods that are accepted as suitable for traditional companies. However, the same is not valid for internet companies. It is difficult to value internet companies for many reasons. The following are the main reasons (Guo & Zmeskal, 2016:4);

- Internet companies suffer losses due to high marketing costs at the beginning of their operations. In addition, they earn revenues that can only be called symbolic. This significantly reduces their profits.
- Since internet companies are in a constantly and rapidly developing market, many companies that cannot keep up with this speed of the market cannot continue their lives. For this reason, very few of the internet companies have long performance favors required for valuation.
- The Internet industry is characterized by high uncertainty.

An analysis of the aforementioned factors reveals that most companies in the internet industry generate minimal or even negative profits. Additionally, only a limited number of these companies have a sufficiently long track record of performance. Given the high level of uncertainty they face, estimating and comparing their earnings, related performance indicators, and cash flows is significantly more challenging than usual. In their 2016 report, Ferreri and Grande highlighted the difficulty in determining the appropriate useful life for valuing internet companies. It remains unclear whether the valuation should be based on physical, functional, technological, economic, or legal lifespan. This uncertainty arises from the fact that approximately 80% of the assets of internet companies are intangible. Despite the challenges in valuing internet-based firms, this process is essential. In recent years, investors have increasingly directed their funds toward stocks of rapidly growing and highly uncertain companies, particularly those in the internet and technology sectors (Goedhart et al., 2016:1). Therefore, it is crucial to establish appropriate valuation methods to determine the true worth of internet companies. While numerous studies have been conducted on traditional firms to identify the variables influencing firm valuation, similar research has emerged with the expansion of internet companies and the rising investment in this sector.

3. Literature Review

Due to the fact that the history of Internet-based companies does not last for many years, academic studies related to the valuation of companies in this sector do not have a long history. When the literature on the subject is examined, Higson and Briginshaw (2000), one of the first studies in the field, evaluated Amazon and Freeserve. They found that methods such as price/income or price/earnings traditionally used in the valuation process they have made on these internet-based companies are not very descriptive. Higson and Briginshaw pointed out that the only way to value companies in the internet industry is to try to predict the cash flows that these businesses will generate. Schwartz and Moon (2000) aimed to find a solution to the valuation problem of internet-based companies in their studies conducted in the same year. As a result of their analyses in line with this objective, they developed a model based on assumptions about the expected rate of revenue growth and expectations about the company's cost structure. After these pioneering studies, following these pioneering studies, Isimbabi (2002) examined the discounted cash flow model and the real option model in detail in his study, which is intended to serve as a textbook on the valuation of internet stocks. In addition to these, he also included empirical studies and pointed out the factors that are important in the valuation of internet stocks. Kettel (2002), in his work on how the internet and technology shares can be valued more accurately, reviewed traditional methods and emphasized their shortcomings in valuing internet shares. In addition, he proposed new methods that can be used in the valuation of the new economy. McCahery and Renneboog (2004) investigated models that can be used to evaluate companies operating in different fields such as biotechnology companies and internet-based companies in their study aiming to give a new perspective to the valuations of high-tech companies. Ben-Menachem and Gavious (2007) presented a quantitative valuation method that allows the fair value of the software to be based on all costs incurred by the system. According to this method, costs are collected by an automated tool and stored in the inventory system of enterprise software assets. They added the impact of the relative importance of each module to the business to the total costs. Kossecki (2009) investigated the relationships between brand, loyalty, trust and valuation in his study, which aimed to identify selected problems related to the valuation and value creation of social networking services from internet companies. In this context, he compared traditional methods in the valuation of social media companies. As a result, he tried to understand how company value is created by defining his own model. Zarzecki (2010) concluded that reduced cash flows and real options

