

Relationship Between Environmental Reports and Environmental Performance: A case of the Processing Industry in the Republic of Slovenia

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Background/Purpose: Environmental protection issues faced by companies constitute a challenging research topic. The main objective of the study was to research if companies' environmental performance relates to the quality of information contained in the environmental reports.

Methods: In order to assess the environmental performance of companies involved we develop the Environmental Performance Index based on the Slovenian Environment Agency's data on emissions in air, water and waste. We measured the correlation between the Environmental Performance Index and quality of environmental reporting using Spearman's correlation coefficient.

Results and Conclusion: The results of our analyses revealed that there is no significant correlation between companies' environmental performance and the quality of their environmental reporting. However, the reasons for the obtained result can be at least partially attributed to the low quality level of analysed environmental reports. This is a reason why the calculated correlation is not as tangible as it would be if company reports would provide more information and therefore more data for analysis. Our findings suggest that voluntary environmental reporting should be complemented by legally defined mandatory elements for such reporting.

Keywords: *Environmental performance, Environmental reports, Environmental Performance Index, Manufacturing*

1 Introduction

As a society, we are exposed to various forms of industrial pollution, which affects almost all environmental areas, primarily the emission of greenhouse gases and other emissions into the air, water and soil (MOP 2010). Furthermore, the EPA (EPA, 2017) reports that manufacturing is one of the three economic activities representing the greatest source of greenhouse gas emissions. According to the facts presented in the publication, monitoring industrial pollution caused by manufacturing activity is very

important, especially when considering that information asymmetry is the central concern in assessing the environmental performance of manufacturing enterprises (Beaver, 1998). Buyers, investors and other stakeholders are not able to make an objective assessment of the attempts that businesses put into addressing environmental issues due to the fact that they do not have accessibility to what is considered the most relevant information (Windolph, 2011).

Researchers face similar problems. For instance, Braam, Uit De Weerd, Hauck and Huijbregts (2016), for the analysis of environmental performance, use available

data on emissions, waste etc., which they acquire from companies' environmental reports. Many comments in the literature about sugar-coated information on environmental subjects appear in several companies' business reports or environmental reports (Deegan & Rankin, 1996; GRI, 2009; Swift, 2001). For example, the reluctance of these companies to reveal real information about their environmental performance happens mainly due to the fear that it would affect their reputation (Knez-Ried, 2001).

Other researchers aiming to determine the companies' environmental performance use objective environmental data; however, there often needs to be better access to this information (Clarkson et al., 2011; Hertin et al., 2004). A thorough level of data about the environment is required to assess the environment's performance quantitatively. Several writers use precompiled indices to obtain information on the companies' environmental performance. For example, the Emissions Efficiency Index, based on the ratio between the Toxic Release Inventory (TRI) and the revenues of the company, is used by Filbeck and Gorman (2004) and Hart and Ahuja (1996). Al-Tuwaijri, Christensen and Hughes (2004) and Clarkson, Li, Richardson and Vasvari (2008), among others, use the proportion of hazardous waste these companies recycle based on TRI. On the other hand, Nakao, Amano, Matsumura, Genba and Nakano (2007) use the ranking system created by the audit agency Nikkei Environmental Management Survey to assess the companies' environmental performance. The use of precompiled data is not without criticisms because auditing agencies adopt a number of techniques for different understandings of the companies' environmental performance, and a series of interests exists in this matter (Windolph, 2011).

Due to the problems in obtaining and using data for environmental performance assessment, as mentioned above, we have developed an innovative approach using original environmental data. This data was not pre-processed or pre-calculated. The data was obtained from the ARSO (Agencija Republike Slovenije za okolje). The database represents a credible, publicly available database in Slovenia where emissions are collected according to a controlled methodology. Based on emission data obtained for air, water and waste, we created an index of environmental performance that represents a proxy for a company's environmental performance.

Besides open questions regarding the measurement of environmental performance in the literature is not yet an agreement as to whether there is a correlation between environmental performance and environmental reporting, i.e. if it is positive (Deswanto & Siregar, 2018; Iatridis, 2013), negative (Braam et al., 2016; Fontana et al., 2015; Guidry & Patten, 2012) or non-existent (Freedman & Jaggi, 2010; Sutantoputra et al., 2012). This issue represents the main research question of our research.

Due to various findings in the research, Patten (2002) concluded that a failure to find a stable relationship between environmental performance and environmental reporting suggests that such a relationship does not exist. In order to find a proper answer to this question, we elaborated an original methodology based on the Theory of Voluntary Disclosures, which predicts a positive link between the companies' environmental performance and the level of their environmental reports. Therefore, our hypothesis is as follows:

Hypothesis H: There is a positive correlation between the quality of environmental reporting and the environmental performance index of manufacturing companies in the Republic of Slovenia

This paper is divided into five sections. The introductory section presents the issue that is the subject of our research, clarifies why the research on environmental performance and environmental reporting is relevant and refers to the research findings of other authors. In the empirical section, we present the environmental reporting quality assessment methodology and environmental performance assessment/evaluation methodology. The quality of environmental reports relates to the diversity and thoroughness of information. In the results section, we present the achieved results of the Index of Environmental Performance and Index of Environmental Reporting. The last section is the discussion, where we discuss the results of the correlation between environmental performance and environmental reporting, along with recommendations for further research.

