

# PERCEPTION OF DATA FROM THE ECOLOGICAL ACTIVITIES OF COMPANIES USING INNOVATIVE COMMUNICATION TOOLS

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## ABSTRACT:

By increasing the diversity of data from the evolving rebirth of societies to become greener, a need to simplify perception has been created, especially in the area of interactive data visualisation, which helps the user with data interpretation. Therefore, it is important to clarify the main factors of perception and predisposition to effective and clear perception of data. The interconnection of data visualisation, environmental activities and communication tools reinforces the fact that the groundswell is a leading innovative element that needs to be taken into account for the complexity of research. The authors analyse the research of domestic and foreign experts so far, summarise the findings as an ideal basis for their subsequent research and supplementation of expertise across the spectrum in the field of data perception, environmental activities of companies and largely innovative communication tools. They also deal with previous research in the field of effective data perception, environmental activities of companies and the resulting data packages. The study uses balanced methods of qualitative and quantitative research. Qualitative methods are in the form of analysis of the content of previously collected texts and documents, which is unstructured and has an emergent relationship between theory and research. It is also a well-established semantic analysis of conceptual expressions. Within the quantitative methods, representation is in the form of evaluation of the authors' own survey carried out in Slovak business entities. The dependence between the variables is tested using Cramer's V. The main goal of the study is to present a proposal for a methodology for displaying data from the environmental activities of businesses using innovative communication tools. Extensive research in the field of data visualisation and findings are formulated into conclusions in order to achieve a professional discussion on the issue. The added value of a scientific study is mainly in the clarification of specific and measurable data resulting in an effective display within the visualisation.

## KEY WORDS:

business environment, data, data visualisation, ecological activities, innovative communication tools

## 1 Introduction

Data has become a phenomenon today. Digital devices that are part of the life of the entire population are constantly generating huge amounts of data. Some data can be collected, stored and then analysed



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and interpreted through visualisation. The implementation of the whole mentioned process is important especially for simple perception and achieving purity in data mediation. Data is an important part of business entities, which can use it to make decisions not only in marketing activities, but also in the entire operation of the company. With the help of data, businesses can make decisions faster with the utmost benefit and more efficiently. It is therefore very important to address the issue and define the best possible procedures for data collection, analysis and interpretation.

The following reflection is a cross-section of the previous research where, in the beginning, Hohl defined “data visualisation” with respect to ecology in 2011.<sup>1</sup> On the other hand, according to Roshdy et al., we can consider the process of simplicity of data display, which is an important factor in data display and perception. At the end of the research, the authors state that the simpler the data displayed, the faster it is possible to perform a specific action. Subsequently, it is important to analyse the process in the electronic segment for collection and storage.<sup>2</sup> Pre-processing, post-analysis and imaging were defined in 2018 by Kim and Kim.<sup>3</sup> Their contents are the individual components that every functional system should contain. Barbosa and Barbosa have defined broad-spectrum data visualisation capabilities that are very important for correct perception, namely categorical, numerical, hierarchical, network, temporal, and spatial imaging capabilities.<sup>4</sup> On the other hand, there are specific options that result in the collection of data from the environmental activities of businesses, the framework for these facts having been defined by Niu et al.<sup>5</sup> The mentioned authors dealt mainly with companies that were active in ecological activities and, along with that, carried out data collection. The authors also state that it is important to use predictions based on large data and artificial intelligence to process and evaluate this data; it is the combination of artistic visualisation and comparison with data visualisation that Li has brought.<sup>6</sup> In addition, other authors examine digital art projects that involve big data, as well as predictions for further data dissemination. The authors Avraam et al. contributed to the definition of “data visualisation” and speak of it as a valuable tool in the use of analysis and interpretation of results.<sup>7</sup> The researched issue gives room for further research. The elaboration of the topic of data visualisation takes place through broad-spectrum methods, but there are gaps that are important to fill in further research on the issue.

Another relevant topic is the ecological activity of business entities. Szabo and Webster state that the environmental activities of businesses should offer added value to consumers, which should reflect current needs and requirements based on the market environment.<sup>8</sup> According to Chabowski, Men and Gonzalez-Padron, businesses should be based on linking long-term and short-term marketing campaigns aimed at communicating eco-products and services with a view to eliminating the negative impact on the environment.<sup>9</sup> Green marketing communication should be based on the four pillars of the IMC (i.e., integrated marketing communication) methodology, which reflects on process management and integration of all so-called green activities of business entities; it should connect the audience with business goals. If we are talking about a green IMC, it should be based on clear strategy and should focus on measurable results. The IMC, therefore, focuses on the strategy and operation of marketing communication and its processes. The essence of marketing communication, which reflects the environmental activities of businesses, is the interpretation of the ‘green’ marketing mix.<sup>10</sup>

