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Intellectual Capital of Game Developers Listed on the Main Market of the Polish Stock Exchange in the Years 2022–2023

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ABSTRACT

Objective: To determine the value of the intellectual capital of joint-stock companies from the gaming sector listed on the Warsaw Stock Exchange Main Market in the years 2022–2023.
Research Design & Methods: The intellectual capital of companies in the gaming sector was calculated using three methods: the difference between market value and book value, economic value added and profit from knowledge capital. Annual financial reports for 2022 and 2023 were used for this purpose. The data were subjected to statistical analysis using methods such as the mean, median, and skewness, Pearson's linear correlation coefficient, and the Shapiro-Wilk normality test.
Findings: The intellectual capital of companies in the gaming sector is highly differential. Three companies have the highest level of intellectual capital, and the value of intellectual capital in other companies in the gaming sector differs significantly from the intellectual capital in these three companies. Such intellectual capital measures as the difference between market value and book value, economic value added and profit from knowledge capital are positively correlated, making them reliable and consistent tools for measuring intellectual capital in the gaming sector.
Implications/Recommendations: The study's findings can benefit both the managers of gaming companies and stock investors, providing insights into the value and trends of intellectual

capital in joint-stock companies within this sector during 2022–2023. The author recommends evaluating intellectual capital using multiple methods and comparing results before managers or investors make decisions.

Contribution: This study is innovative due to the lack of recent research on the intellectual capital of joint-stock companies in the gaming sector.

Article type: original article.

Keywords: intellectual capital, gaming sector, market value, book value, economic value added, knowledge capital earnings.

JEL Classification: M20, M21, M29.

1. Introduction

According to data presented in the report *The Game Industry of Poland – Report 2023*, in 2022 there were 494 game producers and publishers in the Polish computer game industry. The sector employed 15,290 people, and its revenues amounted to EUR 1,286 million. The report also states that more than 530 new games were released during the year (Marszałkowski, Biedermann & Rutkowski, 2023, p. 9). The data indicate great importance of the gaming sector for the economy. In addition, intellectual capital has an impact on business competitiveness (Dyrka, Rogozińska & Soboń, 2023, p. 39), making it a worthwhile area for analysis.

The value of intellectual capital can be calculated using methods such as the difference between market value and book value (MV-BV) – developed by Pulic (2000, pp. 702–714), economic value added (EVA) – developed by Stewart (1991, pp. 118–178), and knowledge capital earnings (KCE) – developed by Gu and Lev (2011, pp. 110–124). The literature review presented in this article indicates the frequent use of these measures of intellectual capital to determine its level and estimate its influence on the companies studied. However, little research has been done on gaming companies.

Taking into account the above, the aim of this article is to determine the value of the intellectual capital of 22 joint-stock companies from the gaming sector listed on the Warsaw Stock Exchange (WSE) Main Market in 2022–2023.

2. Theoretical Background

The MV-BV ratio (also MV/BV) belongs to a group of methods for measuring intellectual capital based on market value (Sopińska, 2008, pp. 130–131). It is also referred to as a measure of a company's saturation with intellectual capital and is an alternative to calculating the value of intellectual capital by subtracting a company's book value from its market value (Urbanek, 2008, p. 106). The research conducted

