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## The Intellectual Capital and its Impact on the Sustainable Development of the SML-Sized Enterprises in Poland

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**Abstract:**

**Purpose:** The main goal of the article is to analyze the level of differentiation of awareness and knowledge of managers of small, medium and large enterprises within the scope of the essence and meaning of intellectual capital and the influence of its elements on the sustainable development of enterprises in Poland.

**Design/Methodology/Approach:** The paper exploits a data set of 1067 companies operating in Poland (employing at least 10 employees). In order to test the research hypotheses, the analysis of variations for fuzzy numbers (FANOVA) was implemented.

**Findings:** Although the majority of enterprises in Poland do not implement intellectual capital management strategies, managers are aware of the essence and significance of intellectual capital. The differentiation of the responses of managers based on the size of the enterprise was not statistically significant.

**Practical implications:** This paper recommends companies to invest in intellectual capital that according to managers' assessment has a significant impact on their sustainability.

**Originality/Value:** This research contributes to enrich the theoretical framework for the Polish context regarding intellectual capital and it allows contrasting the evidence with other studies at national levels.

**Keywords:** Intellectual capital, enterprise development, performance, fuzzy numbers.

**JEL codes:** C12, C38, C81, C83, D81, J24, O34.

**Paper Type:** Research article.

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## **1. Introduction**

Intellectual capital is currently the key resource of the enterprise that determines its success on both the domestic and international market. On the one hand, dynamically changing external conditions force enterprises to introduce innovative solutions, products and services. On the other hand, only unique resources, difficult to reproduce by competitors, allow to achieve and strengthen a competitive advantage. High-quality intellectual capital allows enterprises to meet these challenges and achieve strategic goals. Studies indicate that intellectual capital is positively and significantly correlated with the performance of an organization.

These include the articles published by Tan *et al.* (2007), Diez *et al.* (2010), Gigante (2013), Isanzu (2015). It should be noted, however, that intangible nature of intellectual capital and the multitude of its elements causes that in many enterprises the awareness of the importance of intellectual capital for their development is still low. Thus, there is a need to study issues related to intellectual capital due to its direct impact on the increase in competitive advantage of enterprises.

Intellectual capital is defined as a collection of intangible assets (resources, capabilities and competitiveness), which influence the effectiveness of an organization and value creation (Roos and Ross, 1997). The elements constituting intellectual capital have not yet been uniformly defined. The literature presents different classifications of intellectual capital Edvinsson and Malone (1997), Bontis (1998), Stewart (2001). Often referred to is the division of intellectual capital into three subsets, human capital, structural capital and relational capital. Human capital primarily includes knowledge, skills, experience as well as employees' competences and abilities to perform tasks and solve problems.

Structural capital includes, among others, organizational structure, technical infrastructure, software, licenses and patents. It is usually the result of employee actions. Relational capital is based on relationships with the external environment, including relationships with customers, suppliers, competitors and partners. Between these elements of intellectual capital there is a strong relationship, characterized by a feedback loop. From the perspective of managers, in order to create value, it is essential to connect these three elements together. In this context, intellectual capital is a phenomenon of interaction, transformation and complementation.

In the literature, publications discussing the role of intellectual capital in the development of enterprises can be found. One of them is the publication by Barkat *et al.* (2018), which focuses on the effects of different elements of intellectual capital on innovation capability and organizational performance. The authors of the paper, based on the data collected from 295 large textile companies in Pakistan, have proven significant positive direct and indirect effects on innovation capability and organizational performance among human, relational, and technological capital.

Ibarra Cisneros and Hernandez-Perlines (2018) tested the relationship between the various components of intellectual capital (human, organizational, technological and relational) and organization performance in small and medium enterprises in the manufacturing sector in the region of Baja California, Mexico. The results showed that the four capitals have a positive influence on firms' organizational performance.

Ginesti *et al.* (2018) analysed the impact of intellectual capital on the reputation and performance of Italian companies. Findings indicate, inter alia, that companies, which obtained reputational rating under ICA scrutiny, show a positive relationship between IC components and various measures of financial performance. The influence of intellectual capital on the performance on small and medium enterprises is also discussed in the article by Arshad and Arshad (2018). The authors of the paper, based on a group of 350 enterprises, have proven that intellectual capital significantly impacts the performance of textile enterprises in Pakistan. Research into intellectual capital has also been conducted by Hamdan (2018). The study focused on analyzing the relation between intellectual capital and accounting-based and market-based firm performance.

The research conducted at 198 firms from Kingdom of Saudi Arabia and Kingdom of Bahrain indicate the relationship between intellectual capital and accounting-based performance. Sardo and Serrasqueiro (2017), in their study, observed that intellectual capital playing a predominant role in enhancing European firms' wealth. Among earlier publications the following can be identified, Maditinos *et al.* (2011), Ramezan (2011), Basuki and Kusumawardhani (2012), Mehralian (2012), Komnencic and Pokrajčić (2012), Mention and Bontis (2013), Khan and Terziovski (2014), Ozkan *et al.* (2016).