2 Theoretical background and the development of a hypothesis

2.1 Environmental Performance and Environmental Reporting

Environmental performance refers to how a company manages the environmental impacts of its activities, products and services and their effect on the environment (ISO 14001 2015). However, Guenther and Orlitzky (2012) explain that this concept has no ultimate understanding. According to Trumpp, Endrikat, Zopf and Guenther (2013), although there are differences in the definitions of environmental performance, they have some common features: environmental performance focuses on the results of management activities related to the natural environment, as well as to the activities themselves. The definition proposed by ISO 14001 can be considered a consensual definition that combines the key elements of various academic definitions (Trumpp et al., 2013). This definition also clarifies that an organisation's environmental performance can be improved by diminishing its negative impact or, conversely, by expanding its positive impact on

the environment. Thus, Klassen and Whybark (1991) came to a definition of a company's environmental performance based on the quantitative reduction of pollutants released by the company. This definition is the closest to ours since our research with the environmental performance index determines changes in emissions in relation to the output volume and, thereby, determines whether the company is environmentally effective.

Environmental reporting is the communication process organisations use to provide environmental performance documentation to their stakeholders, including impact on the environment, performance in managing that impact and contribution to ecological and sustainable development. Environmental reporting is crucial if companies want to recognise and understand their environmental footprint and how to reduce risks and improve their status quo when faced with new challenges (KPMG 2008). Under that aspect, the environmental report is thus a process derived from a set of assets that can be adopted to assess how an organisation is and is influenced by the environment.

Environmental reports are public reports made by organisations that provide various aspects of interactions between the environment, organisation and society (da Rosa, Guesser, Hein, Pfitscher and Lunkes 2015) in order to present the impact of an organisation's activities on the environment.

Environmental reports are mostly carried out in the final part of annual business reports. However, some companies publish their environmental information together with information related to quality, employees and participation in the wider society, i.e. sustainability reports. Compared to sustainability reports, which disclose broad and thorough data from a social point of view, environmental reports are often rather brief and insufficient (Fink Babič et al., 2011, 2012; Bennett et al., 2017). This may be because more extended sustainability tracking enables companies to keep sensitive figures around the environment private in favour of sharing with the public the positive impact some of their activities have had, albeit on sustainable development areas which are not particularly problematic. In addition to the significant need for environmental reporting (Liu & Anbumozhi, 2009; Skouloudis et al., 2014; Sutantoputra et al., 2012), researchers are also wondering about their authenticity. Thus, Braam, Uit De Weerd, Hauck and Huijbregts (2016), Lu and Abeysekera (2017), and Schultze and Trommer (2012) explain that reports on the environment are discretionary and not standardised. Hence, the accessibility of factual and equivalent data in the reports is low, and the credibility of the information disclosed in these reports is questionable. Windolph (2011) expresses the same opinion, explaining that the credibility of information disclosed by companies is questionable since top management is motivated to publish reports most favourable to itself. Although some organisations, such as GRI or ISO, provide measurable

guidelines to facilitate companies to take action (Bennett et al., 2017), compliance with these guidelines is voluntary and optional. Therefore, according to Knez-Riedl (2001), voluntary environmental reports provided by the companies to the stakeholders are very different from each other, and the method and frequency of publishing them are left to the free choice of a company. That the availability and quality of data between companies vary can also be found in the research of the Environment Agency (2013), Fink Babič and Biloslavo (2011, 2012), GRI (2009), UNCTAD (2002), Wensen, Broer, Klein and Knopf (2011).

As mentioned above, internationally recognised guidelines for formulating sustainability reports, like the GRI (Global Reporting Initiative), have been accessible since 2000 and are updated regularly. However, in our research, these indicators and similar guidelines, such as the GRI G4 (2013), UNCTAD (2004), and WBCSD (2002), were only used as an orientation for the assessment of environmental reports since most of the Slovenian company's reports far below what is required, so we relied on GRI guidelines only as a reference. Fink Babič and Biloslavo (2011, 2012), who analysed the environmental reports of Slovenian companies published on their websites, found that their scope and the diversity and quality of the information provided are limited.

2.2 The connection between environmental performance and environmental reporting

Socio-political theories indicate that the scope and comprehensiveness of reporting result from the company's exposure to public pressure subjected to the social and political environment in which the company is located. This is because companies that are environmentally less effective, facing increasing social and political pressure and jeopardised legitimacy, seek to "artificially" improve their environmental reports and thereby influence the perception of stakeholders on the current environmental performance of the company (Braam et al., 2016; Gray et al., 1995; Patten, 2002). This created a negative correspondence between the businesses' environmental performance and the quality of environmental reports (Braam et al., 2016; Doan & Sassen, 2020; Fontana et al., 2015; Guidry & Patten, 2012; Patten, 2002).

On the contrary, the Theory of Voluntary Disclosures (Dye, 2001; Verrecchia, 1983), which predicts a positive link between the companies' environmental performance and the level of their environmental reports, is contested. Thus, companies with good environmental performance would have to disclose more environmental information (in quantity and quality) than those with lower environmental performance (Al-Tuwaijri et al., 2004). The basic message of this theory is that environmentally successful

companies will publish higher-quality reports and disclose more information by focusing on objective indicators of environmental performance, which environmentally less successful companies will need help imitating.

Empirical research offers very different and contradictory evidence in establishing the relationship between the companies' environmental performance and the quality of their environmental reports.

