

Carbon footprint in the annual statements of Polish mass passenger transportation carriers

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Abstract

Purpose: Environmental protection constitutes an important challenge for 21st-century civilization and stakeholders not only expect financial statements that describe an entity numerically, but they also want additional, non-financial/descriptive data that presents the impact of the business operations on the natural environment. The main objective of the study was to verify whether the financial statements and management board reports on the activities of Polish mass passenger transportation carriers contain information on the impact of their activities on the environment, and in particular, about the carbon footprint. Consequently, does the information contained allow for an objective assessment of the impact of mass passenger transportation carriers on the climate, and thus allow stakeholders to make decisions regarding the conclusion of business transactions with these companies? **Methodology/approach:** The following research methods were used in the study: a literature review, analysis of legal acts, a case study, and deduction and synthesis methods. **Findings:** On the example of the audited entities, it was found that current disclosures in the area on the impact of business activity on the natural environment of entities dealing with mass passenger transportation are not satisfactory. **Originality/value:** The article is part of a scientific discussion on the growing importance of financial and non-financial disclosures regarding the impact of business activity on the natural environment.


Keywords: carbon footprint, environmental accounting, financial statements, non-financial information.

Streszczenie

Ślad węglowy w rocznych sprawozdaniach polskich firm z branży pasażerskiego transportu masowego

Cel: Ochrona środowiska stanowi ważne wyzwanie cywilizacji XXI wieku, a interesariusze oczekują już nie tylko samych sprawozdań finansowych opisujących jednostkę liczbowo, lecz także dodatkowych, niefinansowych/opisowych danych, prezentujących wpływ prowadzonej działalności na środowisko naturalne. Głównym celem badania była weryfikacja, czy sprawozdania finansowe oraz sprawozdania zarządu z prowadzonej działalności polskich firm z branży pasażerskiego transportu masowego zawierają informacje o wpływie ich działalności na środowisko naturalne, a w szczególności na temat emitowanego śladu węglowego. W konsekwencji ustalenie, czy zawarte informacje pozwalają obiektywnie ocenić wpływ przedsiębiorstw osobowego transportu masowego na klimat, a tym samym umożliwiają interesariuszom

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na podejmowania decyzji w zakresie zawierania transakcji biznesowych z tymi firmami. **Metodyka/podejście:** W opracowaniu wykorzystano następujące metody badawcze: analizę literatury, analizę aktów prawnych, studium przypadku oraz metody dedukcji i syntezy. **Wyniki:** Na przykładzie badanych jednostek stwierdzono, że aktualne informacje w zakresie wpływu działalności gospodarczej na środowisko naturalne podmiotów zajmujących się przewozami masowymi nie są zadowalające. **Oryginalność/wartość:** Artykuł stanowi element dyskusji naukowej na temat wzrostu znaczenia finansowych i niefinansowych ujawnień w zakresie wpływu działalności gospodarczej na środowisko naturalne.

Słowa kluczowe: ślad węglowy, rachunkowość środowiskowa, sprawozdania finansowe, informacja niefinansowa.

Introduction

One of the most important problems of the 21st century is environmental protection, as reflected in the activities of commercial companies, public institutions, and private individuals around the world and in Poland, including the following:

- 1) the global automotive market has started to switch to the production of electric cars instead of internal combustion cars, to reduce greenhouse gas emissions;
- 2) more cities in Poland have introduced anti-smog resolutions, which prohibit the burning of coal in furnaces or heating boilers,¹ in order to reduce the amount of pollutants emitted into the atmosphere;
- 3) starting from 2018, the whole world has observed the successive activities of the Swedish activist Greta Thunberg, who, despite her very young age, has been able to motivate millions of people around the world to fight against the climate change that results from human activity.

The direct inspiration for the selection of the study topic came from the utterance made by an MP of the Polish parliament who, after the last elections in 2019, stated that “knowing a flight’s carbon footprint and how it contributes to global warming”, he would travel to the first sitting of the Parliament by train rather than by plane (Czuma, 2019). Concern about minimizing the emission of CO₂ into the atmosphere has also been expressed by Greta Thunberg, who traveled to the UN Climate Summit in New York on an ecological yacht, *Malizia II*, instead of traveling by plane.

Eco-friendly travel, i.e., choosing a mode of transport that generates as small a carbon footprint as possible, has been of increasing importance for society, as confirmed by, e.g., the publication of guides and calculators on the Internet, which make it possible to calculate the carbon footprint of a journey planned via various means of mass transportation (Wieczorek, 2015). The term “carbon footprint” itself is often defined² as “the total sum of the greenhouse gas emissions caused directly or indirectly by a person, an organization, an event or a product” (Carbon Trust) (Kulczycka, Wernicka, 2015b, p. 63).