with the use of indicators based on market value at the Warsaw Stock Exchange has focused on: the level and dynamics of change in intellectual capital of listed companies in 2002–2006 (Sopińska, 2010, pp. 173–178), the measurement of the intellectual capital of banks in 2005–2009 (Śledzik, 2011, pp. 150–151), the relationship with the VAIC indicator based on a study of non-financial companies listed on the WSE, i.e., on the primary and New Connect markets, covering a total of 230 observations (Urbanek & Bohdanowicz, 2012, p. 111), the measurement of intellectual capital in 2007–2012 in WIG20 index companies (Beyer, 2014, p. 14), the value of intellectual capital of companies listed within the WIG30 index in 2009–2012 and the share of intellectual capital in market value (Beyer, 2015, pp. 120–123), the number of companies with intellectual capital in 2012, in terms of sectors – a study conducted on a group of 345 companies (Wasilewska, 2015, pp. 163, 171), the measurement of intellectual capital of selected companies listed on the WSE in 2016 (Bombiak, 2016, p. 115), the relationship with brand value and brand strength based on 56 companies listed on the WSE in the years 2008–2014 (Urbanek, 2016b, p. 345), the relationship with VAIC in joint-stock companies in the food sector in 2011–2014 (Urbanek, 2016a, p. 227), the intellectual capital of companies in the WIG Informatics index (Paździor & Twardowska, 2017, p. 46), the impact of the financial crisis on intellectual capital (the MV/BV and *q*-Tobin ratios were used to measure the intellectual capital) in the food sector (Garncarz & Mierzejewski, 2019, p. 8), and the intellectual capital of game producers (Rydzewski, 2019, p. 141).

The EVA method has been used in studies on correlations with ROA and ROE ratios and financial liquidity ratios: current, quick and increased, based on data from 146 to 201 companies, for the years 1997–2009 (Kacprzyk, Wolski & Bolek, 2012, pp. 284–285), correlations with liquidity ratios based on data from 395 non-financial listed companies for the years 1998–2012 (Wolski & Bolek, 2014, p. 566), the impact on ROA using a sample of 39 companies listed on the Tehran Stock Exchange from 2007 to 2010 (Salehi, Enayati & Javadi, 2014, pp. 267–268), correlations with VAIC in sectors of the Italian economy such as paper production (n = 243), chemicals production (n = 451), basic metals production (n = 406), software and consultancy (n = 782), advertising and market research (n = 525), travel agencies (n = 189) based on data from 2011 (Iazzolino, Laise & Migliano, 2014, pp. 13, 16), the relationship between the economic rate of return and the market rate of return based on data from the largest companies listed on the Warsaw Stock Exchange, classified in the WIG20 index, excluding the financial sector for 2014 (Nowicki, 2016, pp. 141–142), the impact of value added and wage costs on the example of data from two samples of companies from the Czech automotive industry, i.e., 11 manufacturers and 87 suppliers for the period from 2005 to 2012 (Pavelková *et al*., 2018, pp. 82, 92–93), the relationship with VAIC based on data from 91 companies for the

period 2010–2014 listed on the Nigerian Stock Exchange (Anifowose *et al*., 2018, pp. 652–653).

The KCE method has been used in studies on the level of intangible assets of domestic and benchmark banks for the period 2005–2010 (Śledzik, 2012, pp. 77–78), the impact of knowledge capital gains on net worth per share based on a sample of 361 computer industry firms from Taiwan and 1,018 observations of these firms from 2007–2009 (Wang, 2013, pp. 1221), relationships with other measures of intellectual capital (Wasilewska, 2015, pp. 180–182), relationships with price-value ratios, earnings per share, and return on equity based on data from three selected joint-stock companies in the IT sector from 2012–2016 (Bagieńska, 2019, p. 8).

Each method discussed has its own advantages, disadvantages, and limitations. The MV-BV measure, for instance, is only feasible for publicly listed companies. Additionally, market value is subject to considerable fluctuations, meaning the MV-BV value depends only partially on management actions and may not fully represent a company's intellectual capital. Conversely, book value is influenced by a company's adopted accounting policies. To address the challenges of determining market value or its reliability, profit-based methods, such as EVA and KCE, can be employed to measure intellectual capital. EVA serves as both a company valuation tool and a productivity indicator for intellectual capital, while KCE helps calculate the value of intellectual capital. Both measures show significant correlation with a company's market value. However, profit-based methods rely on historical data, which may not accurately capture the current value of intellectual capital. Additionally, their outcomes can be affected by fluctuations in interest rates and capital costs. Given the strengths and weaknesses of each intellectual capital measurement method, none of them should be used in isolation; results should be cross-checked against those of other companies in the sector (Kasiewicz, Rogowski & Kicińska, 2006, pp. 200–215; Wasilewska, 2015, p. 170).