1 HOHL, M.: From Abstract to Actual: Art and Designer Like Enquiries into Data Visualisation. In *Kybernetes*, 2011, Vol. 40, No. 7-8, p. 1040.  
 2 ROSHDY, A. et al.: Generic Data Visualization Platform. In BANISSI, E., KHOSROW-SHAHI, F. (eds.): *22<sup>nd</sup> International Conference Information Visualisation (IV)*. Fisciano : IEEE, 2018, p. 56.  
 3 KIM, J., KIM, D.: Analyzing and Visualizing Comprehensive and Personalized Online Product Reviews. In *Cluster Computing*, 2019, Vol. 22, No. 1, p. 2115.  
 4 BARBOSA, P. D. J., BARBOSA, G. D. J.: Introduction to Data Visualization. In LAMAS, D., LOIZIDES, L. F. (eds.): *Human-Computer Interaction – INTERACT 2019*. Cham : Springer International Publishing, 2019, p. 528.  
 5 See: NIU, P. et al.: Integrative Ecology in the Era of Big Data – From Observation to Prediction. In *Science China Earth Sciences*, 2020, Vol. 63, No. 10, p. 1429-1441.  
 6 LI, Q.: Data Visualization as Creative Art Practice. In *Visual Communication*, 2018, Vol. 17, No. 3, p. 299.  
 7 See: AVRAAM, D. et al.: Privacy Preserving Data Visualizations. In *EPI Data Science*, 2021, Vol. 10, No. 1, p. 1-34.  
 8 See: SZABO, S., WEBSTER J.: Perceived Greenwashing: The Effects of Green Marketing on Environmental and Product Perceptions. In *Journal of Business Ethics*, 2021, Vol. 171, No. 4, p. 719-730.  
 9 See: CHABOWSKI, B. R., MENA, J. A., GONZALEZ-PADRON, T. L.: The Structure of Sustainability Research in Marketing: A Basis for Future Research Opportunities. In *Journal of the Academy of Marketing Science*, 2011, Vol. 39, No. 1, p. 55-70.  
 10 MUKONZA, C. et al.: *Green Marketing in Emerging Markets: Strategic and Operational Perspectives*. Cham : Springer International Publishing, Palgrave Studies of Marketing in Emerging Economies, 2021, p. 118.

Through their strategies, ecological business activities try to reflect the increasing environmental awareness of consumers, to which they respond with new developments and the implementation of marketing initiatives to reach consumers. We can therefore state that environmentally oriented marketing should be based on the context of harmonisation of business principles, with the assumption of a positive impact on the environment and the satisfaction of consumer requirements.<sup>11</sup> From the point of view of a historical cross-section, it is possible to cite the authors Baker and Sinkula,<sup>12</sup> who defined the critique of green marketing as the integration of environmental responsibility of activities, as the planning and implementation of a strategy that can generate critical competitive advantages. Finally, it is important to define innovative communication tools.

As remarked by Krajčovič, “innovative communication tools” go back to digital marketing tools; specifically we can talk about the progress that has led to the definition of an environment that includes social media, mobile environments, geolocation devices and connections with the target group.<sup>13</sup> According to Yang et al., the innovative communication tools are the social networks they include; for example, social media analysis allows one to collect and define data through social channels, via which one can make business decisions and control activities through pre-focused social media, namely *Facebook*, *Instagram*, *LinkedIn*, *Twitter*, *WhatsApp*, *Igloo*, etc.<sup>14</sup> In 2017, Felix et al. defined a holistic framework for a strategy in social media marketing that is applicable to the current bottom-up trend. Common factors for the framework are the influence of society or individual components of corporate identity and stakeholders. The four quadrants allow the definition of the typology of individual users, namely the culture, scope, structure and management of public affairs placed in a circle with minimum and maximum extremes.<sup>15</sup> In 2020, Wawrowski and Otola identified possible goals of the company with regard to social media, namely brand awareness, generation of potential customers, customer loyalty, and company value.<sup>16</sup> As part of the quantitative approach, we can assess that output metrics such as the number of followers and subscribers can affect the company’s profitability. Given the growing popularity of social media, it can be stated that it is important for businesses to respond to the suggestions of social media users. On the other hand, it is loyalty and trust in the brand that can ultimately increase the company’s profitability. Similarly, users’ loyalty and trust in the brand is a way to gain ambassadors who influence other members of the community on social media. Puspaningrum explained, by methodology and research, the possibilities of recording and evaluating the relationships between social media users, loyalty and trust in the brand.<sup>17</sup> Through the symbiosis of the above facts, we can define the basis for further research in the context of the data visualisation of environmental activities of companies through innovative communication tools.

