

VALUATION OF INTELLECTUAL CAPITAL BASED ON BARUCH LEV'S KNOWLEDGE CAPITAL EARNINGS METHOD

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Abstract

In the scope of the present study, I deal with intangible assets and present those intangible assets that are accountable by the Hungarian accounting system and international financial reporting standards. The article mentions intangible assets existing in the everyday life of enterprises, although the accounting systems cannot fully present them for various reasons in their balance sheet. I present the intangible assets separately which have different statement ways and different future evaluation methods in various accounting systems. As numerous economists have tried to develop different methods/models for measuring the above assets, the study presents Baruch Lev's knowledge capital earnings model through an example of a company applying international financial reporting standards. The model divides the earnings of the company into three parts, earnings achievable through physical, financial and intangible assets. The model considers the value of intangible assets (intellectual capital) as a residual value remaining the deduction of the earnings linked to physical and financial assets. For the illustration of this method, a free cash flow-based model has been developed, which was solved in several variations using the Monte Carlo simulation, and the method applicability was demonstrated by analysing the simulation results of the practical example.

Keywords: *Intellectual Capital; Intangibles; Valuation; IFRS; Hungarian accounting system; Baruch Lev's Knowledge Capital Earnings Method*

JEL Classification: *M4*

Introduction

Currently, intellectual capital plays a continuously increasing role in the life of enterprises. In the literature, it is referred to as intellectual capital or intangible assets as well, but irrespectively of the designations, they are non-material assets, what the companies try to measure through their accounting systems and present in their financial statements with more or less success. Lev and Daum (2004) demonstrated the increasing presence of intellectual capital in business life. As of the 1980s, there have been growing differences between the market and book value of companies listed in the stock exchange. The difference between the two values began to be treated as a sort of invisible asset, only a part of which appears in financial statements. It has been found amongst the companies of the S&P500 index that the calculated value of intellectual capital/intangible assets has increased from 38% to 62% in nearly ten years, while their book value declined from 62% to 38%.

Researchers dealing with intellectual capital have developed different measurement methods and models. However, it can be established that intangible assets

presented through the accounting system do not represent the total intangible assets of companies. According to certain researchers, the solution to this issue could be the development of a new accounting system. Consequently, several studies have been prepared, which compared accounting systems, putting special emphasis on US GAAP and IFRS. The studies sought to find out which accounting systems qualify as more useful and informative for investors, and which systems present the intellectual capital in such a way that it approximates better its real value. A number of similar questions could be investigated, but it is highly probable that the real intellectual capital of companies significantly exceeds the book value of intangible assets represented by them.

1. Intangible assets/Intellectual capital

“For a public limited company to operate, it requires a number of assets. Many of these assets are tangible, while others are intangible”. (Bearly-Mayers, 2005 p.5) What is an intangible asset or intellectual capital, and what is the difference between the two terms? The term intellectual appears mostly in management literature, while the term intangible assets are used by accounting literature. (Lev, 2001) Many researchers have already tried to determine and compose the definition of intangible assets and intellectual capital. Al-Ali (2003) refers to intellectual capital as a hidden resource used by the company to produce new products and services. According to Steward (1994), intellectual capital is an intangible asset of knowledge and information. Glautier et al. (2011) refer to intangible assets as assets that do not possess a physical appearance and future economic benefits originating from them cannot be reliably measured. According to Lev (2001), intangible assets are assets that include economic benefits without a physical and financial appearance. For example, a famous brand name cannot be classified as a physical (tangible) asset, yet it can have considerable value and might allow the company to achieve higher income and increase its earnings. (Lev, 2005)

The current economy operates more like a service- and knowledge-based economy than an industrial economy. Therefore, the majority of businesses can increase their earnings through their intangible assets or intellectual capital (McCracken et al., 2018). Accordingly, numerous studies deal with the measurement of intangible assets, and they elaborated various methods for determining the value of these assets. In the scope of my research, the Baruch Lev method is demonstrated through a Hungarian stock exchange listed company.

The majority of researchers agree that accounting systems have limited recognition of intangible assets in their financial statements, as opposed to material, tangible assets. Intangible assets not represented in accounting also create value for companies. According to Lev and Zarowin (1999), accounting systems are incapable of properly managing intangible assets and the value of these assets is not properly presented in the financial statements. The question may arise that if accounting systems are incapable of proper valuation, to what extent are different valuation models and methods that operate based on financial statements able to properly measure and evaluate intangible assets? (Damodaran, 2006).