3. Methodology

Intellectual capital in the MV-BV method is calculated by subtracting the difference between the total assets and all liabilities from the product of the share price and the number of shares (Edvinsson & Malone, 2001, p. 18).

The value of intellectual capital using the EVA method was calculated according to the formula (Kijewska, 2016, p. 56):

$$EVA = NOPAT - WACC \cdot IC,$$

where:

NOPAT – net operating profit after tax,
IC – invested capital,
WACC – wage average cost of capital.

Invested capital was calculated as the sum of equity and financial liabilities.

The cost of capital was determined as the weighted average cost of capital (*WACC*) using the formula (Wasilewska, 2011, pp. 556–558):

$$WACC = \frac{E}{E+D} \cdot r_e + \frac{D}{E+D} \cdot r_d \cdot (1-T),$$

where:

WACC – weighted average cost of capital,
E – value of equity capital,
D – value of interest-bearing debt (financial liabilities),
r_e – cost of equity capital,
r_d – cost of interest-bearing external capital,
T – tax rate.

The Capital Asset Pricing Model was used to estimate the cost of equity capital according to the formula (Wasilewska, 2011, p. 558):

$$r_e = r_f + \beta_e \cdot (r_m - r_f),$$

where:

r_e – cost of equity capital,
r_f – rate of return on risk-free investment,
β_e – beta indicator for a given company,
$(r_m - r_f)$ – market risk premium.

The interest rate on ten-year treasury bonds was 6.86% on 25 December 2022 and 5.3% on 31 December 2023 (Investing.com, 2023, 2024). Beta indicators for individual companies were adopted based on data from the Biznesradar.pl portal (Biznesradar.pl, 2023, 2024). The market risk premium, in accordance with the recommendations of the literature on the subject, was assumed to be 5% (Maćkowiak, 2009, p. 59; Wasilewska, 2011, p. 558). The costs of external capital were calculated based on the interest rate as the quotient of selected financial costs and the corresponding financial liabilities (Nowicki, 2016, p. 142).

The KCE method was implemented in the following stages (Bombiak, 2012, p. 240):

1. Calculation of normalised profit based on net profit adjusted by the value of the extraordinary result of the last three years and the forecast for the next three years (the same level of profit as in the current year was assumed) according to the formula:

$$ZPP = \frac{PP_{t-2} + PP_{t-1} + PP_t + 2 \cdot (PP_{t+1} + PP_{t+2} + PP_{t+3})}{9},$$

where:

ZPP – normalised profit,

PP_{vol} – net profit in year t adjusted by the value of the result from extraordinary events.

2. Profit attributable to tangible assets was calculated by multiplying fixed assets by 0.07.

3. The profit attributable to financial assets was calculated by multiplying the company's long-term financial investments by 0.045 (rate of return on financial assets).

4. The profit from knowledge capital was calculated by subtracting the profit attributable to tangible and financial assets from the normalised profit.

5. Knowledge capital (intellectual capital) was calculated by dividing the profit from knowledge capital by 0.105 (rate of return on intellectual capital).

Intellectual capital, calculated using the methods described above, was subjected to statistical analysis using methods such as the mean, median, and skewness, Pearson's linear correlation coefficient, and the Shapiro-Wilk normality test.

4. Results

Table 1 contains data of companies from the gaming sector for 2023, such as market value, net operating profit after tax, and net profit. The market value of the five companies with the highest market value is higher than PLN 1 billion. The company with the highest market value, CD PROJEKT SA, is worth approximately five times more than the second and other most valuable companies, the PLAYWAY SA Capital Group and Huuuge Inc. Moreover, CD PROJEKT SA is worth over 10 times more than the other one-billion-zloty companies listed, i.e. 11bit studios SA and PCF Group SA Capital Group.