The main goal of the article is to analyze the level of differentiation of awareness and knowledge of managers of small, medium and large enterprises within the scope of the essence and meaning of intellectual capital and the influence of its elements on the sustainable development of enterprises in Poland.

## **2. Materials and Methods**

The analysis utilizes the results from a study on managing intellectual capital by enterprises in Poland. The research was conducted in May, 2019. The research was realized through the CATI and CAWI methods in a representative group of 1067 enterprises operating in Poland (employing at least 10 employees) with an assumed level of trust of 0,95 and an estimation error of 3%. It was based on a proportional selection of enterprises based on voivodeships and their size measured by the number of employees. The assumed structure of the test group also took into account the differentiation of enterprises based on their type of activity (the number of interviews conducted was proportional to the participation of enterprises in different PKD sections (Polish Classification of Activities). The structure of the research sample was created based on data from Central Statistical Office dated January

2019. The interviews were conducted with representatives of the management level of the enterprises in question.

For the purpose of the analysis of the correlation between the size of an enterprise and its knowledge of intellectual capital, measuring intellectual capital, as well as possessing an intellectual capital management strategy, the classical chi-squared test of independence was utilized, with an assumed level of significance  $p=0,05$ .

In the measurement of the importance of each element of intellectual capital with regards to the sustainable development of enterprises, a four-level scale was used, with each level being respectively described by “definitely insignificant”, “insignificant”, “significant”, “very significant”. In the construction of the measurement tool, it has also been provided that respondents could answer “difficult to say”, if they were unable to definitely determine the influence of elements of intellectual capital on the sustainable development of their enterprises. The measurement scale applied in the survey is a type of a Likert scale, which are most often utilized in gathering opinions and attitudes of respondents. These scales, while being attractive and easy-to-follow for respondents, also have their limitations.

According to Steven’s theory, the analysis of the results of the measurement utilizing ordinal scales only allows for a relationship between the majority and minority as well as the counting of instances. This means the obtained results cannot be directly used to analyze the dependency between observing the influence of the elements of intellectual capital on the sustainable development of enterprises and their size. It is also more difficult to determine which elements of intellectual capital have, in the opinion of respondents, the largest influence on the sustainable development of enterprises. This results from the fact that in the case of ordinal scales it is not possible to average the results, especially in the case of a small number of levels constituting the scale.

In order to overcome these limitation it had been decided that for the purpose of statistical analysis and verification of research hypotheses, a transformation will be applied of the measurement scale to the form of fuzzy sets, resulting in fuzzy conversion scales. Such a step made it possible to average the results in accordance with arithmetical operations, which are allowed in the case of fuzzy numbers presented for instance in the following publications, Klir and Yuan (1995); Chen and Pham (2001). In the article it has been proposed to utilize the fuzzy conversion scale proposed by Lubiano *et al.* (2016).

Averaging the importance assessment results allowed for the construction of the ranking of the influence of the elements of intellectual capital on the sustainable development of enterprises in Poland, as perceived by the respondents, i.e., of the managers partaking in the survey. It should be noted that in accordance with the methodology of arithmetic operations on triangular fuzzy numbers, the result – which was an arithmetical mean – also had the form of a triangular fuzzy number.

The direct comparison of the two averages expressed in such a form is not possible, therefore in such a case it is necessary to apply the so-called defuzzification of fuzzy numbers. The result of this defuzzification is a real number, which, among other things, allows to arrange the mean values of the significance assessment in order from highest to lowest. In the article the two most commonly utilized methods have been applied, which are related to the defuzzification of triangular fuzzy numbers, namely: the center of gravity (CoG) and the median. The application of two methods was aimed at eliminating the element of bias in the selection of the method of defuzzification and determining the validity of the obtained order of mean values. In the case of observed discrepancies in the obtained rankings, their concordance coefficient was estimated using Kendall's tau rank.

The transformation of results into the form of fuzzy numbers, which has been proposed in this paper, has also made it possible to analyze the variance of triangular fuzzy numbers (FANOVA), which allowed for investigating the significance of the differences between the average assessments of the importance of the influence of elements of intellectual capital on the sustainable development of enterprises in Poland, differentiated based on their size. The FANOVA method verifies the hypothesis (Parchami *et al.*, 2017):

$$H_0 : \tilde{\mu}_1 = \tilde{\mu}_2 = \dots = \tilde{\mu}_r, \quad (1)$$

$$H_1 : \text{not all } \tilde{\mu}_i \text{'s } (i = 1, \dots, r) \text{ are equal}, \quad (2)$$

where:  $\tilde{\mu}_i$  - is the average value of the characteristic expressed in the form of a triangular fuzzy number for the  $i$ -th group.