¹ Such a ban is already in force in Krakow, Sopot, Wrocław, Sosnowiec, Tarnów, Rybnik, and Racibórz, while many other Polish cities are preparing to introduce it.

² More definitions of carbon footprint are provided in Part 3 of this study.

This raises the question of what role accounting should play in the provision of such important information on the business activities carried out for financial statement users.

The main aim of the study is to justify the hypothesis that financial statements of entities operating in the mass passenger transportation sector in Poland should contain information presenting the impact of their activity on the natural environment, since preventing climate change currently constitutes an important issue for many people and institutions. The omission of such an important scope of the information disclosed in financial statements both distorts the entity's image presented in the financial statements and hinders or even prevents financial statement users from making decisions.

The issue analyzed is illustrated by the following research questions:

RQ1: Do the existing Polish accounting principles regarding the preparation of financial statements allow for the disclosure of information on the impact on the environment of mass passenger transport business operations, and how useful is such information?

RQ2: Do the largest entities operating in the mass passenger transportation sector in Poland disclose environmental information, including the carbon footprint generated, in their annual reports?

Auxiliary research aims include:

1. Characterizing the primary principles and objectives of environmental accounting.
2. Presenting the options for disclosing environmental information, including the carbon footprint generated by the entities operating in mass passenger transport.
3. Analyzing the financial statements and management board reports of the largest mass passenger transportation carriers in Poland to assess:
 - a) whether the environmental information, including the carbon footprint, is disclosed and what details it contains, and
 - b) the usefulness this information presents for financial statement users, if such information is disclosed at all.

The following research methods were used in the study:

- 1) a literature review, to present the concept of environmental accounting development as well as its primary principles and objectives;
- 2) analysis of national and EU legal accounting regulations as well as a literature review, to present the options for disclosing carbon footprint information in financial statements;
- 3) a case study, in order to examine the current practice in the field of disclosing information on the impact that the activity of mass passenger transportation has on the environment.

At the stage of formulating the final conclusions, the deduction and synthesis methods were used.

The study allowed us to assess the current degree of optional disclosures in the field of environmental protection by entities that operate in the mass passenger transportation sector, thus contributing to the ongoing discussion about the role of accounting in the environmental protection process and the development of non-financial reporting in the sense of accounting.

1. The role of accounting in the process of environmental protection

Environmental accounting constitutes a relatively new part of accounting. It emerged due to humanity's common fear of climate change and the expectation that one of the most important business goals – in addition to the strictly economic ones – will also involve caring for the preservation of the natural environment. One key problem humanity faces today is the deterioration of the natural environment, resulting from intensive and dynamic economic development. It means that “the ever wider communities, who are more aware of the threats, have been demanding information on the impact of economic activity on the quality of life. It includes both the economic responsibility of an entity, i.e., the rational use of resources made available by society, as well as ecological responsibility, i.e., the condition and the living conditions in a given environment” (Wydymus, Stępień, 2007, p. 80). It can, therefore, be said that the growing interest in the issue of enterprises' impact on the natural environment has been reflected in the emergence and development of environmental accounting (Dyduch, 2016, p. 55), which is called environmental protection accounting or green accounting, and is focused on the issues of environmental protection (Macuda, 2015, p. 101).

So how is environmental accounting defined? According to Dyduch (2013, p. 55), “a common element of many definitions of environmental accounting is describing it as a system for identifying, measuring, and presenting information on the company's impact on the natural environment”. Table 1 below presents selected definitions of environmental accounting.

Table 1. Selected definitions of environmental accounting

Definition	Author/ Organization
Environmental accounting is a subset of accounting that deals with: <ul style="list-style-type: none"> • activities, methods, and systems • recording, analysis, and reporting • environmentally induced financial impacts and ecological impacts of a defined economic system (e.g., a firm, plant, region, nation, etc.) 	Schaltegger and Burritt (2000, p. 63)
Environmental accounting is an inclusive field of accounting. It provides reports for both internal use, which generate environmental information to help make management decisions on pricing, controlling overheads, and capital budgeting, and external use, revealing environmental information of interest to the public and to the financial community	Yakhou and Dorweiler (2004, p. 65)
Environmental accounting includes the identification, measurement, and allocation of environmental costs, and the integration of these costs into a business. It encompasses how such information is communicated to the companies' stakeholders	Pramanik et al. (2007, p. 23)