Table 1. Data of Companies from the Gaming Sector for 2023, Such as Market Value, Net Operating Profit after Tax, and Net Profit (in PLN)

Company Name	Market Value	NOPAT	Net Profit
CD PROJEKT SA	11,530,935,000	379,922,400	482,137,000
Grupa Kapitałowa PLAYWAY SA	2,112,000,000	128,914,740	127,602,000
Huuuge Inc.	1,912,005,625	299,843,577	330,878,410
11bit studios SA	1,298,574,743	6,149,793	525,609
Grupa Kapitałowa PCF Group SA	1,058,440,981	–70,026,120	–80,889,000
Ten Square Games SA	707,076,841	2,849,457	7,171,333
Grupa Kapitałowa Bloober Team SA	532,705,420	3,889,708	2,471,394
Creepy Jar SA	418,219,672	12,763,999	18,327,451

Table 1 cnt'd

Company Name	Market Value	NOPAT	Net Profit
Grupa Kapitałowa CI Games	384,180,300	25,506,090	14,035,000
Artifex Mundi SA	205,223,250	19,427,341	24,919,038
Games Operators SA	168,827,282	1,012,500	751,000
BoomBit SA	148,261,379	3,180,060	9,141,000
Big Cheese Studio SA	97,172,500	2,255,850	2,375,000
ALL iN! GAMES SA	94,199,039	–4,043,881	–6,526,589
Grupa Kapitałowa Movie Games SA	68,702,624	–7,871,580	–12,013,000
Grupa Kapitałowa Gaming Factory SA	66,969,630	–2,873,880	–3,871,000
DRAGO ENTERTAINMENT SA	62,967,990	1,836,038	1,409,356
Grupa Kapitałowa Ultimate Games SA	52,300,000	2,259,900	–3,827,000
3R Games SA	29,498,773	486,000	613,000
Vivid Games SA	25,505,782	–1,760,462	–2,521,190
Grupa Kapitałowa SIMFABRIC SA	17,375,000	–327,240	–1,544,000
T-Bull SA	5,466,203	–3,406,961	–4,551,900
Mean	954,391,274	36,363,060	41,209,678
Median	158,544,331	2,257,875	1,080,178

Source: own elaboration.

The value of the next seven companies ranges from PLN 148 million to PLN 707 million. The remaining companies are worth less than PLN 100 million. Such a large variation in the value of companies results in an overestimation of the average company value in the sector, which is almost PLN 954 million. However, the middle value is almost PLN 159 million, which better reflects the value of companies in the entire sector. This structure of company values also shows that the largest and most competitive companies have the best position in the sector.

The highest value of operating profit after tax in 2023 was also generated by CD PROJEKT SA, and its value amounted to almost PLN 380 million. In terms of net profit, it was also the highest for CD PROJEKT SA and amounted to PLN 482 million. An interesting case is the PCF Group SA Capital Group, whose market value exceeds PLN 1 billion. In 2023, the net loss from operations amounted to PLN 70 million, and the net loss for the financial year was almost PLN 81 million. Please note that in this case, poor financial results do not immediately result in a loss of company value, which could be related to the existence of intellectual capital there. Among the listed companies, the average value of operating profit after tax in 2023 was PLN 36 million. However, this value is highly overestimated due to extreme values such as the result of CD PROJEKT SA, which is confirmed by the median of

just over PLN 2 million. The same applies to net profit, but the difference between the average and the median is even greater.

The values of intellectual capital measured using the MV-BV method are presented in Table 2.

Table 2. The Values of Intellectual Capital Measured by the MV-BV Method (in PLN)

