VALUATION OF INTANGIBLE ASSETS IN THE MANUFACTURING INDUSTRY

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Abstract: From an economic and psychological point of view, building and maintaining a good reputation is essential for any branch of economic activity. This work evaluated goodwill using the weighted average return on assets method, WARA. This is according to the average company in the manufacturing industry in the Czech Republic between 2016-2020. The average enterprise was created by filtering enterprises determined according to the classification of economic activities of CZ NACE from section C. These data were transformed into a single entity valued on an accounting basis, and the value of its goodwill was determined. This value was determined from an accounting point of view as the difference between the revenue value of the business plant and the asset value of the business plant. The benefit is the value of goodwill expenses in connection with strengthening the competitive advantage in the market. The limitation of this work was determining which companies should filter out from the list of accounting data completely and which to keep. Further research could examine companies in individual subgroups in the manufacturing industry and other sections of the classification of economic activities.

Keywords: Intangible assets, goodwill, intellectual property, profitability, assets, liabilities.

1 Introduction

The accelerated pace of economic development, the digital revolution and the internationalization of business meant for some entities the creation or acquisition of intangible assets, which are becoming increasingly important for economic prosperity and for determining the global value of the enterprise, and also become an essential stimulus for the creation of added value (Cosmules et al., 2021). The company's assets are divided into financial, tangible and intangible. In particular, the valuation of intangible assets is a challenging task for companies, although in some cases, the obligation to value assets in the Czech Republic is imposed by law (Krulický, Machová and Rowland, 2020). A significant and ever-growing part of corporate assets comprises intangible assets. Despite the growing importance of internally generated intangible assets, they are mostly absent from balance sheets and other corporate statements (Lim, Macias, & Moeller, 2020).

Business plants need to gain a competitive advantage in an interconnected global market. Organizations look for these benefits in all areas; therefore, it is understandable that their areas of interest also apply to tangible and intangible assets and their valuation. Unlike tangible assets, the valuation of intangible assets is very individual and dependent on their nature and specific characteristics. In addition, intangible assets directly rely on their carrier economically and in terms of riskiness. Different methods based on comparison or cost or income approaches are mainly used to estimate intangible assets (Štefánková, 2017a). From a practical point of view, the WACC method, which uses the average cost of capital, is prevalent. One of the other methods that can also be used is the WARA method, which is based on the added value and return on the assets themselves (Schüler, 2020).

Every business has a natural interest in protecting its assets, and this tendency is no less important in the vulnerable area of patent protection. Competitiveness in the protection of new technologies in the Czech Republic is significantly increasing compared to the over-declaration of European patents, thus indicating a significant improvement in this protection in our national market (Štefánková, 2017b). The majority of the source of wealth creation, not only in industrial fields, can be summarized under the same denominator, namely intellectual property. Private individuals' and businesses' financial and economic stability is closely linked to this form of property in business, career and personal life. Another no less important point in the evaluation of this area is also the issue of license fees and their possible relief (Havier, Jančovičová and Bartoš, 2017). Also, overpriced license fees and, conversely, undervalued ones are a significant risk for companies from a financial and legal point of view (Trappey et al., 2021). This trend does not avoid any sector of the manufacturing industry or other sectors of the national economy. Characteristic features and different issues, such as construction technologies, also cause uniqueness in the field of valuation. However, their valuation plays a vital role in the further development, transactions and commercial use of these technologies (Hong et al., 2010).

This article differs from others in emphasizing current economic and technological trends, the individuality of intangible asset valuation, specific valuation methods such as WACC and WARA, patent protection and royalty issues, and uniqueness in construction technology. This approach provides a deeper and more practical insight into the problem of intangible assets, which may be more applicable to the reader in actual business conditions. This article highlights the impact of accelerated economic development, the digital revolution and the internationalization of business on the creation and valuation of intangible assets. The article specifically points to the fact that internally generated intangible assets are often not included in balance sheets and corporate statements despite their growing importance. While all articles discuss different methods of valuing intangible assets, this article focuses more on the WACC (weighted average cost of capital) method and its popularity in practice. It also mentions the WARA (weighted average return on assets) method and its focus on value addition and return on assets.

The article aims to apply the valuation of intangible assets, specifically the WARA method and its approaches, in the manufacturing industry in the Czech Republic between 2016 and 2020.

Research question 1: How can the practical application of the average weighted return on assets method benefit the manufacturing industry in the specified period in the Czech Republic?

Research question 2: Why is this method suitable or, on the contrary, unsuitable for application in the processing industry in the Czech Republic?