Belkhir, Bernard, and Abdelgadir (2017). Freedman and Wasley (1990) and Tadros, Magnan and Boulianne (2020) in their research did not detect any significant correspondence between the quality of environmental reports and environmental performance, and Freedman and Jaggi (2010) did not detect any correspondence between the environmental performance and disclosure of companies around the environment. The impact of environmental performance on the quality of voluntary environmental reports has not been confirmed by Brammer and Pavelin (2008) either, who explains that environmental reporting, in addition to the size of a company, depends primarily on the industry; companies from industries that have a burdensome impact on the environment, publish better quality reports. Sutantoputra, Lindorff and Johnson (2012) also found no significant correspondence between the companies' environmental performance and the level of their environmental reporting.

The results of empirical research of Acar and Temiz (2020), Ahmadi and Bouri (2017), Al-Tuwaijri, Christensen and Hughes (2004), Clarkson, Li, Richardson and Vasvari (2008), Deswanto and Siregar (2018), Giannarakis, Konteos, Sariannidis, Chaitidis (2017), and Iatridis (2013), Lu and Taylor (2018) and Nazari, Hrazdil and Mahmoudian (2017) have shown that there is a meaningful positive correlation between environmental reporting and environmental performance. They found that more environmentally successful companies publish higher-quality environmental reports than less successful ones. On the contrary, research results of Doan and Sassen (2020), Fontana, D'Amico, Coluccia and Solimene (2015), Guidry in Patten (2012), Hughes, Anderson and Golden (2001) and Patten (2002) found a negative correlation between environmental reporting and the environmental performance of a company.

3 Methodology

3.1 Sample selection

We selected companies from the manufacturing sector because they provide a suitable population for analysis, as there is a direct impact on pollution, i.e. emissions into the air, water and soil, that are well visible and measurable. In addition, the authors such as Clarkson, Overell and Chappele (2011) highlight that manufacturing enterprises have

a high propensity to pollute and publish environmental reports.

3.2 Evaluating the standard of environmental reports

To assess the quality of environmental reports, we have developed our methodology, the central part of which is a scheme of 27 indicators that enable an exhaustive assessment of environmental reports. We looked at the approaches used in the Davis Walling and Batterman research (1997). Below, we explain our model for analysing the quality of the companies' environmental reports.

The factors for the evaluation of environmental reports are divided into three categories.

1. Reporting on the activities of the company in order to reduce industrial pollution at a strategic level.

The composition contains five indicators that deal with environmental issues. With them, we determine whether companies in their reports have environmental statements with which the company displays its focus on solving environmental problems; whether the companies in their reports reveal that they have started sharing with the broader public what are the environmental issues of the company; whether the reports contain data on the financial support of various environmental activities, organisations, as well as indications on the active participation in activities or projects related to environmental protection.

2. Report on the endeavour of a company to mitigate the environmental impact at an operational level.

We used twelve indicators to analyse the quality of the companies reporting on their endeavours to mitigate industrial pollution. This spanned from the proper handling of hazardous materials and other waste, noise management, the use of renewable energy sources, the improvement of existing treatment plants, and cooperation with suppliers to investments and changes in technologies, products and services with the intention of reducing the environmental impact.

3. Reporting of companies on achieved environmental results.

The composition consists of ten indicators, which examined the reporting segment where companies presented their (in)effectiveness in mitigating industrial pollution, such as changes in emissions into the air and water, in the amount of hazardous materials and other waste and noise generated, reports on the consumption of energy, water, fossil fuels and dangerous substances and possible changes in the consumption of feedstock.

The quality of environmental reporting was assessed by assigning appropriate ratings to the above-specified indicators.

To evaluate the specific elements of environmental reporting, we used the ratings 0, 1, 2 and 3 assigned to each indicator.

- A rank of 3 indicates an ideal state, that is, a state that reflects complete information in relation to the selected report element, i.e. published quantitative data reflecting changes in individual elements related to individual years of the observed period.
- In cases where the change was else expressed in quantitative terms, but it was not possible to indicate without doubt which period it refers to, and in cases where the change per individual year of the observed period was expressed only descriptively and without quantitative data, we assigned to the assessed element a rating of 2.
- In cases of very modest information, i.e., descriptive changes, we assigned a rating of 1 to the assessed element.
- In the event that the company did not provide any information in relation to the individual item in the report, we gave the assessment element a rating of 0.

In their evaluation of environmental reports, Zeng, Xu, Dong and Tam (2010) also used a ranking from 0 to 3, but the basic criterion for assigning the rating was, in particular, whether the information was monetary or not. Skouloudis, Jones, Malesios and Evangelinos (2014) gave three types of ratings, namely, whether or not the item received an estimate of large-scale publication, general publication, or no publication. Based on the previous research of Fink Babič and Biloslavo (2012), we concluded that the published data on, e.g. emitted emissions over a certain period of time provided the most comprehensive reflection of environmental (in)efficiency for the environmental indicator concerned, which is why we found such information the most convincing and gave it the highest rating.

Based on the ratings obtained for 27 parameters in the previous research, we attained a combined assessment of the reports for 2008-2011 for every company. After that, we calculated the mean score of the quality of environmental reporting for four years together. For further analysis, we converted the initial rankings 1, 2 and 3 to percentages 33%, 66%, and 100%, reflecting the corresponding content of the information in relation to the widest possible range that the individual report should (must) contain.

We applied the same methodology to the 2018 annual reports, with the aim of presenting the situation in 2018 and seeing whether there has been progress in the quality of published environmental reports between 2011 and 2018.