For the verification of the above-mentioned hypothesis, the statistical test value of  $\tilde{F}$  should be calculated through the formula:

$$\tilde{F} = \frac{MSTR}{MSE}, \quad (3)$$

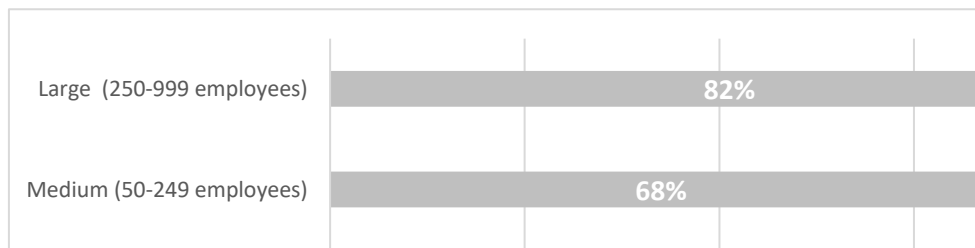
where:  $MSTR$  - treatment mean square,  $MSE$  - mean of squares.

If at the given level of significance of  $\alpha$   $\tilde{F} \leq F_{1-\alpha; r-1; n_i-r}$  then the null hypothesis is accepted. In other cases, the null hypothesis  $H_0$  is rejected and the alternative hypothesis  $H_1$  accepted. For calculations, this article utilizes the ANOVA.TFNs package, developed by Parchami (2018). For the purpose of verification of the hypothesis described in this paper, a level of significance of  $\alpha = 0,05$  has been assumed.

## 2.1 Knowledge of the Concept of Intellectual Capital in Enterprises in Poland

Research studies conducted in 2019 indicate that the term intellectual capital is recognized by almost 70% of respondents from enterprises in Poland, which is illustrated by Figure 1. A notably high recognition of this area has been observed by large enterprises, employing from 250 to 999 employees (82% indications). In the case of small and medium enterprises, a positive answer has been given by 67% and 68% respondents, respectively.

**Figure 1.** The recognition of the term intellectual capital among enterprises in Poland

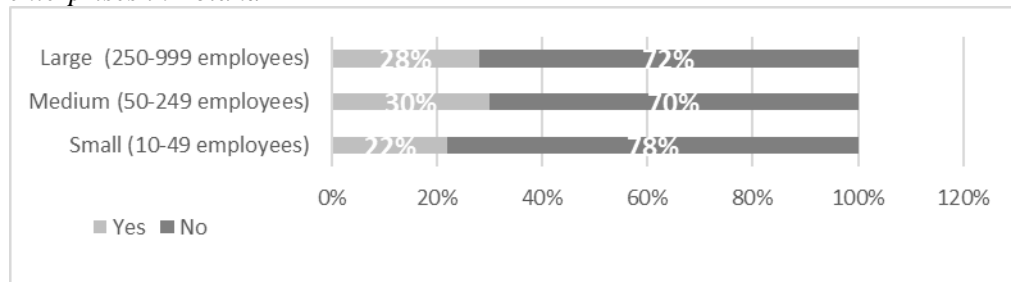


Source: Own elaboration.

## 2.2 The Presence of Intellectual Capital Strategies in Enterprises in Poland

Despite the concept of intellectual capital being recognized in many enterprises in Poland, only few of them have developed and implemented an intellectual capital management strategy. The analysis of the data below indicates that 22% of small enterprises have declared the functioning of such a strategy, in the case of medium enterprises – 30%, and 28% for large companies.

**Figure 2.** The functioning of the strategy of intellectual capital management in enterprises in Poland



Source: Own elaboration.

### **2.3 The Impact of the Elements of Intellectual Capital on the Sustainable Development of Enterprises – Descriptive Analysis**

The assessment of the impact of the elements of intellectual capital on the sustainable development of enterprises was carried out through its division into three components of intellectual capital, among which the following were specified:

- Human capital: H1 - employee knowledge, H2 - employee skills; H3 - creativity and innovativeness of employees, H4 - employee motivation, H5 - employee experience, H6 - employee integrity, H7 - employee honesty, H8 – ability to work in a team, H9 - ability and willingness of employees to share knowledge and information, H10 - employee satisfaction, H11 - employee involvement, H12 - employee well-being, H13 - health;
- Structural capital: S1-technical infrastructure, S2-information resources/systems and databases, S3 - intellectual property (patents, licenses, trademarks), S4 - organizational culture, S5 - processes and management methods;
- Relational capital: R1 - customer loyalty and satisfaction, R2 - customer participation in creating products/services, R3 – investor relations, R4 - relations with science and research units, R5 - relations with suppliers, R6 - reputation and image of the enterprise on the market.

Analyzing the structure of intellectual capital, factors associated with human capital play a significant role for the sustainable development of enterprises in Poland. In the case of small enterprises, employing 10-49 employees, the following factors have been identified as extremely relevant: employee honesty (69% indications), reliability of employees (65% indications), skills of employees (63% indications), knowledge of employees (58% indications), engagement of employees (53% indications) and health (51% indications).

The following factors have been identified as relevant for this group of enterprises: ability and readiness of employees to share knowledge and information (52% indications), well-being of employees (52% indications), teamwork skills (50% indications), satisfaction of employees (49% indications) and creativity and innovativeness of employees (43% indications).