2 Literature review

In today's globalization and rapid change era, businesses have to deal with several externalities and internal influences that increase their demands. One of them is necessary innovation in new technologies, automation and the introduction of robotic systems (Vrchota et al., 2020). According to the Classification of Economic Activities, the monitored industries can be classified into four primary groups, one of which is the manufacturing industry (Czech Statistical Office, 2022). According to CZ-NACE, some companies included in this manufacturing industry group have already taken their path to innovation. Other lean production process innovations are being introduced (Klečka, 2018). Glova et al. (2022) also analyses the effect of intangible assets on firm value in the manufacturing industry and confirm that this causes an increase in market capitalization. Innovations are necessary for global investors in development, research, and market valuation. Investors mainly form their expectations in intellectual property valuation according to comparable companies. This is done by observing the essential industrial unique features of patents or trademarks and their influence on the value of the company and the valuation of its assets (Dosso, Vezzani, 2020). However, in some countries, the main problems of asset valuation are the unstable market environment and the often-unprofessional behavior of appraisers (Cheloti, 2021). In Czech legislation, this problem is minimized by legal measures and regulations. Above all, Act No. 254 /2019 Coll.

Mercurio and Kim (2017) also delve into international patent rules and legal protection challenges. They advocate for a systemic and agile approach from legislators, urging them to seek new solutions within the realm of patent protection proactively. This underscores the need for policymakers to stay abreast of the evolving landscape of intellectual property and adapt their strategies accordingly.

Asset pricing is a trade-off between risk and return. Risk thus plays a fundamental role in the actual asset valuation process. This consists in determining the discount rate and the overall orientation of investors in the valuation of their assets. To arrive at the price of this asset, the expected return must be discounted by the rate of return demanded by investors (Asgar, 2021). Campbell (2000) discussed the stochastic discount factor and its role in economic asset valuation. He presented the opinion that actual interest rates limit this discount factor and risk premiums, on the contrary, limit their volatility. Ionita and Dinu (2021), dealing with listed companies in Romania, point to the negative effect of innovative intangibles on sustainable growth rate and firm value.

In the long-term development of enterprises, the input of intangible assets plays a significant role as a tool for innovation in the knowledge economy (Li et al., 2019). Intangible assets form a substantial part of the assets of both the private and public spheres. They are also one of the essential factors of competitive advantage and one of the greatest assets of modern society. Knowledge and skills generate intangible assets that have become irreplaceable economic resources. And the very reason it is impossible to touch this property physically makes it problematic regarding its valuation. The development of intangible asset and intellectual capital valuation methods has significantly increased since 1988, and this trend continues. However, many intangible asset valuation methods have already been described (Osinski et al., 2017). Dohnal et al. (2019) addressed the importance of Goodwill in a world that is considered an integral part of society and its values. For the scientific community, the value of corporate Goodwill is a constant problem, a phenomenon and a challenge that always offers to find new solutions (Podhorská et al., 2019). According to Tahat et al. (2018), intangible assets are of fundamental importance in increasing companies' performance. However, we must state that the current accounting framework is not a sufficient source of information about intellectual capital. Even among the professional public, there is no agreement on a single correct method of calculating intellectual capital, which could be considered a generally acceptable model (Atalay et al., 2018). Among other things, it is necessary to think that, except for the trademark, the value of industrial property decreases over time (Malý, 2002). Property rights that include intangible assets and industrial rights are valued according to Act No. 151/1997 Coll. on property valuation (Czech Republic, 1997).

Among the primary methods used to evaluate intangible assets as intellectual capital are the market, income, cost and option approach methods as quantitative approaches. On the contrary, the qualitative approaches mentioned by the author are based on point evaluation or indicators. However, a specific difference exists between intangible assets and intellectual capital, as Pastor et al. (2017) refer to the Organization for Economic Cooperation and Development. They explain this difference by classifying intangible assets as non-monetary assets without physical substance that are held, leased, or administratively used for production use. In contrast, intellectual capital is the estimated economic value of a company's intangible assets (Pastor et al., 2017).

According to Svačina (2010), two reasons exist for such a high number of intangible asset valuation methods. Above all, I will discuss these assets' diversity, specificity, and innovation within the newly acquired knowledge framework. However, all methods are based on three approaches, as Pastor et al. (2017) reported. However, Svačina (2010) classifies the option approach under the yield method, as he finds comparable signs with it but performs it using a different technique.

Intangible asset valuation methods also have their pitfalls, as discussed by research into evaluating these assets at one of the international conferences. Huang and Huang (2017) addressed the problems of these three basic methods. With the income method, the authors see the main difficulties in determining and calculating excess income, and selecting the discount rate can also appear very difficult. The market method is very complex when valuing a company, and it is challenging to determine financial indicators and coefficients for self-evaluation. Furthermore, the reliability of relevant data on the securities market could be more questionable or at least debatable. It also needs to be clarified, or at least very difficult, to determine how to use information from listed companies to assess the value of unlisted companies. Finally, the study also addresses problems with the cost method of valuing intangible assets and determining the actual use of these assets (Huang and Huang, 2017).

Although many methods are available for determining the value of intangible assets, the discounted cash-flow approach is most often used in practice. Certain limitations may arise in determining the appropriate discount rate. Carlin (2010) proposes an approach based on the weighted average return on assets (WARA) method. Under this method, a business plant's weighted average cost of capital (WACC) should equal the plant's weighted average return on various assets (WARA). This approach is thus adequate for determining the required return or discount rate of intangible assets. Lipovská (2019) also mentions this method in her work concerning the calculation of goodwill as the difference between the company's purchase price and the assets' net value.