1.1. Intangible assets in the Hungarian accounting system

In Hungary, the framework of the accounting system is provisioned by Act C of 2000. The Accounting Act determines which assets can be recognized as intangible assets, giving companies relatively few choices. According to the law, *“intangible assets within the balance sheet shall include non-material assets (rights representing assets except for rights related to real estate, intellectual property, goodwill), and advance payments on intangible assets, as well as value adjustments of intangible assets”*. (Act C of 2000) The Accounting Act allows the company to present the capitalized value of formation and reorganization and the capitalized value of experimental development among intangible assets (Fenyves et al., 2018). The Hungarian Accounting Act accurately lists and specifies the assets, which can be presented within the balance sheet; however, these assets are only a fraction of the actual non-material assets. The Hungarian Accounting Act also stipulates that planned depreciation shall be accounted in the case of intangible assets, which do not have a valid, useful life, in which case the stipulations of the law determine the depreciation. Consequently, after a certain period, the accounting value of non-material assets presented by the company may be reduced to zero, even though it contributes to the earnings of the company (Fenyves et al., 2018).

In some cases, the company is allowed to decide on the appearance of intangible assets. For example, the company may capitalize the expenses of formation and reorganization based on its own decision and the same is true of direct costs associated with experimental development. In this case, the capitalized value of formation and reorganization and experimental development appear in the balance sheet as intangible assets, and then they are depreciated through the planned depreciation of the asset.

It is important to mention that the Hungarian accounting system allows for value adjustment of certain intangible assets (intellectual goods and rights representing assets), through which it seeks to present them separately in the balance sheet with their *“real”* value among intangible assets. It is necessary to be aware of the market value to determine the amount of value adjustment, which however cannot be determined in all of the cases.

1.2. The appearance of intangible assets within the system of international financial reporting standards

As opposed to the Hungarian accounting system, international financial reporting standards (subsequently IFRS) do not stipulate the scope of assets that qualify as intangible assets. IFRS indicate the definition of the asset and then the definition of intangible assets. If an asset meets the definition criteria of assets or intangible assets according to the IFRS, it may be presented as an intangible asset in the financial statements (Böcskei et al., 2017)

The criteria of assets to be presented are controllability, i.e., the asset shall be owned and controlled by the company, it shall be the result of past events, and future benefits shall be associated with it, which is also referred to as probability criteria by IFRS. (Madarasiné Szirmai - Bartha, 2016) Regulations regarding the presentation and valuation of intangible assets are dealt with by IAS 38 Intangible Assets and IFRS 3 Business Acquisition Standards. According to the standard, intangible assets are without physical substance and are identifiable non-monetary assets, can be transferred separately from other assets and derive from contractual or other rights. (Lakatos et al., 2013)

If in the course of the analysis of expenses of establishing an intangible asset they are found to meet the mentioned criteria, then the expenses are capitalized and the intangible asset can be presented in the financial statements. In any other case, the incurred expenses involve the earnings of the given year.

According to the IFRS, intangible assets can be acquired, or they can be results of self-creation. Acquired assets can usually be included with intangible assets. However, in many cases, the question is, whether they possess a future economic benefit. Intangible assets acquired in the context of a business acquisition require more investigation. In the course of the acquisition process, assets of the acquired company might include items that were present within the company without physical appearance, but did not meet the criteria for intangible assets and thus were not recognized in the financial statements of the company. In this case, the asset should be included in the consolidated financial statement of the company (Lakatos et al., 2013).

Upon the acquisition of a company, goodwill also arises in the case of internally produced assets; this is governed by IFRS 3 (IFRS 3 Business Combinations). Goodwill is the difference between the net asset value and the paid price of the acquired company. The non-material assets mentioned above are identified among the net asset values of the acquired company. Consequently, goodwill could also mean the value of assets that were not identified during the acquisition. The difference between the net asset value and the paid price of the acquired company is reduced by the new intangible assets received in the course of the acquisition, which could not be presented in its financial statements (for example, an internally produced client list) (Lakatos et al., 2013), but which can be disclosed in the consolidated financial statements of the company during the acquisition. If we assume that the acquisition value represents the actual value and all intangible assets were identified during the acquisition, the goodwill is zero.