**Table 1.** *The impact of human capital factors on the sustainable development of small enterprises – research results*

Human capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
H1	1%	4%	4%	33%	58%
H2	1%	2%	2%	32%	63%
H3	1%	7%	8%	43%	41%
H4	1%	2%	4%	44%	49%
H5	1%	3%	7%	44%	45%

H6	1%	1%	1%	32%	65%
H7	1%	0%	1%	29%	69%
H8	0%	3%	7%	50%	40%
H9	0%	4%	6%	52%	38%
H10	1%	2%	5%	49%	43%
H11	0%	1%	2%	44%	53%
H12	0%	4%	8%	52%	36%
H13	1%	2%	4%	42%	51%

*Source: Own elaboration.*

Medium enterprises, which employ around 50-249 employees, have indicated the following factors tied to human capital, as extremely relevant for their sustainable development: employee honesty (63% indications), their abilities (63% indications), knowledge (60% indications), and reliability (56% indications). A relevant impact for these enterprises is made by employee satisfaction (56% indications), well-being of employees (54% indications), their ability and readiness to share knowledge and information (52% indications), health (52% indications), experience (50% indications) and engagement (50% indications). Whereas over 10% of enterprises from this group were unable to indicate the importance of factors such as the ability and readiness of employees to share knowledge and information (12% indications) and creativity and innovativeness of employees (11% indications).

**Table 2.** *The impact of human capital factors on the sustainable development of medium enterprises – research results*

Human capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
H1	0%	3%	4%	33%	60%
H2	0%	2%	1%	34%	63%
H3	0%	8%	11%	39%	42%
H4	0%	1%	6%	46%	47%
H5	0%	6%	9%	50%	35%
H6	0%	0%	2%	42%	56%
H7	0%	0%	3%	34%	63%
H8	0%	5%	6%	47%	42%
H9	0%	4%	12%	52%	32%
H10	0%	1%	5%	56%	38%
H11	0%	0%	5%	50%	45%
H12	0%	5%	9%	54%	32%
H13	0%	2%	3%	52%	43%

*Source: Own elaboration.*

Large enterprises view the following factors as extremely relevant for human capital: knowledge of employees (77% indications), their skills (73% indications), honesty (55% indications), motivation (50% indications) and engagement (50% indications). These enterprises have indicated the following as relevant, reliability of employees (68% indications), teamwork skills (68% of indications), creativity and



innovativeness of employees (63% indications), their experience (59%), engagement (50% indications) and health (50% indications).

**Table 3.** *The impact of human capital factors on the sustainable development of large enterprises – research results*

Human capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
H1	0%	5%	0%	18%	77%
H2	0%	5%	0%	22%	73%
H3	0%	5%	0%	63%	32%
H4	5%	0%	0%	45%	50%
H5	5%	0%	9%	59%	27%
H6	0%	0%	0%	68%	32%
H7	0%	0%	5%	40%	55%
H8	0%	5%	5%	68%	22%
H9	0%	5%	9%	45%	41%
H10	5%	9%	5%	49%	32%
H11	0%	0%	0%	50%	50%
H12	0%	9%	18%	46%	27%
H13	0%	9%	9%	50%	32%

*Source:* Own elaboration.

Whereas organizational capital factors are to a major degree relevant for small enterprises and include organizational culture (59% indications), technical infrastructure (54% indications) and management processes and methods (53% indications). Intellectual property is perceived as relevant by 37% respondents, whereas according to 24% of small enterprises it is irrelevant for their development.

**Table 4.** *The impact of structural capital factors on the sustainable development of small enterprises – research results*

Structural capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
S1	1%	6%	8%	54%	31%
S2	1%	12%	9%	46%	32%
S3	5%	24%	15%	37%	19%
S4	1%	6%	9%	59%	25%
S5	1%	7%	9%	53%	30%

*Source:* Own elaboration.

In the case of medium enterprises there is a similar perception of elements of organizational capital as with small enterprises. This group has indicated the following factors as relevant: technical infrastructure (54% indications), processes and management methods (54% indications) and organizational culture (51% indications). Intellectual property has been indicated as a relevant factor for 36% companies, whereas according to 25%, it is extremely relevant.

**Table 5.** *The impact of structural capital factors on the sustainable development of medium enterprises – research results*

Structural capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
S1	0%	4%	5%	54%	37%
S2	0%	11%	6%	47%	36%
S3	2%	24%	13%	36%	25%
S4	0%	6%	10%	51%	33%
S5	0%	6%	6%	54%	34%

*Source:* Own elaboration.

Large enterprises have indicated the following organizational capital factors as extremely relevant for the sustainable development of their activity, management processes and methods (50% indications) and organizational culture (45% indications). The following factors have been as relevant: technical infrastructure (72% indications) and information resources/systems and databases (63% indications). The following organizational capital factors have been indicated by 14% of enterprises as irrelevant for their sustainable development: intellectual property and management processes and methods.