The literature review focuses on the meaning and valuation of intangible assets in the current business environment, where innovation and automation are critical success factors. The valuation of these assets represents a trade-off between risk and return, where the discount rate is a crucial factor. Intangible asset valuation methods have their pitfalls. The income method is complicated because of the determination of excess returns and the discount rate. The market method is complex due to the need for more financial indicators and coefficients. On the other hand, the cost method presents a problem when calculating the actual use of assets. The discounted cash flow (DCF) method, which is most often used in practice, was chosen for the calculation. This method is appropriate because it considers expected returns and discounts them to present value, allowing for a realistic assessment of the future benefits of intangible assets. The discounted cash-flow approach is reliable, mainly thanks to the weighted average return on assets (WARA) method. WARA ensures that the weighted average cost of capital (WACC) equals the weighted average rate of return on the various assets within the business, which facilitates the determination of the required rate of return, or discount rate.

3 Data and methods

Data taken from the Cribis database from Crif—Czech Credit Bureau will be used and analyzed in this work. This will be the accounting data necessary for processing the balance sheet and profit and loss statement for companies operating in the manufacturing industry from 2016 to 2020. According to the CZ NACE classification of economic activities, this is section "C" Manufacturing industry. Data from subgroups 10 to 33 from 2016-2020 will be used.

The accounting data will be divided into individual years and cleaned of companies with meaningless values in their data, inactive or liquidated. This data will be processed using Excel software, where a balance sheet and a profit and loss statement will be prepared from the assessed companies in the processing industry and individual years. With this procedure, the data will be merged and further analyzed as an average enterprise in the manufacturing industry.

As a next step, the valuation of the assessed average enterprise in the manufacturing industry will be carried out using the income method of capitalization of net income. The calculation of the

revenue value of the enterprise will be carried out according to the following formula:

$$HP = \frac{T\check{C}V}{i_k} \quad (1)$$

Where: *HP* – enterprise value,

TČV – permanently deductible net income,

i_k – calculated interest rate.

The necessary accounting data will be entered into the prepared Excel application, and the table of deductible returns will be transferred to the results section. To determine the capitalization rate, it will be necessary to implement the modular method using data published by the Ministry of Industry and Trade of the Czech Republic. As another essential quantity, the risk-free yield will be determined by comparing the yield of a ten-year government bond for 2020. This data will be searched on the CNB website and processed into a clear table. Additional risk premiums needed for the following capitalization rate calculation will be taken from the tables on the Ministry of Industry and Trade website. The calculation of the company's capitalization rate will be carried out according to the following formula:

$$r_e = r_f + r_{pod} + r_{finstab} + r_{LA} \quad (2)$$

Where: r_e – cost of equity capital,

r_f – risk-free yield,

r_{pod} – risk premium for business risk,

$r_{finstab}$ – risk premium for financial stability,

r_{LA} – risk premium for size.

(Lipovská, 2019)

These searched data will be compiled into a table, and their sum will determine the required capitalization rate. The prediction of the average rate of inflation in 2020 will be found on the website of the Ministry of Finance of the Czech Republic. Then, a table will be compiled from the determined results for calculating permanently deductible net income after correction for the level of investments and capitalized net income, determining the income value of the assessed average business in the manufacturing industry. Furthermore, the asset value of this company will be determined on an accounting basis, where the liabilities of the company are deducted from the company's assets using the equation:

$$(DHM + DNM + OM + P + DFM + FM) - obligations \quad (3)$$

Where: *DHM* – Tangible fixed assets,

DNM – Fixed intangible assets,

OM – Current assets (inventories),

P – Receivables,

DFM – Non-current financial assets,

FM – Financial property.

The illustrative table will be replaced with calculations from the Excel application and the following goodwill calculation table. Here, the determined revenue value of the enterprise will be deducted from its property value according to the formula (Svačina, 2010):

$$+/- Goodwill = Purchaseprice\ of\ the\ business - (\sum Assets - \sum Liabilities) \quad (4)$$

This calculation is based on the statement that goodwill, in accounting terms, is the difference between the purchase price of the business and the sum of the business's net assets. A company's intangible assets can be considered its good reputation (goodwill) represented, for example, by a trade mark, a brand of goods and a trademark (Lipovská, 2019). Furthermore, the data needed to calculate the value of goodwill using the WARA method according to the following formula will be searched and added to the compiled financial statements of the assessed company and inserted into the table.

$$WARA = rVK * \frac{VK}{K} + rCK * (1 - d) * \frac{CK}{K} \quad (5)$$

Where: *rVK* – required return on equity,

VK – equity,

K – total value of invested capital (gross),

rCK – required return on foreign capital,

d – income tax rate (19%),

CK – foreign capital,

$\frac{CK}{K}$ – debt ratio.