## 2 Methods

The presented study deals with the attitude of stakeholders towards perception of data from the ecological activities of business entities with the help of innovative communication tools. Primary and secondary information sources are used in a balanced way, to achieve expected results. Secondary sources consist mainly of literary sources and scientific articles. The primary source of research is a questionnaire solution. The theoretical level of the study is conditioned by the processing of the search and subsequent analysis resulting in conclusions. This level contains a cross-section of researched issues consisting mainly of literary sources,

11 WANG, Y.: An Examination of Market Orientation and Environmental Marketing Strategy: The Case of Chinese Firms. In *The Service Industries Journal*, 2019, Vol. 39, No. 15-16, p. 1046-1047.  
 12 BAKER, W. E., SINKULA, J. M.: Environmental Marketing Strategy and Firm Performance: Effects on New Product Performance and Market Share. In *Journal of the Academy of Marketing Science*, 2005, Vol. 33, No. 4, p. 461-463.  
 13 KRAJČOVIČ, P.: Use of Media to Raise Awareness of Eco-Innovations. In *Communication Today*, 2019, Vol. 10, No. 2, p. 120.  
 14 YANG, J. et al.: Social Media Data Analytics for Business Decision Making System to Competitive Analysis. In *Information Processing & Management*, 2022, Vol. 59, No. 1, p. 1-15.  
 15 FELIX, R. et al.: Elements of Strategic Social Media Marketing: A Holistic Framework. In *Journal of Business Research*, 2017, Vol. 70, p. 118-119.  
 16 WAWROWSKI, B., OTOLA, I.: Social Media Marketing in Creative Industries: How to Use Social Media Marketing to Promote Computer Games? In *Information*, 2020, Vol. 11, No. 5, p. 2.  
 17 PUSPANINGRUM, A.: Social Media Marketing and Brand Loyalty: The Role of Brand Trust. In *The Journal of Asian Finance, Economics and Business*, 2020, Vol. 7, No. 12, p. 951-954.

scientific articles from domestic and foreign authors and their contributions to conferences and leading scientific journals. The practical level of the study consists of a questionnaire survey conducted in an offline environment using a printed questionnaire.

The questionnaire is aimed at a target group of managers, executives, top managers, directors and owners of business entities from various industries, which provides a more comprehensive and broad-based view of the issue. These business entities were small, medium-sized and large companies implementing environmental activities. In terms of age composition of respondents, they were respondents aged 20 to 67 years. The most numerous research sample of respondents were men, while this sample accounted for 75.20% of the respondents involved (i.e., 97 respondents) and women for 24.80% (i.e., 32 respondents). The geographical distribution of the respondents was even within the territory of the Slovak Republic in all regions. The aim of the survey was to analyse the current business environment operating in Slovakia in the field of perception and capture of data within the implementation of environmental activities with regard to innovative elements of marketing communication. The survey was conducted from 9<sup>th</sup> March 2020 to 9<sup>th</sup> June 2020. A total of 129 respondents took part in the survey. The research sample consisted of a base set that was defined by the available sample. The evaluation of the questionnaire survey is carried out through descriptive statistics. Entities of individual variables are correctly evaluated within the description. In order to describe and evaluate all the research questions asked, it is important to state the total number of included questions. The description is important mainly due to the assessment of the relevance of the results. The outcomes within the description are most closely linked to the abundance that is applied to the nominal and ordinal variables. The frequencies are presented in a frequency table. The analysis is supplemented by univariate frequency analysis where the variables are characterised in one set. The output is generated using a frequency and a percentage defined by a formula that allows one to find the percentage of one number from another number:

$$p\% = A/B \cdot 100\%$$

The given formula contains two numerical expressions under the codes A and B. The percentage is calculated from the number A divided by the number B. It is then multiplied by 100. The results are presented by means of descriptive statistics and also by means of statistical methods based on Cramer's V for the relation of nominal and ordinal variable and Spearman's rho for ordinal and ordinal variable. The following formula visualises Cramer's V:

$$\phi_c = \sqrt{\frac{\chi^2}{N(k-1)}}$$

where  $\phi_c$  denotes Cramer's V;

$\chi^2$  is the Pearson chi-square statistic from the aforementioned test;

N is the sample size involved in the test;

k is the lesser number of categories of either variable.