**Table 6.** *The impact of structural capital factors on the sustainable development of large enterprises – research results*

Structural capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
S1	0%	5%	0%	72%	23%
S2	0%	5%	0%	63%	32%
S3	0%	14%	32%	36%	18%
S4	0%	9%	5%	41%	45%
S5	0%	14%	0%	36%	50%

*Source:* Own elaboration.

In the scope of relational capital, the following factors have been indicated as extremely relevant for the sustainable development of small enterprises: reputation and image of the enterprise on the market (69% indications) and loyalty and satisfaction of clients (61% indications). The following have been indicated as relevant: supplier relations (46% indications), participation of clients in developing products/services (39% indications) and investor relations (35% indications). According to 35% enterprises, relations with research and science units are irrelevant.

**Table 7.** *The impact of relational capital factors on the sustainable development of small enterprises – research results*

Relational capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
R1	1%	1%	3%	34%	61%
R2	4%	20%	17%	39%	20%

R3	8%	19%	11%	35%	27%
R4	15%	35%	16%	25%	9%
R5	3%	6%	4%	46%	41%
R6	1%	1%	2%	28%	69%

*Source: Own elaboration.*

Medium enterprises, similarly to small enterprises, perceived the role of particular factors of relational capital for the sustainable development of their activity. The following factors have also been indicated as extremely relevant, reputation and image of the enterprise on the market (68% indications), loyalty and satisfaction of clients (56% indications). A relevant meaning has is associated with investor relations (44% indications), participation of clients in developing products and services (40% indications) and investor relations (35% indications). Similarly to small enterprises, according to 31% of respondents, relations with research and science units have been identified as irrelevant.

**Table 8.** *The impact of relational capital factors on the sustainable development of medium enterprises – research results*

Relational capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
R1	1%	3%	4%	36%	56%
R2	1%	18%	15%	40%	26%
R3	6%	15%	10%	35%	34%
R4	11%	31%	15%	28%	15%
R5	0%	9%	8%	44%	39%
R6	0%	1%	3%	28%	68%

*Source: Own elaboration.*

For large enterprises reputation and image of the enterprise on the market has been identified as extremely relevant (50% indications). Whereas loyalty and satisfaction of clients (50% indications), participation of clients in developing products and services (50% indications), supplier relations (45% indications) and investor relations (40% indications) are factors that have been identified as relevant for the sustainable development of this group of enterprises. Relations with research and science units are irrelevant for 27%, whereas 32% were unable to determine its role in the sustainable development of their activity.

**Table 9.** *The impact of relational capital factors on the sustainable development of large enterprises – research results*

Relational capital elements	Definitely insignificant	Insignificant	Difficult to say	Significant	Very significant
R1	0%	9%	5%	50%	36%
R2	0%	14%	22%	50%	14%
R3	5%	14%	23%	40%	18%
R4	5%	27%	32%	23%	13%

R5	0%	5%	23%	45%	27%
R6	0%	5%	5%	40%	50%

Source: Own elaboration.

## 2.4 The Significance of the Elements of Intellectual Capital in Shaping the Sustainable Development of Enterprises

The assessment of the significance of the impact of the elements of intellectual capital on the sustainable development of enterprises was carried out through its division into three components of intellectual capital. Detailed parameters of fuzzy triangular numbers for factors of human, structural and relational capital have been respectively presented in Tables 10-12.

**Table 10.** The significance of human capital for the sustainable development of enterprises

Human capital elements	Size of enterprise								
	Small			Medium			Large		
	a	b	c	a	b	c	a	b	c
H1	5,189	8,498	9,817	5,305	8,641	9,908	5,752	9,090	9,848
H2	5,411	8,721	9,889	5,386	8,722	9,933	5,600	8,938	9,848
H3	4,564	7,858	9,684	4,597	7,932	9,701	4,238	7,571	9,848
H4	4,946	8,258	9,891	4,972	8,307	9,976	4,844	8,027	9,697
H5	4,777	8,091	9,838	4,416	7,750	9,782	4,163	7,329	9,667
H6	5,475	8,793	9,935	5,243	8,578	10,000	4,390	7,723	10,000
H7	5,612	8,926	9,943	5,482	8,819	10,000	5,233	8,569	10,000
H8	4,615	7,937	9,852	4,667	8,001	9,835	3,964	7,297	9,841
H9	4,489	7,807	9,820	4,407	7,740	9,849	4,662	7,997	9,833
H10	4,763	8,074	9,890	4,648	7,982	9,977	3,964	7,139	9,364
H11	5,081	8,405	9,943	4,903	8,237	10,000	4,995	8,330	10,000
H12	4,481	7,802	9,844	4,368	7,701	9,831	4,070	7,403	9,629
H13	5,005	8,309	9,871	4,744	8,079	9,931	4,163	7,496	9,666

Source: Own elaboration.