3.3 Determination of environmental performance

It should be emphasised that the companies' environmental performance, as defined in the research, needs to

reflect a comprehensive assessment of the companies' environmental performance, as this could be achieved only on the basis of detailed quantitative and qualitative analysis for each company separately.

The purpose of the research was to create an approach that could track the modification in the score of pollutants that companies release into the environment. That being said, we used publicly available emission data. The increase (or decrease) in the score of pollutants during a set timeframe, as a relative value in relation to revenues, indicates the (in)efficiency of companies in resolving environmental issues, therefore describing their environmental performance. With that goal in mind, we drafted an Index of environmental performance. Because our goal was to measure the dynamics of the companies' environmental performance through the Index of Environmental Performance over a four-year period while ensuring that we could monitor the values of the same environmental indicators over the entire four-year period, we had to confine ourselves to those pollutants that are detected in most companies, and to omit those that are prevalent in certain sections, while in others they are not recognised.

Presentation of environmental indicators for the analysis of environmental performance

By analysing the selected pollutants, which the companies emitted into the environment over a four-year period, we wanted to determine the environmental performance of these companies. We picked the following environmental indicators: contaminant waste for the earth, chemical oxygen demand (COD) for the water and the total dust for the air, and formed the Index of Environmental Performance separately for air, water and soil.

In the development of our analysis, we used ISO 14001 as our main guideline on how to measure the emissions of the various media pollutants (water, air, waste). Since hazardous waste materials represent only one aspect of industrial pollution (Clarkson et al., 2011), in addition to hazardous waste, we have opted for non-hazardous substances as environmental indicators of air and water, as they are nonetheless very burdensome for the environment and occur in most companies.

Hazardous waste

The environmental indicator of hazardous waste is very characteristic of the manufacturing industry since most hazardous waste is primarily generated in the manufacturing sector (ARSO 2014). Hazardous waste is also a current subject due to its environmental impact since it poses a risk to the territory and the well-being of the human population. Therefore, this requires more stringent control than non-hazardous waste (ARSO 2014). While the reporting limit for non-hazardous waste is 10 tonnes of waste generated per year, generators of hazardous waste must report when they exceed the limit of 5 kg per year. In accordance with the regulations, generators must label hazardous waste separately and keep a separate record of

it (Šarc 2013¹). Authors such as Al-Tuwaijri, Christensen and Hughes (2004) and Clarkson, Li, Richardson and Vasvari (2008) have used in the same way the environmental indicator of hazardous waste in their research.

Total dust

Total dust is a general environmental indicator and occurs in most companies. Total dust is a very important indicator of air quality, as this is the biggest problem of air pollution in Slovenia. Namely, a level of air pollution exceeding what is allowed has been detected, while firewood, transport and manufacturing are the main contributors to total dust (ARSO 2013; Fašing 2014²). According to the Decree on the emission of substances into the atmosphere from stationary sources of pollution, total dust is defined as the sum of all particles in waste gases, regardless of their chemical composition and size. Earnhart and Lizal (2007) used dust, among other factors, to determine environmental performance.

Chemical oxygen demand, COD

There are significant differences in wastewater in different departments of the companies in the presence of different environmental parameters, and the range of choice for the appropriate environmental indicator that would occur in most companies is very narrow. Chemical Oxygen Demand, COD, is one of the indicators that are present in the majority of companies (Tomažević 2010³). COD is one of the mandatory indicators and one of those that companies should always be required to measure and report on (Žitko Štemberger, 2014⁴). Authors Berkhout et al. (Bl) and Wagner, van Phu, Azomahou and Wehrmeyer (2002), in addition to other environmental indicators, used chemical oxygen demand, COD.

By selecting the listed environmental indicators, we intended to cover both dangerous substances and non-hazardous emissions, which are discarded by companies in larger quantities and are burdensome for the environment. While the Hazardous Waste Indicator represents a heterogeneous group of wastes stored in the Slovenian Environment Agency (ARSO) database, separated from non-hazardous waste, water and air indicators are individual, homogeneous environmental indicators.

In Slovenia, businesses have the duty to report their environmental figures to the Slovenian Environment Agency, ARSO. Hence, the ARSO archive is the sole reference of publicly available data in Slovenia, where the emissions are collected according to a controlled methodology. ARSO's data is available at the level of a company for each

individual pollutant. For our research, such a collection is the essential source of facts and figures since these are unprocessed and are shared with these companies. This allowed our research to evaluate the environmental performance of individual companies.

Quantitative assessment of environmental performance requires detailed figures. A number of researchers use precompiled indices to obtain information on the companies' environmental performance. The use of precompiled data is not without criticisms because auditing agencies use different approaches according to the perception of the companies' environmental performance, who have their own interests in this field (Windolph, 2011). Due to the exposed problems in obtaining data for environmental performance assessment, we have used original, credible and not precompiled environmental data, which gave us a reason to expect that our research would yield conclusive results.

4 Results

4.1 Results of the Index of Environmental Performance

In our research, a problem we faced was the need for more data for certain air, water or waste emissions for four years, which led to a reduction of the initial number of 110 sample companies. Thus, for the environmental indicator of hazardous waste in the final sample of 87 companies (or 79.0% of the total), the total number of observations for hazardous waste in four years (2008-2011) was 348. The number of observations over the four-year period for COD-water was 204, as 51 companies (or 46.4% of the total number) were within the sample companies for this indicator. For the indicator for total dust air, the final number of sample companies was 55 (or 50.0% of the total number), and the number of observations in four years was 220. Table 1 presents the results of the Index of Environmental Performance for all three environmental indicators.