approaches can also be used to evaluate the new economy in their work, which they aim to prepare a theoretical basis for potential methods that can be used in the valuation of internet companies. However, they emphasized that internet companies should be analyzed with dynamically changing markets and high flexibility in mind. Aghabekyan (2010), in his work under the name of a value-conformity research, examined the financial and non-financial factors associated with the market value of Internet-based companies included in the NASDAQ QNET index. He used the Smallest Squares (OLS) method in his review. Kemper (2010), in his work aimed at providing an innovative perspective on the limitations of traditional valuation, has examined the effects of the internet network on valuation. He has built his scope of work on how valuation can be done in the software market and has developed a model for it. Ho et al. (2011) have emphasized that it is very difficult to evaluate internet companies and have aimed to create a model to evaluate these companies. They analyzed samples of 52 internet-based companies with the model they created as a mixture of data enveloping analysis and multiple valuation methods. As a result of the analysis, they determined that the model they created was 70% successful in valuing internet companies. Huarng and Yu (2011) tried to determine whether internet firms are valuable enough to be promising or not and analysed whether they are preferred over other firms. While conducting the analysis, they determined that internet companies formed an economic bubble in 2000 and analysed before and after this year. As a result of the analyses, they concluded that internet companies were overvalued before the economic bubble, but afterwards they were at reasonable value and emphasised that they are a suitable investment option for investors. Wisniewski (2015) reviewed the valuation criteria of global social media companies in his research on the valuation of publicly traded social media companies. He has also examined the investment case for social media against the backdrop of other equity markets. Özkara (2018) aimed to evaluate traditional methods in the valuation of internet companies and to test the new method with an application by investigating a method that can be an alternative to these methods. For this purpose, Schwartz and Moon tested the model, which he created by making additional improvements to the method, with an application on Facebook. As a result of the application, it was concluded that the model was open to improvements and successful. Moro Visconti (2020) examined these assets under the headings of technology, marketing and internet in his work in which he explained the valuation of intangible assets in detail. He focused on the methods of valuing intangible assets, which he examined under separate headings, and explained their differences from traditional methods of valuing assets. Vergili and Çonkar (2020) aimed to evaluate Twitter by regression method from social media network companies operating in the information technology sector in their studies. In this context, they have worked on 65 companies traded in NASDAQ. As a result of the analysis, they calculated the share value of Twitter as 27,9$. Keskin (2021), in his study of the academic literature on company valuation, developed a method based on the evaluation of reduced cash flows and relative valuation techniques. As a case study, he made a valuation application in a Turkish company in the telecommunication sector. As a result of the analysis, the results of the valuation were compared with the Borsa Istanbul price of the company and it was determined that similar results were obtained.

As can be seen above, some of the studies on valuation of companies are aimed to determine whether traditional valuation methods can correctly valuate new economy companies or not and in addition to this, they have tried to develop new methods. "Several studies have sought to examine the relationship between the market valuation of Internet companies and a range of financial indicators (e.g., revenue, book value, expenditures) as well as non-financial factors (e.g., user traffic, customer base size, managerial competencies, and strategic alliances)."

4. Variables Used in Appraisal of Internet Companies

4.1. Financial Variables

According to research on firms in traditional (non-developing) sectors, where earnings are largely positive, the relationship between earnings (or earnings growth) and market values is positive. However, according to the valuation researches done on internet-based companies, it is seen that the company does not focus too much on its earnings. However, the studies do differ in the degree to which each of the financial variables is related to the company value (Isimbabi, 2002:19).

Hand (2000) analysed the basic accounting statements describing the operations of Internet companies and related the results to stock market values. As a result of his analyses, he concluded that basic accounting data are related to firm value, although not linearly. In general, he found that the value of Internet firms has a linear relationship with both adjusted book value and adjusted net income, as recalculated under the valuation model used.

Demers and Lev (2001) analysed the relationship between marketing expenses and R&D expenses and firm value in internet companies. According to their findings, since these items are related to customer acquisition and product development for Internet companies, investors tend to perceive them as capital investments rather than operating expenses.”Therefore, marketing expenses and R&D expenses do not affect the price/sales ratio in internet companies.

Bartov et al. (2002) examined whether financial and non-financial variables differ in the valuation of traditional firms and internet companies. As a result of their analyses, they found that earnings are more important in the valuation of traditional firms. More specifically, positive cash flows are important for both types of firms, while negative cash flows

are important for internet companies.

4.2. Non-Financial Variables

Rajgopal et al. (2002) emphasised the importance of using website traffic as a non-financial variable in the valuation of internet firms. In particular, website traffic is considered important in the valuation of internet firms because it provides information about consumers' interest in the website and is effective in the growth of B2C firms.