I will show the calculation of the WARA coefficient in a table and confirm it with the subsequent calculation of the WACC according to the formula:

$$WACC = \frac{CK}{K} * nCK * (1 - d) + \frac{VK}{K} * nVK \quad (6)$$

Where: *WACC* – weighted average cost of capital,

nVK – cost of equity capital,

nCK – the cost of foreign capital

d – income tax rate,

CK – foreign interest-bearing capital,

VK – equity (in market value),

K – invested capital.

(Lipovská, 2019)

A similar result will confirm that the relation WARA = WACC is valid (Svačina, 2010).

The value of the goodwill determined in the accounts will be multiplied by the achieved value of the WARA coefficient to determine the resulting value of intangible assets in the average enterprise of the manufacturing industry in the years 2016 to 2020. Based on the relationship:

$$Value\ of\ goodwill = The\ value\ of\ goodwill\ dermined\ on\ the\ basis\ of\ accounting\ data + (The\ value\ of\ goodwill\ dermined\ on\ the\ basis\ of\ accounting\ data * \frac{WARA}{100}) \quad (7)$$

4 Results

The valuation of intangible assets in the manufacturing industry in the assessed years 2016-2020 was divided into several parts.

1. Determination of the average company in the manufacturing industry in 2016-2020

2. Valuation of the determined average company in the manufacturing industry in 2016-2020 using the revenue method
3. Determining the asset value of the average company in the manufacturing industry in 2016-2020
4. Calculation of goodwill of the average company in the manufacturing industry in 2016-2020
5. Weighted Average Return on Assets (WARA) concept method

4.1 Determination of the average business in the manufacturing industry in 2016-2020

After cleaning the data of the specified companies in the manufacturing industry from 2016 to 2020, their financial statements were compiled with meaningless and harmful data. These are the balance sheets, where the internal links have been adjusted to maintain the balance between assets and liabilities. Then, the statement of profits and losses, and based on them, the valuation of the average company in the manufacturing industry from 2016 to 2020, will be carried out.

4.2 Valuation of the determined average company in the manufacturing industry in 2016-2020 using the revenue method

The net capitalized income method is used to determine the value of an average company in the manufacturing industry for the period under review from 2016 to 2020. The basis for this method is historical data from the balance sheet and profit and loss statement for the last 3 to 5 years. Part of the specified time series calculation is the removable net income, which can be withdrawn from the company without jeopardizing its continued existence. This situation is shown in Table 1 for the assessed company.

Table 1: Permanently deductible net income before depreciation

	2016	2017	2018	2019	2020
Profit before tax	28 240 759	31 914 745	32 037 360	33 210 151	35 027 288
(+) depreciation	436 287	765 458	891 540	386 669	569 882
(-) Financial returns	0	0	0	0	0
(-) Revenues from the sale of long-term assets	-854 846	-873 173	-976 119	-1 141 590	-1 491 820
(+) The residual value of the sold fixed asset	1 277 086	1 239 463	1 461 644	1 589 568	1 651 688
(+) Extraordinary personnel costs - restructuring				2 000	
(-) Extraordinary earnings	-318 305	-116 021	-112 274	-175 744	-110 138
(+) Extraordinary costs	163 013	153 414	487 369	389 234	141 809
Adjusted profit before depreciation and taxes	28 943 994	33 083 888	33 789 518	34 260 287	35 788 710
Chain price index	1,033	1,014	1,004	1,003	1,005
Primary price index related to 2016	0,974	0,988	0,992	0,995	1,000
Adjusted profit for inflation	29 702 782	33 482 451	34 060 341	34 431 589	35 788 710
Scales	1	2	3	4	5
Adjusted profit for inflation * Scales	29 702 782	66 964 902	102 181 024	137 726 356	178 943 548
TOTAL					515 518 612
Permanently deductible net income before depreciation					34 367 907
Depreciation from replacement prices from the assignment					52 500
Permanently Deductible Net Income Before Taxes					34 315 407
Tax base (with depreciation from the last year)					33 798 025
Tax (19 %)					6 421 625
Permanently deductible net income after tax before adjustment					27 893 783

Source: Own processing based on data from the Cribis database.

Table 1 shows the permanently deductible net income before depreciation. This table shows the company's financial results from 2016 to 2020. It shows the operating result before taxation, which gradually increased from CZK 28,240,759 in 2016 to CZK 35,027,288 in 2020. Various items are subtracted and added from the operating result, such as depreciation, revenue from the sale of fixed assets, extraordinary income and expenses. Adjusted EBITDA is also shown and then recalculated using price indexes that consider inflation. Finally, the permanently deductible after-tax net income is presented after considering taxes and other weighting factors.

To calculate the capitalized net method, the calculated interest rate, which represents the cost of equity capital, is usually referred to as re, must be determined. Here, the modular method will be applied using data published by the Ministry of Industry and Trade of the Czech Republic, the Ministry of Finance, the Czech Statistical Office, and the Czech National Bank.

One of the basic quantities for an asset valuation is the discount rate or, in this case, the calculated interest rate or the capitalization rate. The requirements for the risk-free rate, such as the absence of the risk of non-payment, minimal risk of illiquidity, and accessibility to investment, are determined, and government bonds mainly meet these. With these securities, it is assumed that the state can pay its debt, at least in nominal value. This development of the government bond yield is modelled in Table 2.