The research was repeated in 2018. We have produced an Environmental Performance Index for the period 2011-2018. The sample of companies used was an initial sample of the same companies that were included in the previous survey. This leaves 91 companies in the current sample out of the 110 companies in the sample from the previous survey. Out of this sample of 91 companies, 81 companies (or

¹ Šarc, B., an expert in the area of waste management at ARSO (Slovenian Environment Agency). (2013). Phone interview with the author. Ljubljana, 3 June.

² Fašing, J., an expert in the area of air quality at ARSO (Slovenian Environment Agency). (2014). Interview with the author. Ljubljana, July 16th.

³ Tomažević, E., an expert in the area of water quality at ARSO (Slovenian Environment Agency). (2010). Phone interview with the author. Ljubljana, July 14th.

⁴ Žitko Štemberger, N., an expert in the area of water quality at ARSO (Slovenian Environment Agency). (2014). Interview with the author. Ljubljana, July 16th.

89.0%) are included for the hazardous waste environmental indicator, 46 companies (or 50.5%) are included for the COD-water indicator and 50 companies (or 54.9%) are included for the total dust-air indicator. Table 2 shows the re-

sults of the environmental performance index for all three environmental indicators for the period 2011-2018. Table 2 shows the results of the environmental performance index for the period 2011-2018.

Table 1: Value of the Index of Environmental Performance for hazardous waste $G_{IU\ waste}$, for COD-water $G_{IU\ water}$ and total dust-air $G_{IU\ air}$ for the period 2008 - 2011

	Values of the Index of Environmental Performance			TOTAL
	value of G_{IU} over 100	value of G_{IU} equals 100	value of G_{IU} under 100	
$G_{IU\ waste}$	35 (40%)	13 (15%)	39 (45%)	87 (100%)
$G_{IU\ water}$	16 (31%)	3 (6%)	32 (63%)	51 (100%)
$G_{IU\ air}$	26 (47%)	7 (13%)	22 (40%)	55 (100%)

Table 2: Value of the Index of Environmental Performance for hazardous waste $G_{IU\ waste}$, for COD-water $G_{IU\ water}$ and total dust-air $G_{IU\ air}$ for the period 2011 - 2018

	Values of the Index of Environmental Performance			TOTAL
	value of G_{IU} over 100	value of G_{IU} equals 100	value of G_{IU} under 100	
$G_{IU\ waste}$	50 (62%)	4(5%)	27(33%)	81 (100%)
$G_{IU\ water}$	17 (37%)	2 (4%)	27 (59%)	46 (100%)
$G_{IU\ air}$	15 (30%)	3(6%)	32(64%)	50 (100%)

The results of the Index of Environmental Performance for hazardous waste show the following:

- In 40% of companies, the Index of Environmental Performance for GIU waste exceeded 100. In this four-year period (2008 to 2011), these companies increased the quantity of discarded hazardous waste relative to the change in the volume of their business, measured in revenue.

- In 45% of companies, GIU waste reached values below 100, which consequently defines companies with higher environmental performance.
- The share of companies with a GIU waste value equal to 100, where the amount of emissions did not change, is 15%.

The results of the Index of Environmental Performance for the COD-water indicator demonstrate the following:

- 31% of the companies relatively increased their emission of COD in water compared to the change in production volume and were unsuccessful for this indicator.
- 63% of companies had a value of GIU water below 100, which identifies companies with higher Indicator of Environmental Performance for COD emissions to water.
- In 6% of companies, the emissions in the analysed

period remained unchanged.

The results of the Index of Environmental Performance for the total dust-air indicator demonstrate the following:

- 47% of the companies were environmentally unsuccessful, with GIU air values above 100.
- - Environmental performance shows that 40% of enterprises have achieved GIU air values below 100.
- Changes were not observed in 13% of companies.

The results of the Index of Environmental Performance for hazardous waste show the following:

- In 62% of companies, the Index of Environmental Performance for GIU waste exceeded 100. In the period 2011 - 2018, these companies increased the quantity of discarded hazardous waste relative to the change in the volume of their business, measured in revenue.
- In 33% of companies, GIU waste reached values below 100, which consequently defines companies with higher environmental performance.
- The share of companies with a GIU waste value equal to 100, where the amount of emissions did not change, is 5%

The results of the Index of Environmental Performance for the COD-water indicator demonstrate the following:

- 37% of the companies relatively increased their emission of COD in water compared to the change in production volume and were unsuccessful for this indicator.
- 59% of companies had a value of GIU water below 100, which identifies companies with higher Indicator of Environmental Performance for COD emissions to water.
- In 4% of companies, the emissions in the analysed period remained unchanged.

The results of the Index of Environmental Performance for the total dust-air indicator demonstrate the following:

- 30% of the companies were environmentally unsuccessful, with GIU air values above 100.
- Environmental performance shows that 64% of enterprises have achieved GIU air values below 100.
- Changes were not observed in 6% of companies.

4.2 Analysis results of the quality of environmental reports

Of the 110 companies in the sample, three did not publish annual business reports in all four years. The results of the analysis of the annual reports over the four-year period were therefore presented for 107 companies. The number of all observations in the four-year period (2008-2011) was, therefore, 428.