**Table 11.** The significance of structural capital for the sustainable development of enterprises

Structural capital elements	Size of enterprise								
	Small			Medium			Large		
	a	b	c	a	b	c	a	b	c
S1	4,180	7,477	9,698	4,471	7,805	9,860	3,935	7,268	9,848
S2	3,990	7,282	9,466	4,221	7,555	9,624	4,238	7,571	9,848
S3	2,957	6,101	8,698	3,279	6,536	8,929	3,552	6,885	9,332
S4	4,010	7,314	9,725	4,334	7,668	9,779	4,599	7,933	9,682
S5	4,120	7,412	9,662	4,315	7,649	9,788	4,541	7,876	9,545

Source: Own elaboration.

**Table 12.** The significance of relational capital for the sustainable development of enterprises

Relational capital elements	Size of enterprise								
	Small			Medium			Large		
	a	b	c	a	b	c	a	b	c

R1	5,410	8,723	9,930	5,190	8,503	9,862	4,281	7,615	9,682
R2	3,173	6,352	8,883	3,564	6,845	9,191	3,330	6,662	9,411
R3	3,338	6,382	8,703	3,844	6,958	9,018	3,330	6,466	9,018
R4	1,640	4,365	7,377	2,297	5,216	7,956	2,442	5,552	8,219
R5	4,417	7,653	9,585	4,408	7,742	9,664	4,309	7,643	9,804
R6	5,627	8,938	9,924	5,634	8,971	9,977	4,916	8,251	9,841

*Source:* Own elaboration.

In the next stage of the analysis, the relationship between the size of the enterprise and the perception of the significance of the impact of individual elements of intellectual capital on the sustainable development of enterprises has been examined. For each of the elements of intellectual capital, the following research hypothesis has been verified:

*H0: The size of the enterprise measured by the number of employees does not have an impact on the assessment of the significance of a given element of intellectual capital in shaping the sustainable development of the enterprise.*

*H1: The size of the enterprise measured by the number of employees has an impact on the assessment of the significance of a given element of intellectual capital in shaping the sustainable development of the enterprise.*

The FANOVA method was used as the average importance assessments have been expressed in the form of fuzzy triangular numbers in the analysis of the relationship between the size of the enterprise and the perception of the significance of the impact of selected elements of intellectual capital on the sustainable development of enterprises. Tables 13-16 presents the details of FANOVA for each of the elements of intellectual capital.

**Table 13. Details of FANOVA for H1-H13**

Source of variation	Sum of squares	Degrees of freedom	Mean squares	$\tilde{F}$ -statistic	Test result
<b>H1</b>					
Between Treatments (BS)	7,28	2	3,64	$\tilde{F} = 1,242$	Accept H0
Within Treatments (WT)	2996,51	1022	2,93	-	-
Total (T)	3003,58	1024	-	-	p=0,289
<b>H2</b>					
BS	0,72	2	0,36	$\tilde{F} = 0,139$	Accept H0
WT	2683,24	1040	2,58	-	-
T	2683,95	1042	-	-	p=0,870
<b>H3</b>					
BS	1,76	2	0,88	$\tilde{F} = 0,253$	Accept H0
WT	3389,75	976	3,47	-	-
T	3391,51	978	-	-	p=0,776
<b>H4</b>					
BS	0,97	2	0,48	$\tilde{F} = 0,181$	Accept H0
WT	2718,33	1016	2,68	-	-

T	2719,3	1018	-	-	p=0,834
<b>H5</b>					
BS	18,14	2	9,07	$\tilde{F} = 3,151$	Reject H0
WT	2817,97	979	2,88	-	-
T	2836,11	981	-	-	p=0,043
<b>H6</b>					
BS	21,27	2	10,63	$\tilde{F} = 4,642$	Reject H0
WT	2391,77	1044	2,29	-	-
T	2413,04	1046	-	-	p=0,000
<b>H7</b>					
BS	2,55	2	1,28	$\tilde{F} = 0,585$	Accept H0
WT	2276,59	1042	2,18	-	-
T	2279,14	1044	-	-	p=0,558
<b>H8</b>					
BS	6,86	2	3,43	$\tilde{F} = 1,282$	Accept H0
WT	2655,3	992	2,68	-	-
T	2662,16	994	-	-	p=0,278
<b>H9</b>					
BS	0,9	2	0,45	$\tilde{F} = 0,165$	Accept H0
WT	2673,77	983	2,72	-	-
T	2674,67	985	-	-	p=0,848
<b>H10</b>					
BS	13,25	2	6,62	$\tilde{F} = 2,515$	Accept H0
WT	2659,66	1010	2,63	-	-
T	2672,91	1012	-	-	p=0,081
<b>H11</b>					
BS	2,41	2	1,21	$\tilde{F} = 0,510$	Accept H0
WT	2444,6	1034	2,36	-	-
T	2447,01	1036	-	-	p=0,600
<b>H12</b>					
BS	2,55	2	1,27	$\tilde{F} = 0,487$	Accept H0
WT	2536,74	969	2,62	-	-
T	2539,29	971	-	-	p=0,615
<b>H13</b>					
BS	12,91	2	6,45	$\tilde{F} = 2,322$	Accept H0
WT	2835,36	1020	2,78	-	-
T	2848,26	1022	-	-	p=0,099

Source: Own elaboration.