When an internally generated intangible asset related to research and development is created, IFRS distinguish between the two phases and only allow capitalization of development costs if the following conditions are met (IAS 38 Intangible Assets):

1. Technically feasibility.
2. The company can use or sell the asset.
3. There is an expectable economic benefit in the future.
4. Intention and ability to finalize the development.
5. Costs are reliably measurable.

In contrast to the Hungarian accounting rules, IFRS does not allow the capitalization of the expenses of formation and reorganization, which can only be accounted to the earnings of the given year.

By the above, it may appear that IFRS set stricter criteria for the accounting process for intangible assets and that expenses that emerged for the creation of intangible assets are more likely to be accounted to the earnings of the given financial year. We can conclude from this - perhaps erroneously - that in Hungarian accounting, more intangible assets can be identified in the financial statements than by stricter international financial reporting standards. In their study, Sahut et al. (2011) investigated 1,855 companies, which operated in different European countries and prepared their financial statements according to their local accounting systems before their transition to IFRS. The study analysed the period before and after the transition and found that the presence of intangible assets and goodwill in the

financial statements was 21% higher following the transition to IFRS. It is likely that if similar research was conducted in Hungary focusing on the financial statements of companies that have recently transitioned to IFRS, we could draw a similar conclusion. This may happen even though IFRS may appear to recognize certain assets as intangible assets in a more restricted manner.

1.3. Intellectual capital within the company

It has been mentioned earlier that the majority of companies rely on their intangible assets or intellectual capital to increase their earnings (McCracken et al., 2018). These assets were divided into three main groups by Stewart (1997):

1. Human capital
2. Structural (or organizational) capital
3. Relational capital

Human capital includes the skills, abilities, experiences, and knowledge that employees possess (Jarboe, 2007). Accounting systems also try to trace the human capital, for example in the case of Hungarian accounting, the value of company formation and reorganization, and the value of research and development can be presented as intangible assets, where - besides other direct costs - wage costs of the employees concerned are also capitalized and appear as intangible assets on the 'assets' side of the balance sheet. In the case of IFRS, the situation is similar when development costs are capitalized as intangible assets once the specific criteria have been met. However, accounting systems are unable to represent all employee knowledge, professional competence, ability, and experience. Wage costs of employees do not necessarily reflect the value they create. Pasban and Nojed (2016) consider human capital to be the most difficult to measure and control amongst capital types.

Organizational capital is a knowledge that is possessed by the company; it might involve procedures, organizational processes, and cultures (Jarboe, 2007).

Relational capital may apply to any external relationship that the company possesses (Jarboe, 2007). In the case of relational capital, accounting systems also have the ambition to properly evaluate and represent it (for example, the above-mentioned client list, trademark and brand name); the value of this capital includes the network of relationships with customers and clients. It is not the 'logo' alone that represents value itself, but the circle of customers behind it who are willing to buy and pay more for a given product just because it has a certain brand.

2. Data and methodology

In the scope of the research, I determined the value of the intangible assets/intellectual capital of MOL Hungarian Oil and Gas Plc. (MOL) using the Baruch Lev method, which is based on the earnings related to "invisible assets" (intangibles). For the calculations, the 'mc2d' two-dimensional Monte Carlo simulation module of the R statistical system was applied (Tarnóczy et al., 2011). The data required for the calculations was downloaded via the EMIS database.

2.1. Introduction of MOL Plc.

MOL Plc. was established in 1991 and has since become one of the major oil and gas companies in Central Europe. Based on its revenue, the company is considered

to be the largest company in Hungary (BÉT, 2017). The consolidated financial statements, which refer to the accounting date of 31st December 2017, it possessed 4,321,700 million HUF of total assets, 4,130,320 million HUF of net income and 316,410 million HUF profit. Most of the revenue originates from Hungary, but the company also generates significant income from Croatia, Slovakia, Italy, and Austria (MOL, 2017).