Table 2: Development of the ten-year government bond yield in 2020

Month	Ten-year government bond yield [%]
January	1,62
February	1,47
March	1,28
April	1,28
May	0,92
June	0,86
July	0,86
August	0,95
September	0,98
October	0,94
November	1,12
December	1,26

Source: Own processing according to the Czech National Bank

The development of the yield of the ten-year government bond of the Czech Republic in 2020 ranged from 0.86% to 1.62%. For this work, the last value from this year will be used, i.e. the figure from December 2020, i.e. 1.26%.

Other quantities needed to determine the capitalization rate, such as the risk premium for business risk, the risk premium for financial stability, and the risk premium for size, were taken from the data in the tables of the CZ NACE classification of economic activities with section C for the manufacturing industry on the Ministry of Industry and Trade website. The actual calculation is shown in Table 3.

Table 3: Calculation of the calculated interest rate (cost of equity)

r_f	**1,26 %**
r_{pod}	**3,70 %**
$r_{finstab}$	**2,89 %**
r_{LA}	**0,84 %**
r_e = capitalisation rate	**8,69 %**

Source: Processing according to the Ministry of Industry and Trade of the Czech Republic

Table 3 shows the various components needed to calculate the calculated interest rate. The risk-free rate (r_f) is set at 1.26%, the enterprise risk premium (r_{pod}) is 3.70%, the financial stability premium ($r_{finstab}$) is 2.89% and the liquidity premium (r_{LA}) is 0.84 %. Combining these components results in a total capitalization rate (r_e) of 8.69%. This calculation is essential for determining the cost of equity capital, which affects the company's overall financial strategy.

Table 4 shows the average annual rate of inflation in the Czech Republic expressed by the increase in the average consumer price index (the average of the last 12 months against the average of the previous 12 months).

Table 4: Average annual rate of inflation

Year	Average annual rate of inflation
2016	**0,70 %**
2017	**2,50 %**
2018	**2,10 %**
2020	**3,20 %**

Source: Processing according to the Czech Statistical Office

The macroeconomic predictions on the Ministry of Finance of the Czech Republic website predict the average inflation rate in 2020 at 3.2%. Therefore, this figure will be used (for 2020). After substituting this data into Table 5, we get the permanently deductible net income after correction for the investment rate, and Table 6 shows the calculated value of equity.

Table 5: Permanently deductible net income after correction for the investment rate in thousands of CZK

Expected long-term inflation	**3,20%**
Calculated interest rate (without inflation)	**8,70%**
Permanently deductible net income after correction for investment rate	**20 386 625**

Source: Own processing based on data from the Ministry of Finance and own calculations

Table 5 shows the effect of inflation and interest rates on permanently deductible net income. Expected long-term inflation is listed at 3.2%, while the calculated interest rate without inflation is 8.7%. The result of these calculations is a permanently deductible net income after correction for the investment rate, which amounts to CZK 20,386,625. This correction is crucial for a realistic valuation of the company's returns after considering investment conditions. The calculations here include data from the Ministry of Finance and its calculations.

Table 6: Capitalized net income in thousands of CZK

Operating income value	**234 598 677**
Non-operating assets at the valuation date	**15 719 320**
Equity value according to capitalised net income	**250 317 996**

Source: Own processing based on data from the Cribis database

Table 6 provides an overview of the company's capitalized net income. The revenue value of the operating part of the company is set at CZK 234,598,677. The value of non-operating assets as of the valuation date is added to this, which amounts to CZK 15,719,320. The total equity value according to capitalized net income is then CZK 250,317,996. This data provides critical insight into a business's financial health and ability to generate revenue from various assets.

4.3 Determining the asset value of the average company in the manufacturing industry in 2016-2020

This method consists of valuing assets at their market values and liabilities and then reducing the values determined in this way. In this case, however, the result will be determined on an accounting basis using items in the balance sheet of an average company in the manufacturing industry from 2020, as shown in Table 7.

Table 7: Property valuation

Type of property	Results
Long-term tangible assets	**105 884 306 CZK**
Long-term intangible assets	**8 708 516 CZK**
Long-term financial assets	**2 097 974 CZK**
Current assets (inventories)	**66 258 571 CZK**
Receivables	**4 162 300 CZK**
Financial property	**1 905 353 CZK**
Liabilities	**14 408 763 CZK**
Total property	**189 017 021 CZK**
Total liabilities	**14 408 763 CZK**
Enterprise value	**174 608 258 CZK**

Source: Own processing based on data from the Cribis database

Table 7 shows the value of different types of business assets. Long-term tangible assets are valued at CZK 105,884,306, while long-term intangible assets amount to CZK 8,708,516. The values of long-term financial assets (CZK 2,097,974), current assets (CZK 66,258,571), receivables (CZK 4,162,300) and financial assets (CZK 1,905,353) are also shown. The company's total liabilities are CZK 14,408,763, which leads to a total value of the company of CZK 174,608,258 after deducting liabilities.