The following formula describes the relationship of the variables for the ordinal and the ordinal variable of Spearman's rho:

$$\rho = \frac{S_{xy}}{S_x S_y} = \frac{\frac{1}{n} \sum_{i=1}^n (R(x_i) - \overline{R(x)}) \cdot (R(y_i) - \overline{R(y)})}{\sqrt{\left( \frac{1}{n} \sum_{i=1}^n (R(x_i) - \overline{R(x)})^2 \right) \cdot \left( \frac{1}{n} \sum_{i=1}^n (R(y_i) - \overline{R(y)})^2 \right)}}$$

R(x) and R(y) are the ranks,  $\overline{R(x)}$  and  $\overline{R(y)}$  are the mean ranks.

The following is the relationship of the two populations for the ordinal variable Mann Whitney U test:

$$U_1 = R_1 - \frac{n_1(n_1 + 1)}{2}$$

or

$$U_2 = R_2 - \frac{n_2(n_2 + 1)}{2}$$

Either of these two formulas are valid for the Mann Whitney U Test. R is the sum of ranks in the sample, and n is the number of items included in the sample.

The study uses qualitative methods such as content analysis of texts and professional publications. Within the categorisation, it is a central category with a focus on quality. An idiographic method based on understanding the context and drawing conclusions is used. On the other hand, quantitative methods are used as well, namely explanations based on nomothetic statements in the form of evaluation using statistical methods to determine the relationship between variables using Cramer's V, Spearman's test and Mann Whitney U test. The results are presented through descriptive statistics, as well as Cramer's V statistical methods for the relationship between the nominal and ordinal variables and the Spearman's rho test for the ordinal and ordinal variables. Also used is Mann Whitney U test to determine the relationship between the two populations. Within the ordinal variables, the Likert scale is used, which creates special polytomy questions to examine the attitude or experience of the respondent. It contained 5 possible answers, which were expressed in numerical form from 1 to 5. The participant evaluated the statement they considered correct according to the given scale. The statistical evaluation was performed using the SPSS 22 software.

#### Research topic:

Relationships between the perception of data from the environmental activities of companies by the competencies of respondents in relation to the interpretation and use of these data.

#### Research questions:

**RQ1:** Is there a significant difference in the recognition of inconsistent and weak data between people trying to understand data and individuals who are not trying to understand data?

**RQ2:** Is there a significant difference in the ability to read graphs and graphics and understand important connections between people trying to understand data and individuals who are not trying to understand data?

**RQ3:** Is there a significant relationship between the effort to understand the data source and all the issues related to data and the competence to summarise data and find averages and totals?

**RQ4:** Is there a significant relationship between the competence to summarise data and find averages, sums and read graphs and graphical elements and understand important contexts?

**RQ5:** Is there a significant relationship between the effort to understand the source of the data and all the issues related to the data and the competence to distinguish in the data the elements on the basis of which decisions can be made?

Questions in the questionnaire implementation:

1. Do you try to understand the source of the data and all the issues related to the data?

Scale: Yes/No

Are you able to:

2. Summarise data and find averages and totals?

3. Understand the distribution of values and recognise extremes?

4. Find interesting and useful trends in the data?

5. Read graphs and graphic elements and understand important contexts?
6. Distinguish in the data the elements on the basis of which decisions can be made?
7. Recognise inconsistent and weak data?

The used scaling is visualised in Figure 1 below.

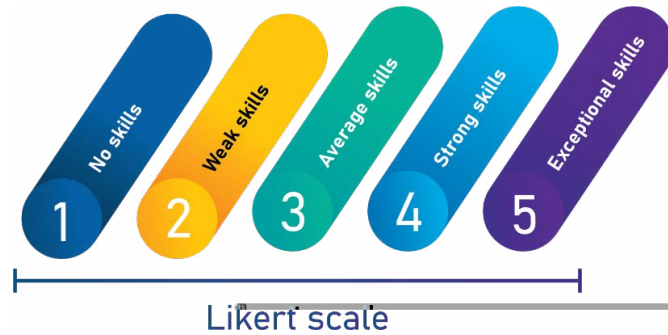


Figure 1: Likert scale  
Source: Own processing

### 3 Results

The following tables are related to the evaluation of the questionnaire solution according to the methodological design of the submitted study on the topic of perception of data from the environmental activities of companies with the help of innovative communication tools.

Table 1: Efforts to understand data sources and all issues related to data

Do you try to understand the source of the data and all the issues related to the data?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	109	84.5	84.5	84.5
	No	20	15.5	15.5	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answering the question ‘Are you trying to understand the data source and all questions related to the data’ are shown in Table 1. 129 respondents (100%) answered the first question, which is the complete research set. Within the valid answers, the answer ‘Yes’ was represented in the highest frequency with the number of 109 answers (84.4%). On the other hand, the answer ‘No’ was represented by 20 participants (15.5%). The above table shows that more respondents are trying to understand the sources of the data and all the issues related to the data. Based on the results, from which we found that most respondents answered in the affirmative, we state that the research area is promising for future scientific inquiry and we also think that it is essential to continue to raise awareness of this issue and its possibilities.