2.2. Baruch Lev's knowledge capital method

According to *Daum (2001)*, Baruch Lev's knowledge capital method assumes that three types of assets of the companies are involved in the creation of earnings:

1. Physical assets (tangible assets)
2. Financial assets (stocks)
3. Immaterial assets (intellectual capital)

Namely, the earnings achieved by the company are based on these types of assets. Physical and financial assets of the above three asset groups are based on the values represented by the financial statements of the company (*Daum, 2001*). It is assumed that in the case of valuation of physical/tangible assets, the company seeks to present them at their actual value in its financial statements. As MOL Plc prepares its financial statements by the IFRS, physical assets are valued based on the valuation methods applied by the IFRS. IFRS, through the requirements of different standards, strive to present tangible assets at their actual value. The situation is similar in the case of financial assets, where the market value of the assets is determined year after year, and the revaluation of assets takes place in the financial statements.

The method is based on the following formulae:

$$\text{Earnings to physical assets} = \text{value of physical assets} * \text{expected rate of return on physical assets}$$
$$\text{Earnings to financial assets} = \text{value of financial assets} * \text{expected rate of return on financial assets}$$
$$\text{Earnings to intangible assets} = \text{value of intangible assets} * \text{expected rate of return on intangible assets}$$

(Wall et al., 2004)

According to the method, earnings of the company have to be divided into three parts and assigned to the assets that had a role in their creation. Calculations are carried out with the following four steps in mind:

Step 1: Determination of the earnings created by physical/tangible assets.

Step 2: Determination of earnings created by financial assets

Step 3: Determination of the earnings created by intangible assets, which is the difference between the total earnings of the company and the previously determined earnings originating from physical and financial assets.

Step 4: The value of intangible assets is the ratio of the earnings originating from intangible assets and the expected rate of return on intangible assets (Tarnóczy – Fenyves, 2018).

According to Baruch Lev, for determining the expected rate of return on financial assets, the returns of the 10-year government securities (Daum, 2001) have to be taken into consideration, which is 3.02% in our case (Állampapír, 2019).

The Return on Assets (ROA) index was applied to determine the expected rate of return on physical assets. The first 48 companies operating in Hungary were selected from a list where they were ranked according to their net sales revenue to determine the value of the index; their ROA indexes were averaged, which is 7.99%. Companies were selected that are assumed to possess a larger amount of intangible assets based on their activities to determine the expected rate of return on intangible assets. Accordingly, the ROA indexes (2017) of companies operating in biotechnology research and development and software development industry were averaged, which is 9.94%.

2.3. Monte Carlo simulation

For the solution of the model compiled for company valuation, the Monte Carlo simulation was applied, which has been widely used in the past decades. The method is utilized both in statistics and economics (*Chib - Greenberg, 1996*). The simulation helps determine the earnings originating from intangible assets, which is the basis of the determined value of intangible assets (intellectual capital). For a more accurate determination of the value, forecasts were made with the assets and liabilities of MOL Plc. A triangular distribution was applied, which is a special case of the beta distribution to produce random numbers required for forecasting. Forecasts were made for the next five years (2018-2022). The normalized earnings for tangible and financial assets were determined using the forecasted and past (2012-2017) values (10 years). Two thousand runs were performed with the simulation.

3. Evaluation of results

Following the simulation, there were 2,000 data available for analysis for each variable. First, the basic statistical characteristics of the most important variables were calculated (minimum, first quartile, median, third quartile, maximum, mean, standard deviation) for the normalized earnings, tangible assets, financial assets, and intangible assets, as shown in Table 1.

Table 1 shows the extent which the examined variables have regarding the four quartiles. It is true for every variable that higher standard deviation occurs in the lower and upper quartiles. The table also shows that there is little difference between the median and mean in the case of all variables, suggesting that the values show nearly normal distribution. Based on the mean of each variable, it can be stated that most of the normalized earnings (62%) are generated by intangible assets, as clearly illustrated in Figure 1. Table 1 also shows that the high standard deviation of the normalized earnings is reflected in the intangible assets. This might be the consequence of the fact that the earnings of intangible assets are determined on a 'residual basis' and high differences are transformed into the new value.