4.4 Calculation of goodwill of the average company in the manufacturing industry in 2016-2020

To calculate the value of the goodwill of an average company in the manufacturing industry for the period 2016-2020, the accounting base mentioned was used based on the established valuations of the company using the income and property method. These values were subtracted from each other to determine the goodwill value of the Assessed Average Business, as shown in Table 8.

Table 8: Calculation of the value of goodwill

$+/- Goodwill = Purchaseprice\ of\ the\ business - (\sum Assets - \sum Liabilities)$
$+/- Goodwill = Equity\ value\ according\ to\ capitalised\ net\ income - Property\ value\ of\ the\ enterprise$
$+/- Goodwill = 250\,317\,996 - 174\,608\,258$
$+/- Goodwill = 75\,709\,738\ CZK$

Table 8 explains the calculation of the company's goodwill. Goodwill is calculated as the difference between the equity value according to the KČV and the company's property value. Specifically, the value of goodwill is CZK 75,709,738, which is the difference between CZK 250,317,996 and CZK 174,608,258. This calculation is essential for understanding what added value a business has beyond its tangible and intangible assets. Goodwill often reflects intangible values such as brand, customer relationships and others.

4.5 Weighted Average Return on Assets (WARA) concept method

Goodwill can be calculated using the WARA method or weighted return on assets. We can say that the value of WARA = WACC, i.e. the average weighted return on assets should be equal to the average weighted return on capital from the perspective of liabilities. The substitution of the necessary indicators and the actual calculation of the WARA coefficient are shown in Table 7, and the resulting value of goodwill in the WARA concept is shown in Table 8.

Calculation of required return on equity

This required return on equity (ROE) calculation can be constructed using the following relationship:

$$ROE = \frac{Profit\ after\ tax}{Equity}$$

Calculation of the required return on foreign capital

$$ROI = \frac{Bank\ loans}{Cost\ interest}$$

Table 9: Calculation of the WARA coefficient

Indicator/Year	2016	2017	2018	2019	2020	Average
Total value of invested capital (brutto)	**155 935 583**	**139 747 210**	**144 909 698**	**161 310 993**	**184 086 943**	**157 198 085**
Required return on equity	**0,282**	**0,254**	**0,229**	**0,255**	**0,244**	**0,253**
Equity	**110 541 880**	**98 474 120**	**103 785 721**	**118 075 783**	**132 079 390**	**112 591 379**
Equity/total market value of invested capital	**0,709**	**0,705**	**0,716**	**0,732**	**0,717**	**0,716**
Required return on foreign capital	**84,332**	**4,492**	**8,688**	**15,628**	**4,063**	**23**
Income tax rate	**0,19**	**0,19**	**0,19**	**0,19**	**0,19**	**0,19**
1 – income tax rate	**0,81**	**0,81**	**0,81**	**0,81**	**0,81**	**0,81**
The value of foreign capital	**45 393 703**	**41 273 091**	**41 123 977**	**43 235 210**	**52 007 553**	**44606706,8**
Indebtedness rate	**0,291**	**0,295**	**0,284**	**0,268**	**0,283**	**0,284**
WARA						**5,58 %**

Table 9 calculates the WARA (Weighted Average Return on Assets) coefficient for the years 2016 to 2020. It shows the total value of invested capital, the required return on equity capital, the value of equity capital, the debt ratio, and the required return

on debt capital. The income tax rate is constant at 19%. The calculations show how the ratio of equity to the total market value of invested capital changes and the average return on these investments.

After performing the WACC calculation according to the above formula, the same value was calculated as when calculating the WARA coefficient, namely 5.77%

Table 10: Calculation of the value of goodwill using the WARA method

Indicator	
Goodwill value	**75 709 738**
Goodwill value * WARA/100	**4 222 353**
Result	**79 932 091**

Table 10 shows the calculation of the value of goodwill using the WARA coefficient. The value of goodwill is 75,709,738 CZK. Subsequently, this value is multiplied by the WARA coefficient (in %) and added back to the original goodwill value. The resulting value of goodwill after adjustment using WARA amounts to CZK 79,932,091. This approach allows the weighted average return on assets to be taken into account when valuing the business's goodwill.

5 Discussion

At the beginning of this work, the following two research questions were set, to which answers were sought by carrying out the application part. This was done using accounting data of companies operating in the processing industry from 2016 to 2020.

RQ1: How to apply the weighted average return on assets method in the manufacturing industry in the specified period in the Czech Republic?

RQ2: Why is this method suitable or, on the contrary, unsuitable for application in the processing industry in the Czech Republic?

The application's results proved that the weighted average return on assets method can be used in the manufacturing industry to determine the average company.

In the method of weighted profitability of WARA assets, the value of goodwill is determined equal to the value of WACC, which corresponds to the control calculation where the same accounting data were used. This comparison is also used in the work by Svačina 2010 and Lipovská 2019. By determining the average company in the entire industry, this procedure can be used to value the goodwill of the Assessed company.