Company Name	2022	2023	Change
CD PROJEKT SA	11,026,659,240	9,127,445,000	–1,899,214,240
Grupa Kapitałowa PLAYWAY SA	1,542,130,000	1,611,864,000	69,734,000
Huuuge Inc.	492,897,247	1,173,665,834	680,768,587
11bit studios SA	1,173,846,590	1,071,509,710	–102,336,880
Grupa Kapitałowa PCF Group SA	914,059,859	630,560,981	–283,498,878
Grupa Kapitałowa Bloober Team SA	257,748,895	436,834,181	179,085,286
Ten Square Games SA	576,002,843	416,065,907	–159,936,936
Creepy Jar SA	375,583,647	320,529,880	–55,053,767
Grupa Kapitałowa CI Games	315,140,500	223,902,300	–91,238,200
Games Operators SA	27,175,651	151,368,282	124,192,631
Artifex Mundi SA	6,821,552	124,560,849	117,739,297
ALL iN! GAMES SA	106,589,491	112,511,105	5,921,614
Big Cheese Studio SA	164,775,000	76,792,500	–87,982,500
BoomBit SA	85,695,000	74,688,379	–11,006,621
DRAGO ENTERTAINMENT SA	44,207,722	52,026,432	7,818,710
Grupa Kapitałowa Gaming Factory SA	9,652,106	43,376,630	33,724,524
Grupa Kapitałowa Movie Games SA	16,227,266	40,232,624	24,005,358
Grupa Kapitałowa Ultimate Games SA	46,284,200	26,127,000	–20,157,200
Vivid Games SA	23,568,962	20,401,542	–3,167,420
3R Games SA	17,492,667	11,538,773	–5,953,894
T-Bull SA	–2,183,664	–745,123	1,438,541
Grupa Kapitałowa SIMFABRIC SA	–32,500	–1,947,000	–1,914,500
Mean	782,742,831	715,604,990	–67,137,841
Median	96,142,246	118,535,977	22,393,731

Source: own elaboration.

CD PROJEKT SA has the highest level of intellectual capital (over PLN 9 billion). However, its value decreased by PLN 1,899,214,240 compared to the previous year. The intellectual capital of CD PROJEKT SA is almost six times greater than that of the second largest intellectual capital, which belongs to the company PLAYWAY SA Capital Group. In total, only four companies have

intellectual capital worth more than PLN 1 billion. The intellectual capital of the next eight companies ranges from PLN 112 million to PLN 630 million. Another eight companies have intellectual capital of less than PLN 100 million. However, two of the listed companies, i.e. T-Bull SA and SIMFABRIC SA Capital Group, do not have intellectual capital. The average intellectual capital amounted to PLN 716 million and was six times higher than the average value of intellectual capital. This shows that the average value of intellectual capital in the sector is significantly overestimated.

Changes in intellectual capital in the gaming sector, measured using the MV-BV method, indicate that its average value decreased by PLN 67,137,841, while the median increased by PLN 22,393,731. Since the analysis of the above statistics offers no clear results, changes in intellectual capital should be analysed in more detail. The value of intellectual capital increased for 10 companies and decreased for 12. The largest increase was achieved by Huuuge Inc., by PLN 680,768,587, and the largest decrease – by the CD PROJEKT SA, by PLN 1,899,214,240.

The values of intellectual capital measured using the EVA method are presented in Table 3. Huuuge Inc. has the highest level of intellectual capital (PLN 259 million), and its value increased by PLN 209,898,261 compared to the previous year. The intellectual capital of Huuuge Inc. is almost twice as large as that of the second largest intellectual capital listed, which belongs to CD PROJEKT SA. The intellectual capital of the next five companies ranges from PLN 3 million to PLN 93 million. Another three companies have an intellectual capital of less than PLN 1 million. However, the remaining 12 companies do not have intellectual capital because their EVA value is less than zero. The average intellectual capital was PLN 17 million, while the median EVA had a negative value. This shows that the average value of intellectual capital in the sector is significantly overestimated.

Table 3. The Values of Intellectual Capital Measured by the EVA Method (in PLN)

Company Name	2022	2023	Change
Huuuge Inc.	49,489,935	259,388,196	209,898,261
CD PROJEKT SA	72,152,362	146,130,200	73,977,838
Grupa Kapitałowa PLAYWAY SA	87,196,803	93,239,938	6,043,135
Artifex Mundi SA	3,104,011	13,982,629	10,878,618
Grupa Kapitałowa CI Games	–10,750,969	10,230,858	20,981,827
Creepy Jar SA	20,927,361	6,779,468	–14,147,893
BoomBit SA	1,487,870	3,073,624	1,585,754
DRAGO ENTERTAINMENT SA	175,480	802,061	626,581
Big Cheese Studio SA	10,755,373	683,870	–10,071,503
Grupa Kapitałowa Ultimate Games SA	1,811,637	624,088	–1,187,549