Table 2: Ability to summarise data and find averages and totals

Are you able to summarise the data and find the means and totals?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	7	5.4	5.4	5.4
	Average abilities	39	30.2	30.2	35.7
	Strong abilities	57	44.2	44.2	79.8
	Exceptional abilities	26	20.2	20.2	100.0
	Total	129	100.0	100.0	

Source: Own processing

Table 2 presents the results of the frequency analysis of the variable answering the question ‘Can you summarise the data and find the means and sums’. The question was answered by 129 respondents (100%), which is the entire research group. Of the above valid answers, the answer ‘strong abilities’ was the most represented with the number of answers 57 (44.2%). The second most frequent answer was ‘average abilities’ (39 respondents, which is 30.2%). Another answer was ‘exceptional abilities’, which was chosen by 26 respondents (20.2%). As a result, we may conclude that only a small number of the respondents are aware of their own potential for understanding. The last answer was ‘weak abilities’ (7 respondents, 5.4%). The above table shows that about half of the respondents stated that they have significant and exceptional ability to summarise data and find averages and totals. Based on this fact, we can state that systems for visualisation and data collection are important, as the vast majority of respondents can summarise and implement basic operations with data. Although they are able to decompose values and recognise extremes from secondary sources, it is clear that businesses do not work with data to a large extent. For this reason, we conclude that it is very important to raise awareness and support further education in these areas.

Table 3: Ability to understand the distribution of values and recognise extremes

Are you able to understand the distribution of values and recognise extremes?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	0	0	0	0
	Average abilities	65	50.4	50.4	50.4
	Strong abilities	39	30.2	30.2	80.6
	Exceptional abilities	25	19.4	19.4	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answer to the question ‘Can you understand the distribution of values and recognise extremes’ are shown in Table 3. Within the valid answers, the answer ‘average abilities’ was the most represented with 65 responses (50.4%), which shows that the largest percentage of respondents is considered to be of average skill in terms of understanding the distribution of values and recognising extremes. This was followed by the possibility of ‘strong abilities’ with 39 recorded responses (30.2%). The least represented was the answer ‘exceptional abilities’ with a number of 25 participants (19.4%).

The table shows that more than half of the respondents can understand the distribution of values and recognise extremes, which indicates their ability to perform more complex data operations. The results of this question can be summarised by saying that participants can better respond and receive suggestions in the form of evaluation of data provided by subjects, but the implementation of these activities is not at a high level.

Table 4: Ability to find interesting and useful trends in the data

Are you able to find interesting and useful trends in the data?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	27	20.9	20.9	20.9
	Average abilities	49	38.0	38.0	58.9
	Strong abilities	28	21.7	21.7	80.6
	Exceptional abilities	25	19.4	19.4	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answering the question ‘Can you find interesting and useful trends in the data’ are shown in Table 4. The question was answered by 129 respondents (100%), which is a complete research set. Within the valid answers, the answer ‘average abilities’ was represented in the highest frequency with a number of 49 answers (38.0%). Other responses were approximately evenly distributed, with ‘strong abilities’ at 28 (21.7%), followed by ‘weak abilities’ at 27 (20.9%) and the last option ‘exceptional abilities’ was represented by 25 respondents (19.4%). The table shows that respondents usually have average or significant to exceptional ability to find interesting and useful trends in the data. As a result of the collected data, we observed that the level of respondents’ ability to find interesting and useful trends in the data is represented to a lesser extent than the weaker ability of a smaller number of respondents. Therefore, we think that it is important to carry out education, but also to create systems that support the analysis and subsequent determination of trends and points of interest in the data. Equally important is the perception, which results in the statement that data visualisation is important for people in businesses.

Table 5: Ability to read graphs and graphics and understand important contexts.

Are you able to read graphs and graphics and understand important contexts?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	6	4.7	4.7	4.7
	Average abilities	33	25.6	25.6	30.2
	Strong abilities	52	40.3	40.3	70.5
	Exceptional abilities	38	29.5	29.5	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answer to the question ‘Can you read graphs and graphics and understand important contexts’ are shown in Table 5. Within the valid answers, the answer

‘strong abilities’ was the most represented with a number of 52 participants (40.3%). This was followed by the answer ‘exceptional abilities’ with 38 responses (29.5%). Another answer was ‘average abilities’ with a number of 33 participants (25.6%). Given the result of this question, it can be determined that the respondents can read graphs and graphic elements and also know how to understand the important connections between them. The least represented answer was the answer ‘weak abilities’ with 6 respondents (4.7%); based on this, we can assess that only a minimum of recipients think they have weak skills related to reading graphs and graphics and understanding connections between them. The table shows that almost all respondents can read graphs and graphic elements and understand important contexts drawn from them. Therefore, it is important to create suitable systems for data visualisation.