Table 14. Details of FANOVA for S1-S5

Source of variation	Sum of squares	Degrees of freedom	Mean squares	$\tilde{F}$ -statistic	Test result
<b>S1</b>					
Between Treatments (BT)	10,65	2	5,32	$\tilde{F} = 1,803$	Accept H0
Within Treatments (WT)	2896,71	981	2,95	-	-
Total (T)	2907,36	983	-	-	p=0,165
<b>S2</b>					
BT	7	2	3,5	$\tilde{F} = 0,944$	Accept H0
WT	3590,13	968	3,71	-	-
T	3597,13	970	-	-	p=0,390

<b>S3</b>					
BT	21,97	2	10,99	$\tilde{F} = 2,112$	Accept H0
WT	4677,02	902	5,19	-	-
T	4698,99	904	-	-	p=0,121
<b>S4</b>					
BT	16,54	2	8,27	$\tilde{F} = 3,077$	Reject H0
WT	2599,02	967	2,69	-	-
T	2615,56	969	-	-	p=0,047
<b>S5</b>					
BT	8,13	2	4,06	$\tilde{F} = 1,308$	Accept H0
WT	3012,09	970	3,11	-	-
T	3020,22	972	-	-	p=0,271

*Source: Own elaboration.*

**Table 15. Details of FANOVA for R1-R6**

Source of variation	Sum of squares	Degrees of freedom	Mean squares	$\tilde{F}$ -statistic	Test result
<b>R1</b>					
Between Treatments (BT)	21,7	2	10,85	$\tilde{F} = 4,336$	Reject H0
Within Treatments (WT)	2567,74	1026	2,5	-	-
Total (T)	2589,45	1028	-	-	p=0,013
<b>R2</b>					
BT	19,64	2	9,82	$\tilde{F} = 2,023$	Accept H0
WT	4286,44	883	4,85	-	-
T	4306,93	885	-	-	p=0,133
<b>R3</b>					
BT	27,78	2	13,89	$\tilde{F} = 2,085$	Accept H0
WT	6294,54	945	6,66	-	-
T	6322,32	947	-	-	p=0,125
<b>R4</b>					
BT	71,27	2	35,63	$\tilde{F} = 5,974$	Reject H0
WT	5296,9	888	5,96	-	-
T	5368,16	890	-	-	p=0,003
<b>R5</b>					
BT	0,55	2	0,27	$\tilde{F} = 0,068$	Accept H0
WT	4025,86	1005	4,01	-	-
T	4026,4	1007	-	-	p=0,934
<b>R6</b>					
BT	7,23	2	3,62	$\tilde{F} = 1,588$	Accept H0
WT	2363,1	1038	2,28	-	-
T	2370,33	1040	-	-	p=0,205

*Source: Own elaboration.*

Table 16 presents the value of test statistics  $\tilde{F}$ , the p-value and the decision regarding the lack of grounds for, or the rejection of the null hypothesis for each of the elements of intellectual capital.

**Table 16.** Details of FANOVA for intellectual capital components

Intellectual capital elements	$\tilde{F}$ -statistic	p-value	Test result
Human capital			
H1	1,242	0,289	Accept H0
H2	0,139	0,870	Accept H0
H3	0,253	0,776	Accept H0
H4	0,181	0,834	Accept H0
H5	3,151	0,043	Reject H0
H6	4,642	0,009	Reject H0
H7	0,585	0,558	Accept H0
H8	1,282	0,278	
H9	0,165	0,848	
H10	2,515	0,081	
H11	0,510	0,600	
H12	0,487	0,615	
H13	2,322	0,099	
Structural Capital			
S1	1,803	0,165	Accept H0
S2	0,944	0,390	
S3	2,112	0,121	
S4	3,077	0,047	Reject H0
S5	1,308	0,271	Accept H0
Relational Capital			
R1	4,336	0,013	Reject H0
R2	2,023	0,133	Accept H0
R3	2,085	0,125	Accept H0
R4	5,973	0,003	Reject H0
R5	0,068	0,934	Accept H0
R6	1,588	0,205	Accept H0

*Source:* Own elaboration.

Analysis of the results indicates that in most cases the size of the enterprise measured by the number of employees does not have an impact on the assessment of the significance of a given element of intellectual capital in shaping the sustainable development of the enterprise. This relation has not been confirmed only in the case of employee experience (H5) and integrity (H6) (being a part of human capital), organizational culture (S4) (being a part of structural capital), customer loyalty and satisfaction (R1) and relations with science and research units (R4) (being a part of relational capital).