We repeated the research for 2018. For the sample companies, we used the initial sample of the same companies listed in the previous research. As such, from the 110 initial samples of the previous research, 91 companies remained as part of the current sample. 19 companies closed during the period. All 91 companies published yearly reports for 2018.

The results given in Table 3 are presented in % and arranged in sections. Table 3 presents an assessment of the average value of the quality of environmental reporting for individual departments in manufacturing in the period 2008-2011 and for the year 2018.

The results of the assessment of companies' environmental reporting reveal a significant shortcoming in the environmental reporting of manufacturing companies. The average value of the quality of environmental reporting does not exceed 35%. In 2018 as well the average value was far below the maximum possible range of reporting quality (100%).

4.3 Results of the analysis of the correlation between environmental performance and the quality of environmental reporting

Results of the analysis of the correlation between environmental performance and the quality of environmental reporting are shown in Table 4 and Table 5.

Table 3: Assessment of the quality of environmental reports of the companies by sections for the period 2008-2011 and for the year 2018

	2008-2011	2008-2011	2018	2018
	The average score of the quality of environmental reporting in %	Number of companies with environmental reports in the department	The average score of the quality of environmental reporting in %	Number of companies with environmental reports in the department
C24	14.52	10	11,87	9
C23	13.80	8	6,45	7
C25	9.43	12	4,64	10
C26	3.93	5	9,19	4
C27	10.92	16	7,70	15
C28	10.56	9	3,84	8
C29	13.41	10	9,69	8
C20	9.55	13	7,25	11
C21	20.37	2	34,46	2
C11	16.63	4	11,65	2
C10	11.68	12	3,23	11
C17	16.94	6	16,41	3

Table 4: Correlation between the Index of Environmental Performance GIU for three environmental indicators and the quality of environmental reporting for the period 2008 - 2011

Environmental performance indicators	Quality of environmental reporting	
	Spearman's correlation coefficient	Degree of relevance of the test of correlation (double-sided test)
GIU waste	.152	.163
GIU water	-.017	.905
GIU air	-.074	.590

Table 5: Correlation between the Index of Environmental Performance GIU for three environmental indicators and the quality of environmental reporting for the period 2011 - 2018

Environmental performance indicators	Quality of environmental reporting	
	Spearman's correlation coefficient	Degree of relevance of the test of correlation (double-sided test)
GIU waste	-.136	.225
GIU water	-.235	.116
GIU air	-.272	.056

The assessment of the correlation between the average environmental performance of waste and the average quality of environmental reports is 0.152. The assessment of the correlation between the average environmental performance of COD water and the average quality of environmental reports is -0.017 . The assessment of the correlation between the average environmental performance for total dust air and the quality of environmental reports is -0.074 .

The results of the analysis of the correlation between environmental performance and the quality of environmental reporting do not demonstrate statistical significance.

The assessment of the correlation between the average environmental performance of waste and the average quality of environmental reports is -0.136 . The assessment of the correlation between the average environmental performance of COD water and the average quality of environmental reports is -0.235 . The assessment of the correlation between the average environmental performance for total dust air and the quality of environmental reports is -0.272 .

The results of the analysis of the correlation between environmental performance and the quality of environmental reporting do not demonstrate statistical significance.

5 Discussion

With the results we obtained on the performance and the standard of environmental reporting, the hypothesis we brought at the core of our research is H: There is a positive correlation between the quality of environmental reporting and the environmental performance index of manufacturing companies in the Republic of Slovenia. With the outcome of the study on the correlation between the three environmental factors, hazardous waste, COD-water and total dust-air, hypothesis H was refuted.

Gray, Kouhy and Lavers (1995) and Patten (2002) observed a negative correlation between the companies' environmental performance and the quality of their environmental reports. Gray, Kouhy and Lavers (1995) conducted research on sample companies in the field of the oil industry. In his research, Patten (2002) analyses companies from the chemical, metal, paper and petroleum industries; environmental performance data was obtained from emission data on toxic substances TRI⁵. Provided by the EPA, Environmental Agency of America. The emissions data was captured for one year (1988) and then normalised with corporate income. Environmental performance is calculated as a ratio to the expected environmental performance, which is based on how large the company is and its industry. Environmental reports of the company refer to the year 1990.

⁵ Toxics release inventory, TRI (TRI listing of the top 500 companies from United States Environmental Protection Agency EPA).

The positive correspondence between the companies' environmental performance and the quality level of their environmental reports was found by the authors Al-Tuwaijri, Christensen and Hughes (2004), who used the data for the year 1994 for the research on the samples of their companies. To measure environmental performance, they used a ratio based on the relative amount of recycled hazardous waste. Clarkson, Li, Richardson and Vasvari (2008)

Looked into the environmental reports of companies in the area of paper, chemical, metal, oil and mining industries for 2003. As did Al-Tuwaijri, Christensen and Hughes (2004), for determining environmental performance, they used the ratio of the relative amount of recycled hazardous waste for their research. In addition, they used the ratio of TRI to the total sales of the company (TRI/sales). They also focused on determining the companies' environmental performance within the industry.