This method can be used in this context for this field of business activity, but it is necessary to consider which accounting data will be considered meaningless or unnecessary in order to filter and modify them properly. In its essence, the WARA approach can be regarded as suitable for application in the processing industry in the Czech Republic in the set time horizon of 2016 to 2020.

However, there is still very little comparable research and information on using the WARA method.

There is not enough information about the method in a narrower context. Therefore, it can be concluded that this question will be addressed again in the future, and other ways will be sought to find a satisfactory result and move the intangible asset valuation industry forward.

6 Conclusion

The work aimed to apply the valuation of intangible assets, precisely the WARA method and its approaches in the manufacturing industry in the Czech Republic between 2016-2020. After processing the application part of this work, we can state that the set goal of the work has been fulfilled. The issue of intangible assets in the form of goodwill was analyzed and examined on the accounting basis of companies in the manufacturing industry from 2016 to 2020. Here, the resulting value of goodwill was achieved using the calculated coefficient of the weighted return on assets method.

The value of goodwill as of 31/12/2020 from the point of view of accounting as the difference between the revenue value of the commercial plant and the property value of the commercial plant was set at 75,709,738 CZK and due to the WARA weighted average profitability concept, the value of the average business in the manufacturing industry is set at the resulting value of 79 932,091 CZK.

Because goodwill is intangible and, therefore, very difficult to grasp, I have a very vague idea about it and the company unless a good name is mentioned. Every business entity would like to own a good name or reputation to the greatest extent possible and would not want to slip into the level of bad will, increasing the business risk of losing stakeholders. The business entity would lose its primary function of generating profit by losing public interest.

Further investigation and introduction into the more profound practice of the weighted return on assets gives experts and appraisers another possibility in assessing and valuing intangible assets. Determining goodwill as a specific surplus value of a company is very difficult, and no uniform methodology has been established. The business entities would like to know if the costs incurred in creating and maintaining the company's good name are spent purposefully with a specific possible value in their return. This return can prove to be a competitive advantage in the market, gaining and maintaining customer popularity and consolidating or finding its position in the competitive market.

The work was limited by filtering out certain types of businesses with meaningless or missing data and enterprises in liquidation. Further research shows that businesses could be broken down into subgroups 10-33 within the manufacturing industry section. Thus, the company could learn which subgroup has the greatest and least prestige and how this could be corrected.

Literature:

1. Ali, A. a Bashir, H.A., 2021. Bibliometric study on asset pricing. *Qualitative Research in Financial Markets*, 2020. ISSN 1755-4179.
2. Atalay, B., Gokten, S. a Turkcan, M. *An Overview of Measuring and Reporting Intellectual Capital. Global Approaches in Financial Economics, Banking, and Finance*, 2018. 369-388. ISBN 978-3-319-78493-9.
3. Campbell, J.Y., 2000. Asset Pricing at the Millennium. *The Journal of Finance*, 2000. 55(4), 1515-1567. ISSN 0022-1082.
4. Carlin, T. M., Schauten, M., Stegink, R. a de Graaff, G., 2010. The discount rate for discounted cash flow valuations of intangible assets. *Managerial Finance*, 2010. 36(9), 799-811. ISSN 0307-4358.
5. Cosmulese, C.G., Socoliuc, M., Ciubotariu, M.S., Grosu, V. a Mates, D. Empirical study on the impact of evaluation of intangible assets on the market value of the listed companies. *E & M Ekonomie a Management*, 2021. 24(1), 84-101. ISSN 1212-3609.
6. Dohnal, R., Hanusova, H., Lipovska, Z. *Goodwill, The Problematics of Determination of Its Value Within the Marketing Strategy*. Varazdin: Varazdin Development and Entrepreneurship Agency (VADEA). 2019. Available from: http://ezproxy.techlib.cz/login?url=https://www.proquest.com/conference-papers-proceedings/goodwill-problematics-determination-value-within/docview/2188521451/se-2?accountid=11984
7. Dosso, M. a Vezzani, A. Firm market valuation and intellectual property assets. *Industry and Innovation*, 2020. 27(7), 705-729. ISSN 1366-2716.
8. Glova, J., Andrejovska, A. a Vegsoova, O. Intangibles in Manufacturing Industry: An Empirical Analysis. *5th EAI International Conference on Management of Manufacturing Systems*, 2022. 469-477. ISBN 978-3-030-67240-9.