Table 1: Main statistical characteristics of normalized earnings

million HUF

Statistical properties	Normalized total earnings	Normalized earnings of tangible assets	Normalized earnings of financial assets	Normalized earnings of intangible assets
Minimum	-1 464 744	98 970	15 926	-1 655 285
1 st quartile	88 604	136 115	25 299	-98 608
Median	473 701	150 069	29 044	289 744
3 rd quartile	865 281	165 837	33 119	686 177
Maximum	2 178 852	221 836	49 304	1 986 178
Mean	472 397	151 080	29 421	291 895
Standard deviation	584 323	20 729	5 628	585 067

Source: own editing based on calculated data

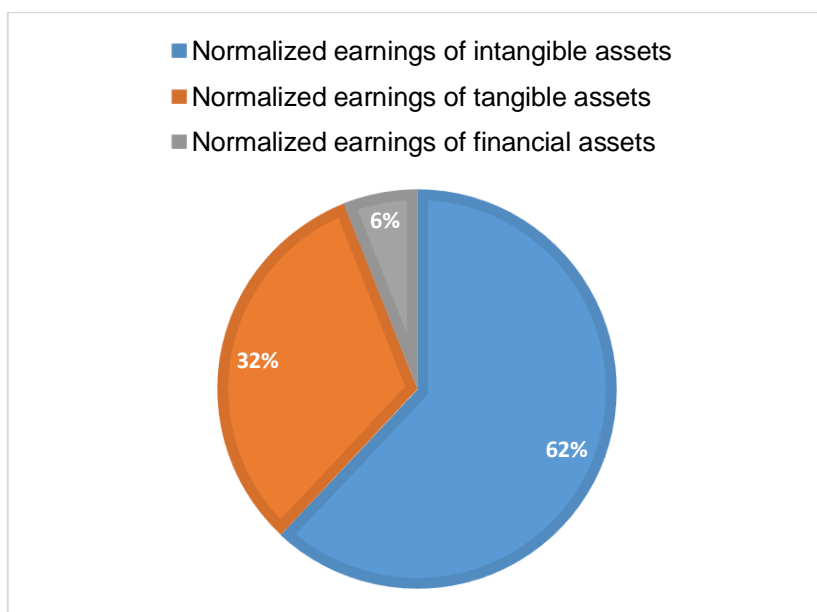


Figure 1: Distribution of normalized earnings amongst tangible, financial and intangible assets based on their calculated mean values

Source: own editing based on calculated data

Essentially, normalized earnings are not generated by the intangible assets that the company has presented in its financial statements, but by the intellectual capital that the company has not disclosed, because the accounting systems do not support their representation, and in some instances of the IFRS. Distribution of normalized earnings also shows that intangible assets generate a higher portion of the earnings for the company.

Table 1 shows that the earnings generated by intangible assets can also be negative. Therefore, with the help of a normal distribution function, the probability of

occurrence of different positive values for the earnings of intangible assets has been examined, as shown in Table 2.

Table 2: Probability of occurrence of the normalized earnings of intangible assets

Normalized earnings of intangible assets (million HUF)	Probability of occurrence
> 0	69.11%
> 100 000	62.85%
> 250 000	52.85%
> 500 000	36.10%
> 750 000	21.68%

Source: own editing based on calculated data

Table 2 shows that there is a 70% chance for intangible assets to generate positive earnings. The negative earnings were due to the large fluctuation in the basic data and its significant standard deviation. For the model for approaching reality as close as possible, the substantial standard deviation was not reduced, and this led to the possible occurrence of negative values upon the utilization of the random numbers. Although the probability for normalized earnings of intangible assets to be higher than zero (positive) is close to 70%. However, there is only approximately 36% probability for the earnings of intangible assets to exceed 500 000 million HUF.

Table 3 demonstrates the normalized value of intangible assets. The normalized value of intangible assets is equal to the ratio of the earnings generated by intangible assets (normalized earnings of intangible assets) and the expected return on intangible assets. Determination of the expected returns was also carried out using the simulation. The normalized value of tangible, financial and intangible assets was also evaluated with the basic statistical properties used earlier.

Examination of the mean values clearly shows that intangible assets account for the majority of the assets of the company, even though different findings were recorded upon the analysis of the financial statements. This suggests that the company has an amount of intellectual capital that cannot be shown by IFRS. The negative number representing the normalized value of intangible assets indicates that there might be cases when the book value of assets exceeds their actual value.

Figure 2 shows that according to the data calculated via the described method, intangible assets/intellectual capital accounts for more than half of the assets of the Plc.