Jansen and Perotti (2002) consider non-financial variables that influence the value of Internet firms, which they consider to be able to influence value in their work (website use, web traffic, the influence of financial analysts, managerial actions, strategic alliances, etc, stock options, etc.) are included in their analysis. According to their findings, web traffic is not a significant factor for the value of internet companies in contrast to the research done by Rajgopal and others. However, the comments of financial analysts have encouraged the overvaluation of internet stocks. Bartov et al. (2002) found that in addition to the financial variable results mentioned in the previous heading, non-financial variables (high risk warning, offer price, and percentage of total shares outstanding) are only important for internet companies.

In his study, Isimbabi (2002) concluded that both financial variables (such as product development expenses and advertising and marketing expenditures) and non-financial factors (such as website traffic, strategic alliances, and brand awareness) play a significant role in the valuation of Internet companies. When the studies are examined, it is seen that the studies reach different results due to factors such as data sets used in the studies, model features and data limitations in methodologies. However, it would not be wrong to say that the importance of the role of non-financial variables in the valuation of internet companies is clear. Which non-financial variable is effective or more important varies according to the data set used and the analysis method.

5. Research Methodology

5.1. Subject and Purpose of Research

This research is aimed at identifying the factors that influence the valuation of software companies, particularly those that are internet-based and predominantly composed of intangible assets. The goal of the study is to determine the key factors that affect the valuation of modern software firms, assess their contribution to company value, and provide recommendations for valuation analyses in companies where intangible assets are a dominant factor.

The research investigates the factors influencing the value of companies listed on NASDAQ and operating within the software industry. To establish the sample, the companies eligible for inclusion in the study were first identified. Particular attention was given to ensuring that the companies were software manufacturers and shared the same fiscal year. Out of the 153 companies initially considered, 97 were selected for inclusion in the study, as they met all the specified criteria, and all the required data was accessible. The list of related companies is available at https://topforeignstocks.com.

5.2. Data Collection Method of Research

Within the scope of the research, a set of questions was prepared in order to determine the factors affecting the value of companies operating in the software industry. A data set was created by carefully examining the official websites, published financial reports, annual reports and sustainability reports of 97 companies determined for the answers to the questions in the prepared question set.

Data on sampling were analyzed by “content analysis method” from qualitative research methods. According to Berelson (1952), content analysis is a research technique for the objective, systematic and quantitative description of the content of open communication. Within the scope of the analysis in question, the data that is fundamentally similar to each other is combined within the framework of predetermined concepts and interpreted in a way that readers can understand. In this respect, in the process of applying content analysis, categorization is made between the data obtained after determining the subject and sample of the research, and then the results are interpreted by subjecting them to various analysis methods such as frequency distributions (İsbil et al., 2021: 124).

5.3. Conceptual Framework of Research

In the research, an attempt was made to determine the potential factors that affect the performance or market value of software companies. The conceptual model for this situation is as follows. To the variables used in the study, De Alwis shed light on what he prepared in 2007 (De Alwis, 2007: 19-20).

Table 1: Conceptual Framework of the Research

Depended	Independed Variables
Value of Company	1. The number of engineer
	2. Maturity Level of Products
	3. Employee Growth
	4. Technology Capability
	5. Growth Strategy
	6. Studies on Risk Management
	7. Studies for Customer Satisfaction
	8. Number of Past Years in the Sector
	9. Academic Level of Management
	10. Staff Development Quality
	11. The Existence of Intangible Fixed Assets
	12. Donation and Social Responsibility
	13. Sales Growth
	14. Net Profit Growth
	15. R&D Growth
	16. Intangible Fixed Asset Growth

As seen in Table 1, firm value is the dependent variable of

the research. In addition, 16 variables created by utilising De Alwis' study constitute the independent variable of the research.