Sutantoputra, Lindorff and Johnson (2012) did not identify a significant correspondence between the companies' environmental performance and the standard of their environmental reports. Freedman and Wasley (1990), and Freedman and Jaggi (2010), did not find any either. The latter has determined whether there is a correlation between the change in greenhouse gas emissions of companies over a period from 2004 to 2006 and the standard of environmental reports for greenhouse gases in these businesses, i.e. whether the environmental reports reveal the environmental (un)performance of greenhouse gas companies. Freedman and Wasley (1990) carried out a survey based on the use of information from the research organisation Council on Economic Priorities (CEP)⁶ in defining the companies' environmental performance from the metal, paper, oil and electrical industries. Environmental performance researchers did not use calculations based on their methodology but used previously calculated estimates.

In terms of the time frame considered by individual research, the authors Al-Tuwaijri, Christensen and Hughes (2004), Clarkson, Li, Richardson and Vasvari (2008), and Patten (2002) focused on a single year, and in our study, we covered the period from 2008 to 2011. Similarly, the research conducted by Freedman and Jaggi (2010) covered a period of two years.

In terms of determining the companies' environmental performance, the monitoring of emissions over a period of several years is appropriate because that is the only way to determine a change in the quantity of emissions.

Clarkson, Li, Richardson and Vasvari (2008) and Patten (2002) put the environmental performance of a company into relation to the industry, and in our study, the emphasis was on establishing the environmental performance of individual companies.

In our survey, the sample companies were selected exclusively from the manufacturing sector; however, other authors, in addition to manufacturing companies, also included mining companies such as Clarkson, Li, Richardson and Vasvari (2008). Determining the companies' environmental performance is difficult because companies, due to the different production processes, also pollute in different ways, representing a significant problem in designing a common approach for identifying environmental performance. Therefore, it is more appropriate to develop a specific approach for each sector, such as manufacturing, energy, tourism, etc.

In order to determine the environmental performance, we have selected both general pollutants (total dust for air, COD for water) and toxic substances (hazardous waste). Clarkson, Li, Richardson and Vasvari (2008), and Patten (2002) focused on the data of emissions of toxic substances TRI, i.e. hazardous waste such as Al-Tuwaijri, Christensen and Hughes (2004), Clarkson, Li, Richardson and Vasvari (2008). Freedman and Jaggi (2010) focused on greenhouse gas emissions. In Slovenia, we have a non-hazardous and hazardous emissions database, which is collected by the Slovenian Environmental Agency (ARSO). Therefore, in addition to toxic substances, it is also appropriate to take into account the general, non-hazardous, non-polluters, especially those that, due to their intensity of pollution, pose a significant problem to the environment, such as total dust.

Many authors such as Al-Tuwaijri, Christensen and Hughes (2004), Clarkson, Li, Richardson and Vasvari (2008), Filbeck and Gorman (2004), Hart and Ahuja (1996), Nakao, Amano, Matsumura, Genba and Nakano (2007), used pre-processed environmental information from various institutions to determine the companies' environmental performance. In our research, however, we have developed an original approach to determine the companies' environmental performance, i.e. the Index of Environmental Performance. Extensive databases from ARSO offer researchers the challenge of how to develop models that would enable the creation of a successful presentation of environmental performance based on the vast amount of raw emission data to be presented to the interested members of the public.

6 Conclusion

Our research did not affirm the socio-political theories about social and environmental disclosures of businesses that set a negative relationship between the companies' environmental performance and the quality of environmental

⁶ CEP, the Council on Economic Priorities, established in 1969, is a research organisation for the social and environmental recording of companies

reports. On the other hand, it also did not affirm the theory of voluntary disclosures that sets a positive relationship between the companies' environmental performance and the standard of their environmental reports.

The outcome of our study joins the findings of authors such as Freedman and Jagga (2010), Freedman and Wasley (1990), Sutantoputra, Lindorff and Johnson (2012), who did not detect a strong enough correlation between the quality of environmental reporting and performance.

Thus, the contribution of our research is revealed in the finding that the quality of environmental reporting is not related to the environmental effort of companies, which is demonstrated by the reduction of pollution, nor the other way around, with worse environmental outcomes. Therefore, we find that environmental reports do not try to conceal poor environmental performance, nor do they necessarily produce qualitative environmental reports due to good environmental results, i.e. the reduction of emissions. Thus, it would be appropriate to create theoretical starting points in the direction of tolerance of differences between variables to existing theories which explain contradictory possibilities regarding the connection between environmental reporting and environmental performance.

On top of elucidating that there is no existing correspondence, the explanations for the outcome we obtained also reside in the fact that the study's conclusion of the environmental reporting quality shows the quality of environmental reports of processing companies in the Republic of Slovenia. We found little information in environmental reports and thus little data to analyse. The inferior quality of environmental reports, however, contributes to the fact that the correlation we drew is not as visible as it would have been had the company reports been more thorough, as the reports would have provided us with wider information and, hence, more data to analyse. The outcome of the connection could remain unaffected, but its relevance would be higher.

An important contribution of our research is seen in the fact that the environmental performance assessment has been addressed in a unique way, using original environmental data. This data was not pre-processed or pre-calculated. Recognising the importance of keeping in mind that environmental indicators do not enclose all the environmental impacts a company has but are limited to a representative selection (Schultze & Trommer, 2012), we have made a selection of parameters for the evaluation of environmental performance. The Index of Environmental Performance for Environmental Indicators hazardous waste, COD-water and total dust-air reflects the business's environmental performance in terms of general pollution. Our selection also has shortcomings, especially in water and

air indicators, as these were only found in some companies from the full sample. As a result, the sample of companies eligible for our analysis was very much restricted, and this impacted the relevancy of our research, as per the environmental reports. Broad environmental parameters cannot be embedded into the overall pollution of companies, which is also shown in the emission of specific pollutants.