cont. tab. 1

Definition	Author/ Organization
Environmental accounting is nothing more than quantifying environmental effects for the purpose of detecting the costs and benefits that may arise to make business decisions and inform the internal and external users of them	Zrnic et al. (2020, p. 49)
<p>Environmental Accounting (EA) is a broad term used in a number of different contexts, such as:</p> <ul style="list-style-type: none"> • assessment and disclosure of environment-related financial information in the context of financial accounting and reporting; • assessment and use of environment-related physical and monetary information in the context of Environmental Management Accounting (EMA); • estimation of external environmental impacts and costs, often referred to as Full Cost Accounting (FCA); • accounting for stocks and flows of natural resources in both physical and monetary terms, that is, Natural Resource Accounting (NRA); • aggregation and reporting of organization-level accounting information, natural resource accounting information and other information for national accounting purposes; and • consideration of environment-related physical and monetary information in the broader context of sustainability accounting 	IFAC (2005, pp. 13–14)

Source: authors' own elaboration based on the literature on the subject.

When it comes to the role of accounting in the process of environmental protection, as Stępień (2002, p. 54) notes, accounting [“has always been (...) associated with the creation of the course-of-business image”]. Wojciechowska (2009, p. 46), in turn, expects that “accounting as an information system should change along with the changes in the demand for information, which depend on the conditions of enterprise functioning”. This standpoint on the issue is not isolated. Macuda (2015, p. 100) believes that “the changing environment and the significant increase in social awareness inevitably lead to changes, not only within the scope of the goals and styles of business entity management but also concerning the systems serving this purpose, including the accounting system, which adapts its solutions to these changes”. Stępień (2002, p. 53), in turn, expects that “accounting, which by creating an image of the course of economic activity through making appropriate measurements, must also include new phenomena, which require measurement and economic interpretation as well as appropriate recognition and visibility thereof in financial reporting”. A similar statement was expressed by Wiszniowski (2011, p. 396), who believes that the main task of environmental accounting is “to isolate such economic events in an entity, which would allow them to be presented in a way that enables the assessment of environmental protection activities” (see also Reizinger-Ducsai, 2018, pp. 189–192).

In this regard, it is worth defining what exactly environmental protection is. How should this concept be understood, and exactly what functions does accounting have to perform in this process? It would seem that, with so much information on environmental protection and the risks associated with its degradation, everyone should know what environmental protection means and what it is about. Nonetheless, information that shows this is not the case regularly appears in the public space. To clarify the concept of environmental protection, one can refer to the statutory definition that was included in the Act of 27 April 2001 on Environmental Protection, where environmental protection is described as “undertaking or discontinuing the actions enabling preservation or restoration of environmental balance, in particular:

- 1) rational shaping of the environment and management of environmental resources, in accordance with the principle of sustainable development;
- 2) pollution countermeasures;
- 3) restoration of the natural environment elements to their proper condition” (Article 3 Paragraph 13).

When it comes to determining the function of accounting in the process of environmental protection, it should be noted that environmental accounting constitutes a subgroup of accounting.³ Therefore, environmental accounting has to fulfill all the functions of traditional accounting, but primarily “as the language of business and the source of information, it must meet the requirements of sustainable development” (Hernadi, 2012, p. 25). The concept of sustainable development is very important for enterprise development because respect for the principles of sustainable development makes it possible to combine the company's responsibility towards society and the environment with making a profit (Dyląg, Puchalska, 2014, p. 25).⁴

There is not even the slightest doubt that ecological accounting will play a key role in the coming years, as confirmed by, e.g., Moorthy and Yacob (2013, p. 6), who believe that “green accounting constitutes a new aspect of the accounting science, which will affect it in the near future”.⁵

³ Contrary opinions have already emerged, or at least those ordering high temperance in the division of accounting into many new groups, subgroups and subsystems, such as ecological, behavioral, computer accounting, etc. As Sojak (2011, p. 281) believes, “it has been a fact that the number of the users of accounting-generated information is still growing. Satisfaction of their expectations causes an increase in the amount of the information disclosed in financial statements. Often, this new information addresses an area that is socially important enough to constitute the basis for the emergence of new accounting “segments”, but it does not always require a separate or additional name”.

⁴ A similar opinion was expressed by Stępień (2008, p. 159), who describes sustainable economic development as “a way to conduct business that reconciles the laws of nature with the laws of economics, guarantees improvement, and maintains a high quality of life, while taking into account the rights of future generations”.

⁵ For more on environmental accounting, see also Boyd, Banzhaf (2006), Gray et al. (1995), Ahmad et al. (1989), Lehmann (1999; 2009) and Stępień, Pramanik (2006).