Table 2: Definitions of Variables Used

Variable	Variable definition for this research
The Number of Engineer	Number of engineers working in software companies in 2021
Maturity Level of Products	The number of products successfully deployed in the market for more than 5 years
Employee Growth	Increase in the number of employees working in the relevant software company over the year
Technology Capability	The number of products offered by the software company in line with the latest technology
Growth Strategy	The ability of the software company to use partnerships and collaborations to access the latest technology, new markets, new service areas and grow in market share.
Studies on Risk Management	The ability of the software company to manage possible risks.
Studies for Customer Satisfaction	The ability of the software company to get jobs from the same customers as a result of whether it cares about customer feedback.
Number of Years in the Sector	Total number of years the software company has been active in this sector.
Academic Level of Management	Academic qualifications of senior management.
Quality of Personnel Development	Trainings supporting the development and motivation of personnel by the company, awards etc.
The Existence of Intangible Fixed Assets	Whether the software company has or does not have awards, patents and trademarks in any field.
Donation and Social Responsibility	The fact that the software company is involved in any corporate social responsibility project in 2021 or whether it has made any donations. The fact that the software company is involved in any corporate social responsibility project in 2021 or whether it has made any donations.
Sales Growth	Increase of sales of the software company in 2021 compared to 2020.
Net Profit Growth	The increase of the net profit achieved by the software company in 2021 compared to the year 2020.
R&D Growth	Increase of R&D spending by software company for 2021 compared to 2020.
Intangible Fixed Asset Growth	The increase of intangible assets that the software company has in 2021 compared to 2020.

Table 2 provides explanations of the significance of the independent variables: number of engineers, maturity level of products, employee growth, technology capability, studies on risk management, studies on customer satisfaction, number of years in the industry, academic level of management, quality of staff development, presence of intangible assets, donations and social responsibility, sales growth, net profit growth, R&D growth and intangible asset growth.

5.4. Question Set of the Research

The questionnaire prepared for the research was based on De Alwis' 2007 study entitled "Analysis of factors affecting a business valuation model for software companies in Sri Lanka". The question set consists of 3 main parts.

Part A: This part of the question set consists of a few simple questions asked to understand whether the companies traded on the NASDAQ and operating in the software industry are within the scope of the research and to get to know the company.

Part B: The statements in this part of the question set generally consist of questions about understanding the intellectual capital of the firm. In this way, it is aimed to determine the effects of intellectual capital on the company value in companies operating in the software sector, which are known to be predominant and intangible assets with the results of this section.

Part C: The questions that form this part of the question set consist of technical questions to understand the financial situation of the firm. Therefore, in addition to the intellectual capital of the company identified in section B, the financial data affecting the company's value are discussed in this section.

Table 3: Matching Questions Involved in the Research

Conceptual Framework Variable	Scale Question
The number of Engineer	Part B Q-4
Maturity Level of Products	Part B Q-6
Employee Growth	Part B Q-1,2,3
Technology Capability	Part B Q-5
Growth Strategy	Part B Q-
Studies on Risk Management	Part B Q-23,24,25
Studies for Customer Satisfaction	Part B Q-21,22

Number of Years in the Sector	Part A Q-1
Academic Level of Management	Part B Q-7
Quality of Personnel Development	Part B Q-11,12,13,14
The Existence of Intangible Fixed	Part B Q-8,9,10
Donation and Social Responsibility	Part B Q-26,27
Sales Growth	Part C Q -1,2
Net Profit Growth	Part C Q - 3,4
R&D Growth	Part C Q-5,6
Intangible Fixed Asset Growth	Part C Q-7,8

Table 3 provides a conceptual framework of which variable is signalled by the questions in the question set prepared specifically for the research. It should be noted that some variables were tried to be measured with more than one statement. During the analysis, these variables were used by taking their averages.

5.5. Analysis and Interpretation of Research Data

Throughout the study, the data collected using a specifically designed question set were analyzed through statistical methods. In this context, the SPSS (Statistical Package for the Social Sciences) software, version 21.0, was utilized for data analysis. As part of the research analysis, the frequency and percentage distributions of the descriptive characteristics of the companies included in the study were first examined. Subsequently, regression analysis was conducted to identify the factors influencing firm value, and an attempt was made to develop a mathematical model. Descriptive Characteristics and Statistical Analysis of Software Companies Included in Research

Among 153 software companies operating on NASDAQ, 97 were selected for inclusion in the study. The frequency and percentage distributions of the questions in the question set of the companies included in the research are shown in Table 4, Table 5 and Table 6.