9. Havier, J., Jančovičová., M, Bartoš, A. The royalty rate as a key parameter of IP valuation. *International Scientific Conference for Doctoral and Postdoctoral Students (EDAMBA)*. 2017.
10. Hong, S.J., Seo J.W., Kim, Y.S. a Kang, S.H. Construction technology valuation for patent transaction. *KSCE Journal of Civil Engineering*, 2010. 14(2), 111-122. ISSN 1226-7988.
11. Huang, H.P., Huang, H.M. Research on intangible asset valuation methods. *3 International Conference on Social Science and Development*. 2017.
12. Cheloti, I. a Mooya, M. Valuation Problems in Developing Countries: A New Perspective. *Land*, 2021. 10(12). ISSN 2073-445X.
13. Ionita, C. a Dinu, E. The effect of intangible assets on sustainable growth and firm value – Evidence on intellectual capital investment in companies listed on Bucharest Stock Exchange. *Kybernetes*, 2021.50(10), 2823-2849. ISSN 0368-492X.
14. Klečka, J. Development of economic characteristics of the use of the production factor of labor in the chemical industry and other selected branches of industry in the Czech Republic in the period of industry 4.0. *6th International Conference on Chemical Technology*. 2018.
15. Krulicky, T., Machova, V. a Rowland, Z., 2020. Determining carrying amount of intangible assets using modified income-based and assets-based valuation method difference. *Ad Alta-Journal of Interdisciplinary Research*, 2020. 10(2), 212-217. ISSN 1804-7890.
16. Li, Y., Song, Y., Wang, J. a Li, CH. Intellectual Capital, Knowledge Sharing, and Innovation Performance: Evidence from the Chinese Construction Industry. *Sustainability*, 2019. 11(9). ISSN 2071-1050.
17. Lim, S.C., Macias, A.J. a Moeller, T. Intangible assets and capital structure. *Journal of Banking & Finance*, 2020. 118. ISSN 0378-4266.
18. Lipovská, Z., 2019. *The issue of goodwill as an integral part of the value of a construction company*. Brno. Master thesis. Brno University of Technology. Faculty of Civil Engineering. Department of Construction Economics and Management.
19. Malý, J. *Trade in intangibles: patents, inventions, know-how, trademarks*. Prague: C.H. Beck. C.H. Beck for practice. 2002. ISBN 80-7179-320-5.
20. Mercurio, B. a Kim, D. Contemporary *Issues in Pharmaceutical Patent Law*. Routledge. 2017. ISBN 978-13-1567-797-2.
21. Ministry of Finance of The Czech Republic, 2022. Available from: https://www.mfcr.cz/cs/verejny-sektor/makroekonomika/makroekonomicka-predikce/2020/makroekonomicka-predikce-zari-2020-39418
22. Ministry of Industry and Trade, 2022. Available from: www.mpo.cz
23. Osinski, M., Selig, P.M., Matos, F. a Roman, D.J. Methods of evaluation of intangible assets and intellectual capital. *Journal of Intellectual Capital*, 2017. 18(3), 470-485. ISSN 1469-1930.
24. Pastor, D., Glova, J., Lipták, F. a Kováč, V. Intangibles and methods for their valuation in financial terms: Literature review. I*ntangible Capital*, 2017. 13(2), 387-410. ISSN 1697-9818.
25. Podhorska, I., Valaskova, K., Stehel, V. a Kliestik, T. Possibility of Company Goodwill Valuation: Verification in Slovak and Czech Republic. *Management & Marketing*, 2019. 14(3), 338-356. ISSN 2069-8887.
26. Schüler, A. Zur kapitalwertorientierten Bewertung (nicht nur) von immateriellen Vermögenswerten in der internationalen Rechnungslegung. *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung*, 2020. 72(3), 371-396. ISSN 0341-2687.
27. Svačina, P. *Valuation of Intangible Assets*. 1st ed. Prague, Ekopress, 2010. ISBN: 978-80-86929-0.
28. Štefánková, S. Valuation of intangible assets: Estimating the Value of Patents. *17th International Scientific Conference on Globalization and its Socioeconomic Consequences*, 2017a.
29. Štefánková, S. Development of Patent Activity in the Czech Republic. *14th International Scientific Conference on European Financial Systems*, 2017a.
30. Tahat, Y. A., Ahmed, A.H. a Alhadab, M.M., 2018. The impact of intangibles on firms' financial and market performance: UK evidence. *Review of Quantitative Finance and Accounting*, 2018. ISSN 0924-865X.
31. The Czech National Bank. 2022. Available from: The Czech National Bank (cnb.cz).
32. The Czech. Act No. 1997 of 17 June 1997 on the Valuation of Property and on Amendments to Certain Acts (the Valuation of Property Act). 1997. Available from: https://www.zakonyprolidi.cz/cs/1997-151
33. The Czech. Act No. 254 of 10 September 2019 on experts, expert offices and expert institutes. 2019. Available from: https://www.zakonyprolidi.cz/cs/2019-254
34. The Czech Statistical Office. Annual structural statistics of industry - Methodology. Prague.2022. Available from: https://www.czso.cz/csu/czso/prumysl_energetika
35. Trappey, A.J.C., Trappey, CH.V., Govindarajan, U.H. a Sun, J.J.H. Patent Value Analysis Using Deep Learning Models—The Case of IoT Technology Mining for the Manufacturing Industry. *IEEE Transactions on Engineering Management*, 2021. 68(5), 1334-1346. ISSN 0018-9391.
36. Vrchota, J., Vlčková, M. a Frantíková, Z. Division of Enterprises and Their Strategies in Relation to Industry 4.0. *Central European Business Review*, 2020. 9(4), 27-44. ISSN 1805-4854.

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