2. The environmental impact of enterprises in financial statements

The purpose of environmental accounting is to identify, measure, and present the impact of an enterprise's activities on the natural environment. It is primarily expressed in:

- 1) environmental assets, i.e., emission rights, licenses, concessions, and other environmental investments (Szadziewska, 2013, pp. 331–333);
- 2) environmental liabilities, i.e., provisions for liabilities, contingent liabilities, etc. (Szadziewska, 2013, pp. 333–336);
- 3) environmental costs, i.e., the fees and costs related to environmental protection as well as the losses resulting from its absence.⁶

The premise of ecological accounting, in turn, includes the company's impact on the environment, resulting in the presentation of that impact in the form of an appropriate report (Macuda, 2003, p. 101).

2.1. Non-financial reporting in the EU

Issues of social responsibility accounting began to appear in EU legislation at the beginning of the 21st century. As Sobczyk (2012, p. 165) notes, “a unified standpoint of the European Union regarding social responsibility accounting, including social responsibility reporting, was expressed in Directive 2003/51/EC of the European Parliament and of the Council”. Point (9) of the preamble to the aforementioned Directive (2003/51/EC) states that financial statements “should not be restricted to the financial aspects of the company's business” and, in certain cases, it should also contain non-financial information that allows for a reliable evaluation of the entity. In other words, it should also contain information that makes it possible to analyze the environmental protection aspects and the social issues of the business activity.⁷ Importantly, Directive 2003/51/EC assumes that “due to the evolving nature of this area of financial reporting and considering the imposition of a possible additional burden on enterprises under a certain size, Member States may decide to waive the obligation to provide non-financial information in the case of annual reports on the business operations of these entities” (Krasodomska, 2011, p. 92).

⁶ According to Stepień (2002, p. 9), environmental-protection expenditures involve the intentional consumption of material resources, labor, and external services (expressed in monetary assets), resulting in ecological balance (the optimal condition of the environment, with the possibility of self-cleaning) being maintained. As Majchrzak (2018, p. 232) notes, however, the concept of environmental costs is not unambiguously defined in the literature on the subject. What is more, according to Szadziewska (2013, pp. 166–170), definitions of environmental-protection costs have also been provided by international organizations (e.g., the US Environmental Protection Agency, among others). However, the definitions presented by these organizations are not binding standards; rather, they constitute a set of recommendations and guidelines that enable measurement, recording, accounting, and presentation of such costs in financial statements.

⁷ More on non-financial reporting in Krasodomska (2009, 2010, 2014, 2017).

One of the first EU documents to address the preparation of financial statements to incorporate the term non-financial reporting is Directive 2013/34/EU of the European Parliament and of the Council on annual financial statements, consolidated financial statements, and related reports of certain types of entities, issued on 26 June 2013. Under Article 19 of the Directive, a report on business activity contains a reliable review of the development and the results of an entity's activity, a review of its situation, and a description of the most important threats and uncertainties it faces, in line with the size and the complexity of its operations. This review should take the form of a balanced and comprehensive analysis of the development and results of an entity's activities, as well as its situation, in line with the size and the complexity of the business conducted. When it is necessary to understand the entity's development, performance, or situation, the analysis should include both financial and, where applicable, non-financial key performance indicators that are related to the specific area of activity, including information on environmental issues and employee-related matters. Presenting the analysis, the report should include, where relevant, references to the amounts disclosed in the annual report and additional explanations regarding these amounts (see also Hońko, 2014; Mućko, Hońko, 2013).

According to Kryk (2017, p. 110), “the most precise – and mandatory – recommendations appeared in Directive 2014/95/EU, which constitutes the most important EU legislative initiative undertaken in the last ten years in the area of disclosure of environmental, social, and corporate governance information. He goes on to say, its implementation will have a significant impact on the way non-financial information is reported by many entities covered by the Directive”. This Directive was adopted by the EU Council in September 2014 and concerned the disclosure of non-financial data and information on diversity for some large entities and entity groups that consist of a parent company and its subsidiaries. The obligation for non-financial reporting has been imposed on large entities, i.e., entities which, as of the balance sheet date, exceeded at least two of the following three amounts: total assets – EUR 20 million, net sales revenues – EUR 40 million, average number of employees – 500 people.⁸ Public-interest entities⁹ are treated the same as large entities, regardless of sales revenues, balance sheet total, or the average number of employees (2013/34/EU, Article 40).

Pursuant to the principles presented, if an entity is required to prepare a non-financial statement, it should include aspects related to the disclosure of information about the natural environment, in particular, information on the current and anticipated impact of the entity's activities on:

⁸ Before the amendment, the criterion was 250 people (2013/34/EU, Article 3 Paragraph 4).