Table 6: The ability to distinguish in the data the elements on the basis of which decisions can be made

Are you able to distinguish in the data the elements on the basis of which decisions can be made?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	14	10.9	10.9	10.9
	Average abilities	33	25.6	25.6	36.4
	Strong abilities	51	39.5	39.5	76.0
	Exceptional abilities	31	24.0	24.0	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answering the question ‘Can you find interesting and useful trends in the data’ are shown in Table 6. The question was answered by 129 respondents (100%), which is a complete research set. Within the valid answers, the answer ‘strong abilities’ was represented in the highest frequency with a number of 51 answers (39.5%). The other responses were approximately evenly distributed, with 33 (25.6%) claiming to have ‘average abilities’, followed by 31 participants (24.0%) with ‘exceptional abilities’ and 14 surveyed people with ‘weak abilities’ (10.9%). The table shows that respondents generally have strong or average to exceptional ability to distinguish in the data the elements on the basis of which decisions can be made. As a result of the data obtained by frequency analysis, it can be concluded that by implementing automated systems, respondents could more easily distinguish elements that will help them in the decision-making process.

Table 7: Ability to recognise inconsistent and weak data

Are you able to recognise inconsistent and weak data?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No abilities	0	0	0	0
	Weak abilities	14	10.9	10.9	10.9
	Average abilities	26	20.2	20.2	31.0
	Strong abilities	45	34.9	34.9	65.9
	Exceptional abilities	44	34.1	34.1	100.0
	Total	129	100.0	100.0	

Source: Own processing

The results of the frequency analysis of the variable answering the question ‘Can you recognise inconsistent and weak data’ are shown in Table 7. The question was answered by 129 respondents (100%), which is the whole research sample. Of the above valid answers, the answer ‘strong abilities’ was the most represented with a number of answers 45 (34.9%). This was followed by the answer ‘exceptional abilities’, to which 44 respondents (34.1%) agreed in the decision-making process. Another answer was ‘average abilities’ of 26 respondents (20.2%). The last answer was ‘weak abilities’, which was chosen by 14 respondents (10.9%). By summarising the results obtained on Question 7, it can be stated that data visualisation is necessary in order to ensure more efficient implementation of data into the system and techniques, based on which recipients will be able to more easily distinguish the consistency of data.

**RQ1: Is there a significant difference in the recognition of inconsistent and weak data between people trying to understand data and individuals who are not trying to understand data?**

Table 8: The difference in the recognition of inconsistent and weak data between people trying to understand the data and those who are not trying to understand the data

	n	MR	Z	Sig.
Understand	109	67.48		
Do not understand	20	51.50	1.843	0.065

Source: Own processing

Table 8 shows the difference in the recognition of inconsistent and weak data between people trying to understand the data and those who are not trying to understand the data. We verified the research question using the Mann Whitney U test. The table shows that the significance exceeds 0.05, so we reject the research question. There was no statistically significant difference in the recognition of inconsistent and weak data between people trying to understand the data and those who are not trying to understand the data. By summarising the above results, we can state that there is no significant difference in the target groups in the ability to recognise weak data. Based on the findings, we can evaluate that by implementing a system for automation and analysis with subsequent evaluation of inconsistent and weak data, we can prevent decision-making problems in business entities, regardless of their efforts to understand the data.

**RQ2: Is there a significant difference in the ability to read graphs and graphics and understand important connections between people trying to understand data and individuals who are not trying to understand data?**

Table 9: The difference in the ability to read graphs and graphics and to understand the important connections between people who are trying to understand data and those who are not trying to understand data

	n	MR	Z	Sig.
Understand	109	67.89		
Do not understand	20	49.25	2.170	0.030

Source: Own processing

Table 9 reflects on the research question whether there is a difference in the ability to read graphs and graphics and to understand the important connections between people who are trying to understand data and those who are not trying to understand data. The table shows that the significance does not exceed the value of 0.05, so we confirm the research question. There is a small, but statistically significant difference

between people who try to understand data and those who do not try to understand data in their ability to read graphs and graphics and understand important contexts, which points to the importance of integrating data systematisation into business activities. Awareness should be aimed at people who do not make an effort to understand data, because with the right system and data visualisation, we can prevent misinterpretation of data. Moreover, in the target group that is trying to understand the data, we should apply perception through visualisation, but the effort of enlightenment in this case is meant to build a higher level of understanding of the data.