Nonetheless, the development of such a parameter would restrict us from determining the environmental performance of companies within a certain type of industry, namely exclusively amongst those companies that are much resemblant to each other, as for the type of production, and where consequently the range of emissions that they discharge into the environment is consistent. In establishing the correlation between the environmental performance and the quality of environmental reporting, such a specific index of environmental performance would raise problems related to environmental reporting since, due to the need for a high enough figure of companies in the sample (with similar production and pollution), additionally to large and medium-sized companies in Slovenia, small ones should be included too. Research by authors Brammer and Pavelin (2008), Dey and Dey (2018), Iatridis (2013), Ismail, Rahman and Hezabr (2018), Oryzalin and Mahmood (2020), Patten (2002) show that size is a key element that impacts the quality of environmental reports. As a result of our analysis of the low standard of environmental reports of large and medium-sized Slovenian businesses, we would reasonably infer that smaller businesses show even lower standards. Therefore, The possibility of conducting such a survey in the Slovene territory would be questionable.

From the point of view of environmental reporting, based on the results of our research, we can conclude that the rationale for the companies' lack of reporting on their environmental impact should be looked for in the absence of adequate regulations that would encourage companies to produce comprehensive environmental protection analyses and to inform the interested members of the public through their annual reports. Companies have all the required information on emissions into water, air and waste disposal, as they have to be provided to the Environmental Protection Agency of the Republic of Slovenia annually. Directive on the disclosure of non-financial information and information on the diversity of certain large companies and groups⁷ require the disclosure of non-financial information by large companies.

Besides the Directive published in 2014, 2017 have been published optional guidelines to help companies disclose environmental and social information. However, the standard of these reports remains questionable, as the di-

⁷ DIRECTIVE 2014/95 / EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

rectories on the methodology for publishing non-financial information are non-binding, which raises the question of the quality of such reports and their comparability. For this reason, we welcome the Corporate Sustainability Reporting Directive (CSRD) of 14 December 2022⁸, which modernises and strengthens the rules about the social and environmental information that companies have to report. A broader set of large companies and listed SMEs will now be required to report on sustainability (EU Finance, 2023).

Considering that the most pressing global problems at the moment are climate change and loss of biodiversity, the emissions selected for this study (hazardous waste, COD, and total dust) do not address this issue directly, as tackling these two problems would require a different research approach. Biodiversity loss needs to be assessed in the field for an individual location where an industrial plant is located. This approach would not fit our research as we have used publicly available data. Regarding the impact on climate change, studies performed by ARSO (2012) and MOP (2010) indicate that greenhouse emissions mostly characterise the energy sector, transport industry, consumption of fossil fuels for industrial and household use, the manufacturing industry does not substantially contribute to greenhouse gases with its industrial processes on which this research is focused. However, we acknowledge this as a limitation of our research.

For future research, we recommend monitoring the Index of Environmental Performance over a longer period of time (up to 20 years). These findings would give us a more credible picture of the companies' environmental performance. The conclusion that companies continuously improve their environmental performance over the years could be a statement of their strategic commitment to environmental issues. If improvement is detected only in the short term, this may result from a one-time change in the company (e.g., the replacement of technology). We also recommend the use of environmental data published by the Environmental Agency of the RS. This publicly available and original data enable the researcher to further develop in the area of the assessment of environmental performance, to compile a selection of the environmental indicators by industry, and by integrating both general and industry-specific environmental indicators, to take a comprehensive approach to determine the companies' environmental performance by industry.

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Povezava med okoljskimi poročili in okoljsko uspešnostjo: Primer predelovalne industrije v Republiki Sloveniji

Izhodišče/Namen: Raziskati povezanost med kakovostjo okoljskega poročanja in okoljsko uspešnostjo podjetij predelovalne industrije v Republiki Sloveniji.

Metode: Za ugotavljanje okoljske uspešnosti smo zasnovali lasten Indeks okoljske uspešnosti, ki temelji na podatkih Agencije Republike Slovenije za okolje o emisijah v zrak, vode in odpadke. Povezanost med indeksom okoljske uspešnosti in kakovostjo okoljskega poročanja smo izmerili z uporabo Spearmanovega korelacijskega koeficienta. Raziskava je bila izvedena na vzorcu podjetij predelovalne industrije v Republiki Sloveniji.

Rezultati in zaključek: Rezultati analize povezanosti med okoljsko uspešnostjo in kakovostjo okoljskega poročanja ne izkazujejo statistične pomembnosti. Poleg pojasnitve, da povezanost ne obstaja, lahko vzroke za dobljeni rezultat naše raziskave iščemo tudi v tem, da rezultati analize kakovosti okoljskega poročanja kažejo na nizko kakovost okoljskih poročil. Slednje prispeva temu, da izračunana povezanost ni tako oprijemljiva kot bi bila, če bi bila poročila podjetij izčrpnjša, saj bi bilo tako informacij in s tem podatkov za analizo več. Naše ugotovitve kažejo na potrebo, da se prostovoljno okoljsko poročanje dopolni z obveznimi elementi za tovrstno poročanje.

Ključne besede: *Okoljska uspešnost, Okoljsko poročanje, Indeks okoljske uspešnosti, Predelovalna industrija*