Table 4: Frequency and Percentage Distributions Regarding the Descriptive Characteristics of Software Companies Included in Research

Descriptive Feature		**Distribution**	
		Amount(f)	**Percent(%)**
Number of Years in Sector	Between 1-10 years	2	2,1
	Between 11-20 years	25	25,8
	Between 21-30 years	42	43,3
	Between 31-40 years	23	23,7
	More than 41 years	5	5,2
Property Status	Sole proprietorship	0	0
	Partnership	97	100
Operational Markets	Local	0	0
	International	0	0
	Both of them	97	100
TOTAL		97	100
Field of Activity	Consultancy	18	18,6
	Software Development	97	100
	Cloud Management	28	28,9
The Industry Served	Health	16	16,5
	Entertainment	11	11,3
	Education	10	10,3
	Finance	12	12,4
	Informatics	49	50,5
	Business Management	36	37,2
	Other	28	28,9

Note: The total number of responses varies for the service area and sector of activity questions, as these were designed as multiple-choice items allowing participants to select more than one option.

As shown in Table 4, the distribution of years spent in the sector by the companies included in the study indicates that the highest proportion falls within the 21-30 year range (43.3%), while the lowest is within the 1-10 year range (2.1%). All software companies analyzed in the research operate under joint ownership. Additionally, they all provide services in both local and international markets. Although only software-producing companies were included in the study, some of these firms also offer consultancy services (18.6%) and cloud management services (28.9%). Analyzing the sectors in which these companies operate reveals that the highest service provision is in the field of information technology (50.5%), while the lowest is in the education sector (10.3%).

Table 5: Frequency and Percentage Distributions on Intellectual Capital of Software Companies Included in Research

Feature		Distribution	
		Amount(f)	Percent(%)
Employee Growth	Between 1-250 people	53	54,6
	Between 251-500 product	27	27,8
	Between 501-750 people	8	8,2
	Between 751-1000 people	2	2,1
	Between 1001 people and more	7	7,2
The Number of Engineer	Between 1-250 people	35	36,1
	Between 251-500 people	7	7,2
	Between 501-750 people	7	7,2
	Between 751-1000 people	23	23,7
	Between 1001 people and more	25	25,8
Technology Capability	Between 1-10 product	26	26,8
	Between 11-20 product	26	26,8
	Between 21-30 product	15	15,5
	Between 31-40 product	12	12,4
	41 product and more	18	18,6
Maturity Level of Product	Between 1-10 product	48	49,5
	Between 11-20 product	19	19,6
	Between 21-30 product	14	14,4
	Between 31-40 product	2	2,1
	41 product and more	14	14,4
Academic Level of Management	Bachelor's degree	46	47,4
	Master	45	46,4
	PhD	6	6,2
TOTAL		97	100

An analysis of Table 5 reveals that, over the past year, most software companies included in the study experienced an increase in the number of employees within the range of 1-250 people (54.6%). The number of engineers was also predominantly within the 1-250 range (36.1%). The technological capability of software companies was found to be distributed equally between 1-10 products (26.8%) and 11-20 products (26.8%). Additionally, the maturity level of most products fell within the 1-10 product range (49.5%). Examining the academic background of top management within the analyzed companies shows that 46 executives (47.4%) hold an undergraduate degree.

Table 6: Frequency and Percentage Distributions on Intellectual Capital of Software Companies Included in Research-2

Terms	Yes	No
	f %	f %
Does the business have any awards?	68 70,1	27 27,8
Are there any patents the business has?	59 60,8	38 39,2
Does the business have a brand?	52 53,6	45 46,4
Does it engage in activities that support the development of business personnel?	88 90,7	9 9,3
Are successful personnel rewarded by the business?	74 76,3	23 23,7
Does the business treat its personnel with care about any discrimination-related issues?	72	25

	74,2	25,8
Does the business conduct a survey that measures staff satisfaction and loyalty?	37 38,1	60 61,9
Does the company have a subsidiary?	81 83,5	16 16,5
Are there organizations where the company is in cooperation?	64 66,0	33 34,0
Has the company entered new markets in the last five years?	37 38,1	60 61,9
Does the company have any offices or subsidiaries in countries identified as Tax Paradise?	26 26,8	71 73,2
Did the business buy any company in 2021?	47 48,5	50 51,5
Does the company pay dividends?	52 53,6	45 46,4
Does the business offer its customers training support for product use?	46 47,4	51 52,6
Does the business care about customer feedback?	73 75,3	24 24,7
Has it fulfilled its commitments to customers in 2021?	85 87,6	12 12,4
Has the company informed about the risks it faces?	97 100	0
Does the company have studies on risk management?	32 33,0	65 67,0
Is there a CSR project in which the business is involved?	67 69,1	30 30,9
Has the business also received any donations or social assistance in 2021?	65 67,0	32 33,0

In Table 6, the frequency and percentage distributions of the software companies included in the study continue to be analyzed to assess their understanding of intellectual capital.