Table 3 cnt'd

Company Name	2022	2023	Change
3R Games SA	586,247	–413,916	–1,000,163
Games Operators SA	–577,737	–487,980	89,757
Grupa Kapitałowa Bloober Team SA	–7,412,221	–1,868,806	5,543,415
Grupa Kapitałowa SIMFABRIC SA	–5,660,330	–1,930,966	3,729,364
Vivid Games SA	–122,537	–2,150,352	–2,027,815
ALL iN! GAMES SA	–32,003,255	–3,318,888	28,684,367
T-Bull SA	–7,630,710	–3,831,087	3,799,623
Grupa Kapitałowa Gaming Factory SA	–6,720,314	–5,056,233	1,664,081
11bit studios SA	–2,222,513	–8,074,457	–5,851,944
Grupa Kapitałowa Movie Games SA	–8,113,500	–10,354,020	–2,240,520
Ten Square Games SA	21,223,303	–22,668,044	–43,891,347
Grupa Kapitałowa PCF Group SA	–1,311,626	–105,444,590	–104,132,964
Mean	8,472,030	16,787,981	8,315,951
Median	26,472	–450,948	–477,420

Source: own elaboration.

Changes in intellectual capital, measured by the EVA method, in the gaming sector indicate that its average value increased by PLN 8,315,951, while the median decreased by PLN 477,420. Since the analysis of the above statistics offers no clear results, changes in intellectual capital should be analysed in more detail. The value of intellectual capital increased for 13 companies and decreased for nine. The largest increase was achieved by Huuge Inc. SA, by PLN 209,898,261, and the largest decrease by the PCF SA Capital Group, by PLN 104,132,964.

The values of intellectual capital measured using the KCE method are presented in Table 4.

CD PROJEKT SA has the highest level of intellectual capital (PLN 3.841 billion), and its value increased by PLN 53,923,153 compared to the previous year. Moreover, CD PROJEKT SA, Huuuge Inc. and PLAYWAY SA Capital Group are the only companies with intellectual capital exceeding PLN 1 billion. The intellectual capital of the next five companies ranges from PLN 153 million to PLN 272 million. Six other companies have intellectual capital ranging from PLN 4 to 48 million. However, the remaining eight companies do not have intellectual capital because their intellectual capital value is less than zero. The average intellectual capital of the listed companies was PLN 352 million, while the median was negative. This shows that the average value of intellectual capital in the sector is significantly overestimated.

Table 4. The Values of Intellectual Capital Measured by the KCE Method (in PLN)

Company Name	2022	2023	Change
CD PROJEKT SA	3,787,405,974	3,841,329,127	53,923,153
Huuuge Inc.	505,428,044	2,519,453,998	2,014,025,954
Grupa Kapitałowa PLAYWAY SA	330,343,338	1,050,273,150	719,929,812
BoomBit SA	253,414,534	271,621,989	18,207,455
Ten Square Games SA	746,637,386	239,646,136	–506,991,250
Artifex Mundi SA	109,994,943	207,517,041	97,522,098
Creepy Jar SA	300,442,609	204,329,427	–96,113,182
Grupa Kapitałowa CI Games	110,584,508	152,700,307	42,115,799
Big Cheese Studio SA	136,894,254	48,221,196	–88,673,058
11bit studios SA	217,379,345	39,965,624	–177,413,721
DRAGO ENTERTAINMENT SA	15,836,950	16,805,605	968,655
Grupa Kapitałowa Bloober Team SA	11,686,136	14,326,740	2,640,604
Games Operators SA	27,102,021	11,417,101	–15,684,920
3R Games SA	–721,693	4,423,280	5,144,973
Grupa Kapitałowa SIMFABRIC SA	–15,258,995	–12,375,275	2,883,720
Grupa Kapitałowa Ultimate Games SA	–27,594,164	–31,799,873	–4,205,709
Vivid Games SA	–8,703,162	–33,797,107	–25,093,945
Grupa Kapitałowa Gaming Factory SA	–52,233,862	–39,555,947	12,677,915
T-Bull SA	–87,189,580	–67,389,421	19,800,159
Grupa Kapitałowa Movie Games SA	29,476,747	–83,038,725	–112,515,472
ALL iN! GAMES SA	–284,058,345	–88,222,860	195,835,485
Grupa Kapitałowa PCF Group SA	245,895,873	–519,089,048	–764,984,921
Average	288,761,948	352,125,567	63,363,619
Median	69,735,845	15,566,173	–54,169,672