**RQ3: Is there a significant relationship between the effort to understand the source of the data and all issues related to data and the competence to summarise data and find averages and totals?**

Table 10: The relationship between the effort to understand the source of the data and all issues related to data and the competence to summarise data and find averages and totals

Symmetric Measures		
	Value	Approx. Sig.
Cramer's V	0.443	0.000

Source: Own processing

Table 10 shows the research question ‘Is there a significant relationship between the effort to understand the data source and all questions related to data and the competence to summarise data and find averages and totals’ and has a value of 0.001, so we confirm the research question. There is a strong, significant relationship between the variable trying to understand the data source and all issues related to data and the competence variable to summarise data and find averages and totals. Based on the survey results, we can demonstrate that the correlation between efforts to understand data sources and recipients’ competence clearly exists, and we should consider activating educational enhancement activities to change the attitude of recipients who do not try to understand data.

**RQ4: Is there a significant relationship between the competence to summarise data and to find averages, sums and read graphs and graphical elements and to understand important contexts?**

Table 11: Relationship between the competence to summarise data and find averages, sums and read graphs and graphical elements and understanding important contexts

Correlations				
			Var Sum	Var Citat
Spearman's rho	Var Sum	Correlation Coefficient	1.000	0.556**
		Sig. (2-tailed)	.	0.000
		N	129	129
	Var Citat	Correlation Coefficient	0.556**	1.000
		Sig. (2-tailed)	0.000	.
		N	129	129

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Own processing

Table 11 shows the research question ‘Is there a significant relationship between the competence to summarise data and find averages, sums and read graphs and graphics and understanding important contexts’.



We tested this research question using Spearman's rho. The table shows that the significance does not exceed 0.001, and therefore we confirm the research question. There is a strong, significant relationship between the competence to summarise data, find averages, sums and to read graphs and graphical elements, and understanding important contexts. If we increase the competence to summarise data, we can also strengthen the ability to read graphs and graphic elements. It is also important to create systems that will lead to educational activities, especially when summarising data. By improving the perception of data visualisation, we can lead the recipient to increased competence to work with data, based on which they can more quickly understand the individual connections between data sets. Business entities can thus make better decisions, especially when implementing environmental activities.

**RQ5: Is there a significant relationship between the effort to understand the source of the data and all the issues related to the data and the competence to distinguish in the data the decision-making elements?**

Table 12: The relationship between the effort to understand the source of the data and all issues related to the data and the competence to distinguish in the data the elements on the basis of which decisions can be made

Symmetric Measures		
	Value	Approx. Sig.
Cramer's V	0.845	0.000

Source: Own processing

Table 12 shows the research question 'Is there a significant relationship between the effort to understand the source of the data and all the issues related to data and the competence to distinguish decision-making elements in the data'. The significance does not exceed the value of 0.05; therefore, we confirm the research question. There is a strong, significant relationship between the variable to understand the source of the data and all issues related to the data and the competence variable to distinguish in the data on which to base decisions. By a suitable method of education in the field of understanding the elements on the basis of which the recipients can make decisions, we could bring ecologically oriented companies an increased degree of positive perspective due to higher competence in important business decisions.

The following figure is the result of the research in the form of a proposal for a methodology for displaying data from the environmental activities of businesses with the help of innovative communication tools.

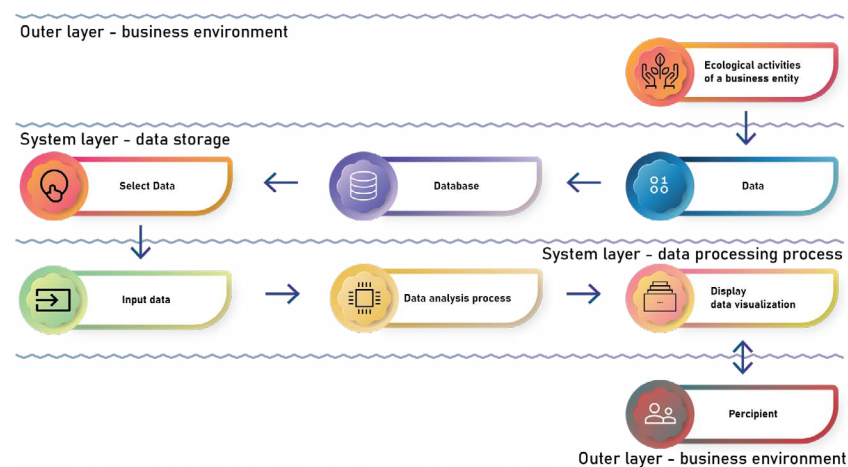


Figure 2: Proposal of methodology of displaying data from ecological activities of business entities