5.6. Research Model

At this stage, the study aims to identify the factors influencing the value of software companies, which form the core focus of the research, and to develop a mathematical model based on these findings. Multiple linear regression methods were employed to construct the model. Before conducting the tests, all variables included in the analysis were examined to ensure their compliance with the assumptions of the multiple linear regression method. These assumptions are set out below (Field, 2009);

- All of the variables must have normal distribution.
- There must be a linear relationship between variables.
- There should be no multicollinearity between the variables.
- There should be no extremes in the observation values.
- Errors of estimates should be distributed normally.
- Must be co-variance (homoscedasticity).
- Mistakes should be independent of each other.

Within the scope of the research, multiple model analyses were conducted using independent variables defined within the conceptual framework to determine the most suitable company valuation model. Among these, the model with the highest explanatory power was selected. The dependent and independent variables used in the analysis are listed below.

Dependent Variable: Company Value / Interest, Depreciation and Pre-tax Profitability (EV/EBITDA)

Independent Variables:

- Employee growth (EG)
- Number of engineers (NE)
- Technology ability (TA)
- Intangible assets (IA)
- Staff development quality (SDQ)

- Growth strategy (GS)
- Studies on risk management (SRM)
- Corporate social responsibility (CSR)
- Sales Growth (SG)
- Net profit growth (NPG)

The EV/EBITDA multiplier was selected from the market-based valuation methods as the dependent variable. Due to the fact that the general approach of market-based methods is conducive to the comparison of the valuation company with similar qualified companies on the market, it was deemed appropriate to choose one of these factors as a dependent variable within the scope of the research.

The main reason for determining the EV/EBITDA rate as an independent variable is to add tax, depreciation and interest costs to the net profit item, it is a ratio that makes the denominator relatively free from the effects and sectoral effects of the operational and financial structure specific to the company and therefore more comparable. Bancel and Mitto (2014) surveyed 10 appraisers in 365 European countries with CFO or equivalent titles to gain some insights into valuation practices. According to the results of this study, 83% of the appraisers used the EV/EBITDA value in the applications.

Chan and Lui (2010) stated that the EV/EBITDA ratio is suitable for industries where cash flow is important and capital expenditures are large and irregular. They have listed these industries as telecommunications, software, energy, utilities, etc. In addition, stressing that capital expenditure requirements will differ from sector to sector, they stated that the EV/EBITDA rate can only be used when comparing companies in the same sector.

The literature was reviewed and the fact that the EV/EBITDA ratio was used in many valuation applications in the software industry was effective in determining the dependent variable of the research as EV/EBITDA (Trusculescu et al., 2015:20, 7; Machholm and Heimann, 2022:18-19). EV/EBITDA rates of 31.12.2021 of the companies that constitute the sample of the research were obtained from https://finbox.com/ .

Table 7: Descriptive Statistics of EV/EBITDA Rate

	N	X̄	SS	Min.	Max
EV/EBITDA	97	74,5	110,24	0,20	365,20

Before applying the multi-linear regression test, it was checked whether the variables showed normal distribution. Then it was examined whether the relationship between variables was linear. These assumptions appear to be appropriate. Then the analysis began. Other assumptions were checked at the analysis stage.

Table 8: Company Value Independent Variables Correlation

		EV/ EBITDA	SDQ	GS	SRM	SG	NPG	NE	EG	IA	CSR	TA
Pearson Correlation	**EV/ EBITDA**											
	SDQ		1,000									
	GS		0,134	1,000								
	SRM		0,016	0,439	1,000							
	SG		0,184	0,273	0,050	1,000						
	NPG		0,066	0,162	0,236	0,339	1,000					
	NE		0,316	0,421	0,361	0,387	0,013	1,000				
	EG		0,209	0,208	0,232	0,073	0,040	0,366	1,000			
	IA		0,394	0,124	0,513	0,067	0,243	0,366	0,337	1,000		
	CSR		0,177	0,348	0,470	0,166	0,166	0,412	0,232	0,308	1,000	
	TA		0,262	0,428	0,355	0,374	0,115	0,702	0,341	0,276	0,464	1,000

According to the corrected R2 value shown in Table 9, independent variables included in the model are shown to explain the dependent variable by 0.76.