Source: own elaboration.

Changes in intellectual capital, measured using the KCE method, in the gaming sector indicate that its average value increased by PLN 63,363,619, while the median decreased by PLN 54,169,672. Since the analysis of the above statistics offers no clear results, changes in intellectual capital should be analysed in more detail. The value of intellectual capital increased for 13 companies and decreased for nine. Huuuge Inc. achieved the greatest growth, by PLN 2,014,025,954, and the largest decrease belonged to PCF Group SA Capital Group (PLN 764,984,921).

5. Conclusions

The intellectual capital of gaming sector companies listed on the Main Market was subjected to statistical analysis for the years 2022–2023. Three methods were used to measure intellectual capital: the difference between market value and book value, economic added value, and profit from knowledge capital. The first conclusion that comes to mind after analysing the data is the large diversity of the variables studied.

The next conclusion drawn from the analysis is related to the value of intellectual capital in three companies in the gaming sector, namely: CD PROJEKT SA, PLAYWAY SA Capital Group, and Huuuge Inc. They rank in the top three in terms of the value of intellectual capital calculated using the three methods. CD PROJEKT SA has the highest level of intellectual capital calculated as the difference between market value and book value and the KCE method. This shows the high position of the company in the computer games market and its involvement in the development of intellectual capital. This is also evidenced by the distance that separates it from other companies in terms of intellectual capital, which is several times higher than that of companies in subsequent positions in the ranking. It is also many times higher than in the case of companies with average or low intellectual capital.

Please note that not all companies in the gaming sector possess intellectual capital. According to the MV-BV method, there are two companies in the ranking possessing intellectual capital. When measured using the EVA method, intellectual capital was found in 12 companies, and when the KCE method was used, eight companies. Such a large number of companies lacking intellectual capital can be attributed to the deterioration of the profitability of gaming companies. As shown in the data in Table 1, eight companies in the analysed sector recorded a net loss. In turn, in the case of the EVA method, the large number of companies with a negative result of economic value added could have been influenced by the high cost of capital.

As part of the statistical analysis, a Shapiro-Wilk test for the normality of the distribution of variables was conducted. It revealed that when using all three valuation methods, the value of intellectual capital was not normally distributed. In turn, the skewness coefficients calculated for individual methods reach positive values, indicating a right-skewed distribution. In the case of the MV-BV and KCE methods, the skewness is above 4, which is high and results in the arithmetic mean being significantly overestimated. In the case of the EVA method, the skewness of the distribution is lower, amounting to approximately 2.

The high variability of the analysed variables, the skewness of the distribution manifested by large differences between the mean and the median, and only two analysed periods are factors that make it difficult to draw general conclusions

regarding the level and changes in the level of intellectual capital of companies in the Polish gaming sector.

Finally, it should be noted that the study of Pearson's linear correlation between the level of intellectual capital measured using the MV-BV, EVA, and KCE methods for 2023 confirmed a statistically significant positive correlation (at $p < 0.05$). It was 0.87 between intellectual capital measured using MV-BV and EVA methods, 0.89 between intellectual capital measured using MV-BV and KCE methods, and 0.90 between intellectual capital measured using EVA and KCE methods. This shows the consistency of the study results and the high practicality of the intellectual capital measurement methods.

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Conflict of Interest

The author declares no conflict of interest.

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