Source: Own processing

The methodology of displaying data from the ecological activities of business entities follows the mentioned primary and secondary sources. As can be seen in Figure 2, the methodology consists of an outer layer and a system layer. Within the outer layer, the business environment in which the methodology begins is included. In this environment, business entities that implement environmental activities are taken into account. Subsequently, the system layer is referred to as data storage. In the said layer, data is collected; data packages are formed, stored in a database and specific data is selected for further use. Subsequently, the system layer is mentioned again, but in this part, it is another step of data processing. The incoming selected data is further processed through a data analysis process, where the data enters through data input. Subsequently, the data is ready for further processing and in the final phase of said layer, the data is visualised for a more adequate perception. The next step takes place in the outer layer, specifically in the business environment where the recipient is located, which can read the data more efficiently and cleanly in this way. The model is focused on education and training in the field of data, where the system works automatically and the business entity only needs to enter data into the input, which ultimately ensures smooth work with data in the business environment. On the other hand, a change in perception will need to be made, as we cannot assume that most businesses will be inclined to work with data. If we achieve this change, the system can work broadly and will be understood by most people in business. By improving the perception of data visualisation, we can lead the recipient to increased competence to work with data, based on which they can more quickly understand the individual connections between data packages. Businesses can thus make better decisions, especially during the implementation of environmental activities.

## 4 Discussion and Conclusion

The set goal of presenting a proposal for the methodology of displaying data obtained from the ecological activities of business entities with the help of innovative communication tools has been successfully fulfilled. As a result of the research findings published by leading authors and based on a questionnaire solution, we presented a proposal for a methodology for displaying data from the environmental activities of businesses with the help of innovative communication tools. The methodology can be used across a wide range of businesses. The limits of the survey were the availability of resources as well as the possible distortion of the results of the questionnaire solution, which could have arisen from false answers of respondents or incorrect perception and inattention of respondents.

More respondents are trying to understand the sources of data and all the issues related to data. The above questionnaire survey shows that half of business entities have significant and exceptional ability to summarise data and find averages and totals. This is very important knowledge for data processing and the possible potential of the methodology of displaying data from the ecological activities of business entities. Another important finding is that more than half of businesses can understand the distribution of values and recognise extremes. This is important especially in the marketing sphere and also in the display of any data. Representatives of business entities usually have average or significant to exceptional ability to find interesting and useful trends in the data, which is more efficient through data visualisation and, therefore, representatives of business entities can make important decisions within the direction of the business entity. Almost all representatives of business entities can read graphs and graphic elements and understand important contexts drawn from them. This fact is very important because it outlines the importance of visualisation across the whole spectrum, especially when displaying data from environmental activities, which is represented only to a minimal extent.

Decision-making is also justified in the next result, because the representatives of business entities have significant or average to exceptional abilities in distinguishing important elements on the basis of which decisions can be made. On the other hand, it is important to separate inconsistent and weak data so that we can achieve relevant results. About half of business representatives have exceptional abilities to recognise inconsistent and weak data. Within the relationships of variables, a statistically significant difference in the recognition of inconsistent and weak data was not confirmed in the representatives of business entities who

try to understand the data and those who do not try to understand the data. In conclusion, it is not important whether the representatives of business entities have an incentive to understand the data and the competence to recognise inconsistent and weak data.

However, the stimulus to understand data has a significant relationship with the perception of graphs and graphic elements. For this reason, it is important to mention that just having the will can lead to a better perception and thus to a better conclusion and reaching a better decision on the direction of the business entity, especially in the field of environmental activities. Another important finding is that the motivation to understand data sources is closely related to the competence to summarise data and find averages and totals. If business entities have the will to understand data, this is also reflected in the competence and will to do basic data operations. There is also a connection between the competence to summarise data and to find out averages, sums, read graphs and graphic elements and to understand important contexts. For this reason, data visualisation is a very important set of processes and representatives of business entities have the competence to handle such data perception. An effort to understand the sources of the data and the distinction in the data by the elements on the basis of which decisions can be made is a link. For this reason, awareness of data processing is important, especially for business representatives. These outputs suggest that it is crucial to examine the environmental activities from which data can be derived.

Extensive research has led to the definition of a methodology through which businesses can make better business decisions with regard to environmental issues. As part of our research, we reached important findings in the field of perception of data from the environmental activities of companies and the competencies of respondents in relation to the interpretation and use of these data. These results are a milestone leading to further research on data collection, analysis and visualisation. They are also an important complementary element to related research carried out by other authors. Further direction of inquiry has potential especially in terms of focusing on verification and optimisation of the defined methodology, as well as on clarifying the effective and clean visualisation of data with respect to the analysis of specific target groups and different segments.

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