Table 9: Company Value Model Summary-ANOVA

Model Özeti			ANOVA	
$R^2_{Adjusted}$	Std. Error of the Estimate	Durbin Watson	F	Sig (p)
0,76	54,24	2,01	31,051	0,000

However, it was concluded that the sig (p) value of the ANOVA test is 0,000 and that at least one of the independent variables significantly affects the dependent variable.

Table 10: Company Value Model Regression Analysis Coefficients

Independent Variables	Standardized * Coefficients Beta	t	Sig (p)	VIF
SDQ	0,295	4,128	0,000	2,027
GS	0,464	7,284	0,000	1,606
SRM	0,402	5,546	0,000	2,082
SG	0,115	1,913	0,059	1,425
NPG	0,404	6,574	0,000	1,499
NE	0,145	1,771	0,080	2,154
EG	0,119	2,006	0,048	1,398
IA	0,152	1,821	0,072	2,381
CSR	0,437	6,682	0,000	1,698
TA	0,243	3,216	0,002	2,266

Not: * Due to the difference in measurement levels between variables, "*standardised beta coefficients*" were used when interpreting the results of multiple linear regression analysis.

Above are the tables showing the results of the multiple linear regression test applied to create the firm value model. Table 8 shows the correlation results of independent variables that affect the company value. The values in this Table and the VIF values in Table 10' are examined together to help understand whether there is a multiple connectivity problem in regression analysis. Correlation values are not greater than 0.800 (Berry and Feldman, 1985) and VIF values are below 2,5 (Allison, etc. 1999) shows that there is no problem of multiple connectivity. Cooks Distance test was performed to check for the assumption that says there is no extreme value. The fact that the maximum value as a result of this test is not over 1 indicates that there is no end value in the research data (Cook and Weisberg, 1982). No extreme values were found in the research data. It has been determined that errors are normally distributed from the generated Histogram Table. Finally, after determining that the observation values have equal variance and the errors are independent of each other, it was seen that there was no problem in the suitability of the research data for multiple linear regression analysis.

When Table 10 is continued to be analysed, it is seen which variables have what kind of an effect on the dependent variable. According to this table;

- In software companies, the quality of personnel development has a significant positive effect on the company value (p= 0,000). The 1-unit standard deviation change on the quality of personnel development causes an increase in the value of software companies up to 295 units of standard deviation.
- The growth strategy of software companies has a significant effect on the company value (p=0,000) and positive effect. The 1-unit standard deviation change on the growth strategy causes an increase in the value of software companies up to 464 units of standard deviation.
- The work of software companies on risk has a significant effect on company value (p=0,000) and positive direction. The 1-unit standard deviation change on the company's work on risk causes an increase in the value of software companies up to 402 units of standard deviation.
- In software companies, sales growth has a positive effect on firm value at the statistical trend level (p = 0.059). This finding is just above the statistical significance threshold, indicating a situation often referred to as "borderline significance" or "trend" in the literature (Di Leo and Sardanelli, 2020; Andrade, 2019). In this context, it has been observed that a 1-unit standard deviation increase in sales growth can be associated with a standard deviation increase of approximately 115 units in firm value. The result obtained shows a relationship trend in favor of the hypothesis and should not completely exclude the random effect (Kwak, 2023).
- Net profit growth of software companies has a significant effect on the company value (p=0,000) and positive direction. The 1-unit standard deviation change over net profit growth leads to an increase in the value of software companies up to 404 units of standard deviation.
- In software companies, the number of engineers shows a positive efect with firm value at a marginal level of significance (p = 0.080). Although this value exceeds the conventional 0.05 threshold, it falls within the range of borderline significance often accepted in social sciences (Di Leo & Sardanelli, 2020; Andrade, 2019). As Benjamin and Berger (2019) suggest, p-values up to 0.10 can be interpreted as marginally significant based on the research context. A one-unit standard deviation increase in the number of engineers is associated with a 145-unit increase in firm value.
- Employee growth of software companies has a significant effect on company value (p=0,048) and positive direction. The standard deviation change

of 1 unit over employee growth causes an increase in the value of software companies up to 119 units of standard deviation.