Table 3: Main statistical characteristics of the normalized values of tangible assets, financial assets and intangible assets

Statistical properties	Normalized earnings	million HUF	
		Normalized earnings of tangible assets	Normalized earnings of financial assets

Minimum	1 781 753	627 513	-42 047 946
1 st quartile	2 055 422	883 644	-917 516
Median	2 157 796	968 811	2 802 170
3 rd quartile	2 266 457	1 059 958	7 014 367
Maximum	2 752 418	1 421 016	45 805 680
Mean	2 168 014	975 166	3 376 096
Standard deviation	155 830	127 687	7 537 160

Source: own editing based on calculated data

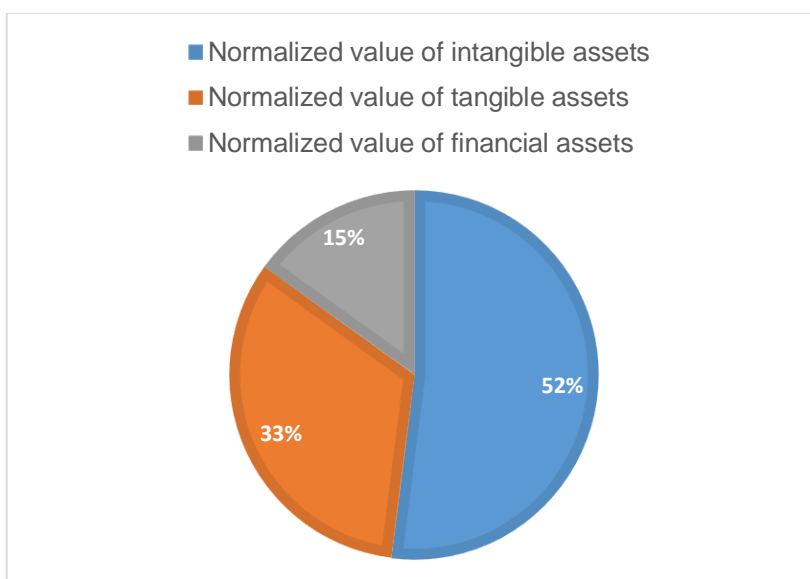


Figure 2: Distribution of the normalized value of assets based on the calculated mean values

Source: own editing based on calculated data

Regarding the normalized value of intangible assets, probabilities of occurrence were also calculated, which are demonstrated in Table 4.

Table 4: Probability of occurrence of the normalized values of intangible assets

Normalized value of intangible assets (million HUF)	Probability of occurrence

> 0	67.29%
> 100 000	66.81%
> 250 000	66.08%
> 500 000	64.86%
> 1 000 000	62.37%
> 2 000 000	57.24%
> 3 000 000	51.99%

Source: own editing based on calculated data

Table 4 shows the probability of the normalized value of intangible assets to be above zero is 60%. Even the scenario when the normalized value of intangible assets exceeds 3 million HUF – which is higher than the median value – is above 50%.

Conclusions

Intangible assets pose a challenge for both investors and accounting professionals, but also corporate evaluators. This challenge does not only concern their measurement but also their management. Currently, it is usually not argued that knowledge has a value-creating role. Since knowledge is utilized through people in the course of corporate activity, dealing with the workforce and human resource management play an increasingly important role. It is also not disputed anymore that external stakeholders of the company also contribute to the creation of corporate value. The third element is organizational capital. If we accept the definition of system theory and cybernetics according to which structure is the carrier of systematic capabilities, the role of this 3rd element is not debatable either.

It is also necessary to deal with the value of intellectual capital because we seek an answer to the emerging difference between market value and book value. This difference might prove to be quite significant from time to time.

The carried out calculations confirm that the presented model might be suitable for the determination of corporate intellectual capital. It was successfully demonstrated that intangible assets presented and not disclosed in the financial statements represent a very significant proportion in the case of the investigated company. The resulting value can be considered significant even if we take into account that the findings of the model might be subject to inaccurate estimation. However, further refinement of the model is also required as the obtained values show a significant standard deviation. The results are also influenced by the adequately accurate estimation of parameters used for the calculations. A more accurately elaborated model and better estimation of parameters, or the use of other probability distributions, might result in more reliable findings.

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