### 3. Conclusions

The research clearly indicates that the majority of enterprises in Poland do neither formulate nor implement intellectual capital management strategies. However, this does not mean that company managers are not aware of the essence and significance of intellectual capital. Just over 2/3 of the surveyed small and medium-sized enterprises, have declared knowledge in the field of intellectual capital. The share of positive answers in the group of enterprises employing more than 250 employees was even higher and reached 82%. It is worth observing that managers of large enterprises are less likely than managers of medium-sized enterprises to base their decisions and actions on intellectual capital management strategies. The highest



percentage – 30% – of positive responses has been recorded at medium-sized enterprises.

The FANOVA results presented in the article, prove that in the case of the majority of the elements of intellectual capital, the size of the enterprise does not determine the importance assessment of the influence of the elements of intellectual capital on the sustainable development of enterprises. Only in the case of two elements of human capital, the null hypothesis has been rejected, which means that the assessment of employee experience and integrity on the sustainable development of enterprises significantly varies among managers of small, medium and large enterprises. The significance of employee experience and integrity is mostly appreciated by representatives of small enterprises.

In the case of structural capital, the null hypothesis has been rejected for organizational culture, which means that the opinions of managers of the surveyed enterprises significantly vary, when it comes to the impact of this element of intellectual capital on the sustainable development of enterprises. The significance of this element has been mostly appreciated by managers of large and medium enterprises. In the case of relational capital, the most significant differences in the opinion of the management were identified in relations with science and research units. The influence of this element of intellectual capital on the sustainable development of enterprises is mostly appreciated by managers of large enterprises. The lowest appreciation for this factor of relational capital is declared by managers of small enterprises.

When it comes to human capital, managers of small enterprises have most commonly positively indicated (both “significant” and “very significant”) employee honesty (98%), employee integrity (97%) and employee involvement (97%). Managers of medium size enterprises believe integrity (98% positive indications) and, to an equal degree, employee honesty and employee skills – to be most important, with 97% positive indications each. In both of the analyzed cases, respondents, i.e. managers of small and medium enterprises have rarely given negative indications. With the exception of the creativity and innovativeness of employees, indications of “definitely insignificant” and “insignificant” have not exceeded 8%, collectively.

Moreover, in the group of respondents managing small enterprises, the creativity and innovativeness of employees as well as employee well-being, were the justification for not answering. In both cases, 8% of respondents indicated that it was “difficult to say”. Within the group of managers of medium enterprises, the ability to indicate a valuating answer – in terms of the influence of the elements of human capital on the sustainable development of enterprises – was utilized in the assessment of two elements: the ability and willingness of employees to share knowledge and information (12% indications of “difficult to say”) and the creativity and innovativeness of employees (11% indications of “difficult to say”).

According to managers of large enterprises, the most important element of human capital is employee knowledge. Over  $\frac{3}{4}$  of the respondents of this group of managers believed it to be “very significant”, whereas 18% said it was “significant” from the perspective of the sustainable development of the company. Moreover, managers managing large companies have consistently indicated (100% positive answers, i.e. both “significant” and “very significant”) that employee integrity and employee involvement are also important. Managers of large enterprises avoided answering chiefly in the case of the following elements: employee well-being (18% indications of “difficult to say”) and employee experience, the ability and willingness of employees to share knowledge and information as well as health. The last three of the abovementioned elements have each received 9% of indications of “difficult to say”.

In a detailed assessment of the elements of structural capital, respondents of the three groups have consistently agreed that the most important from the perspective of the sustainable development of enterprises is technical infrastructure. The majority of positive answers was constituted by indications of it being “significant”. The least “significant” impact was indicated in the case of intellectual property (patents, licenses, trademarks). Most negative indications for this element were assigned by the group of managers of small enterprises (a total of 29% indications of “definitely insignificant” and “insignificant”). Moreover, managers of all of the analyzed enterprises, most commonly avoided answering when it came to the assessment of this element. The “difficult to say” option was given by managers of large enterprises (32% of indications).

Respondents were also consistent in the detailed assessment of elements of relational capital. Up to 70% of managers of small and medium enterprises were of the opinion that the reputation and image of the enterprise on the market is “very significant” in terms of the sustainable development of enterprises. In the group of managers of large enterprises this indication was given by every other respondent (50% of indications of “very significant”). The least importance was assigned by managers of all groups to relations with science and research units. The greatest number of negative answers assigned to this element was given by managers of small enterprises (a total of 50% of answers of “definitely insignificant” and “insignificant”), whereas the fewest answers were given by managers of large enterprises (a total of 32% of indications of “definitely insignificant” and “insignificant”). In the assessment of the elements of relational capital, the greatest share of non-indications was observed, in comparison with the assessment of the two other elements of intellectual capital, i.e. human and relational capital.

To summarize the analysis of the detailed distributions of the answers of respondents, it is possible to determine that – in the context of the impact on the sustainable development of enterprises – the elements of human capital were most significant. Moreover, a large consistency of assessments has been observed in the analysis of the elements of human capital in the group of managers of small and

medium enterprises and a slightly different approach in the group of managers of large enterprises. A higher consistency of answers in all groups, i.e. small, medium and large enterprises, was observed in the assessment of the impact of the particular elements of structural and relational capital.

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