- In software companies, intangible assets exhibit a positive effect with firm value at the level of statistical trend (p = 0.072). Although this result does not fall below the conventional significance threshold of 0.05, it is situated within the range typically referred to as "borderline significance" or "marginal significance" in the literature (Di Leo & Sardanelli, 2020; Andrade, 2019). Specifically, a one-unit standard deviation increase in intangible assets is associated with an estimated 152-unit increase in the standard deviation of firm value.
- The donation and social responsibilities of software companies have a significant effect on the company value (p=0,000) and positive direction. The 1-unit standard deviation change over donation and social responsibility causes an increase in the value of software companies up to 437 units of standard deviation.
- The technology ability of software companies has a significant effect on the company value (p=0,002) and positive direction. The 1-unit standard deviation change over technology capability causes an increase in the value of software companies by up to 243 units of standard deviation.

According to the applied results of multiple linear regression test, the firm value model is as follows.

$Y = \beta + \beta 1X1 + \beta 2X2 + \beta 3X3 + \ldots. + \beta nXn$

EV/EBITDA = 59,6 + ,295 (SDQ) + ,464 (GS) + ,402 (SRM) + ,115 (SG) + ,404 (NPG) + ,145 (NE) + ,119 (EG) + ,152 (IA) + ,437 (CSR) + ,243 (TA)

6. Conclusion And Recommendations

The growth of knowledge-based industries over time has raised several questions regarding the valuation of firms operating in these sectors. Key concerns include identifying the most appropriate valuation methods, determining the factors influencing company value, and understanding the criteria for selecting these methods. The primary reason behind these questions is the distinct asset structure of knowledge-based industries compared to traditional industries. Factors such as the dominance of intangible assets, reliance on internet-based operations, and the prevalence of network effects make valuation a critical issue for companies in these industries. Traditional valuation methods often prove insufficient, as they fail to incorporate various elements that significantly impact firm value, necessitating a reassessment of these approaches.

The software industry is a prominent example of a knowledge-based sector, where the primary activity is software development. Various intangible factors, including the software development process, storage conditions, and marketing strategies, influence a firm's value. To accurately assess firm value, these factors must be thoroughly analyzed. The results of the multiple linear regression analysis conducted in this study indicate that intellectual capital has a significant impact on firm valuation. In knowledge-intensive sectors such as software, the prominence of technology and the highly competitive market environment compel firms to develop effective strategies and differentiate themselves from competitors. According to the findings, factors such as employee growth, number of engineers, technological capability, intangible assets, growth strategy, quality of staff development, risk management initiatives, corporate social responsibility activities, sales growth, and net profit growth have a positive and significant impact on firm value. These results highlight the crucial role of intellectual capital components in the development and valuation of firms in the software industry.

When evaluated in general, the research results gave satisfactory answers to the purpose of the study and the research questions developed within the framework of this purpose. Therefore, it is possible to say that the objectives of this study have been achieved. The results are also consistent with the results obtained by De Alwis (2007), which is in literature and sheds light on this study. It is thought that the results obtained fill important gaps in the finance literature on the factors affecting firm value in the software industry, which is one of the knowledge-based sectors where intangible assets are concentrated. Therefore, it can be stated that the findings obtained provide important contributions to knowledge-based sectors.

In addition to all these, it has been observed that there is a great deal of focus on the importance of intellectual capital and its components in literature. However, it has been observed that the valuations of knowledge-based companies are generally made by applying traditional methods. In the future, it is thought that paying attention to the measurement of intellectual capital, especially in the valuation studies to be carried out in knowledge-based companies, will make a significant contribution to the development of literature. In this study, firstly, the factors affecting the values of the firms operating in the field of software in the BIST IT index were tried to be determined. However, due to the small number of firms and insufficient data, the desired results could not be reached. Due to these limitations, the study had to focus on software firms traded on NASDAQ. However, conducting large-scale research on software companies in Turkey, in which the views of the sectoral leaders are taken, will further advance the studies on the effect of intellectual capital on firm value at the national level.

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