⁹ Public interest entities are entities with a special status in the area of financial statement audit. Their activities are significant from the perspective of the public interest, and any possible malpractice in these entities causes particularly negative consequences for the shareholders and third parties. As such, it is necessary to strengthen the supervision mechanisms to eliminate the risk of violating the auditors' independence and the risk of reporting shortcomings; for more detail see Article 2 (Subparagraph 9) of the Act of 11 May 2017 on Statutory Auditors, Audit Firms, and Public Supervision.

- 1) the natural environment and, where appropriate, the health and safety;
- 2) the use of renewable and non-renewable energy;
- 3) greenhouse gas emissions;
- 4) water consumption;
- 5) air pollution (Szadziwska et al., 2018; Macuda et al., 2015).

2.2. Environmental reports in the Polish financial statements law

In the Polish accounting system, environmental reporting became obligatory relatively late, i.e., in 2017, when Article 49b was added to the Accounting Act (AA) of 29 September 1994, obliging specific groups of entities to prepare non-financial information, including a part on the impact of the business activity conducted on the natural environment.¹⁰ Before 2017, environmental disclosures, as part of the statements prepared under accounting, were optional.

According to the AA, entities that meet specific statutory requirements¹¹ must additionally include a statement on non-financial information in the report of activities. It should include, among other things (AA, Article 49b Paragraph 2):

- 1) a description of the policies implemented by the entity regarding social issues and employee-related matters, the natural environment, respect for human rights, and anti-corruption activities, as well as a description of the outcomes resulting from the application of these policies;
- 2) a description of the due-diligence procedures – if an entity applies them under the policies indicated above;
- 3) a description of the material risks associated with the entity's operations that may have adverse effects on the issues referred to in point 1, including the risks associated with the entity's products or its relations with the external environment, including contractors, and a description of the risk management.

The primary principles of non-financial information disclosures in the field of environmental protection were determined by Article 49b Paragraphs 3–11 of the AA.

¹⁰ The amendment to the AA, obliging some units to disclose non-financial information, results from the adoption of Directive 2014/95/EU by the European Parliament.

¹¹ An entity obliged to prepare a statement section containing non-financial information has been defined as “a unit, referred to in Article 3 Paragraph 1e Subparagraphs 1–6, which is a limited company, a limited joint-stock partnership, or a general partnership or limited partnership, whose partners with unlimited liability are capital companies, limited joint-stock partnerships, or companies from other countries with a similar legal form to these companies, provided that, in the fiscal year for which it prepares financial statements, and in the preceding year, it exceeds the following amounts:

- 1) 500 people – in the case of average annual employment in full-time equivalents, and
- 2) PLN 85,000,000 – in the case of the balance sheet total assets at the end of the fiscal year, or
- 3) PLN 170,000,000 – in the case of the net fiscal year revenues from the sale of goods and products” (AA, Article 49b Paragraph 1).

Possible annual report sections in which environmental information can be placed by entities not legally bound to make such disclosures are presented in Figure 1.

Figure 1. Placement options for environmental disclosures in an entity's annual report



Source: Szadziewska (2013, p. 373).

The variants of placing environmental disclosures in the additional information section of the report (i.e., Option I – in the additional information and explanations section) and in a separate environmental report (Option III) are available to all entities. The variant of placing disclosures in the report on business operations (Option II) is possible only for those entities that prepare such reports following the provisions of the AA.

The scope of the facultative environmental information disclosures proposed by Szadziewska (2013, p. 374) encompasses the following:

- 1) substantial environmental aspects and the related environmental impact of economic activities on the environment, the environmental policy, as well as the environmental objectives and tasks set;
- 2) the accounting principles used to record environmental operations;
- 3) environmental assets, environmental liabilities (including provisions for liabilities and contingent liabilities);
- 4) the environmental costs charged to the profit and loss account, including ecological penalties, compensation for pollution damage caused by business operations, as well as the incurred and the planned expenditures on ecological projects;
- 5) the environmental certificates held;
- 6) the primary environmental indicators adopted to determine the degree to which environmental objectives have been implemented and the possibility of future environmental risk;
- 7) the management's approach to environmental protection;
- 8) the scope of the organizational units' responsibility for the implementation of environmental goals and tasks;
- 9) the manner of increasing employees' environmental awareness (e.g., through courses or training; the reasons why environmental goals have not been achieved);
- 10) the main changes in management systems aimed at improving environmental performance;

- 11) the method of verifying the environmental report and the wide range of the environmental indicators that enable the full assessment of the company's impact on the natural environment and an assessment of the effectiveness of the measures taken to protect it.

When selecting the information set intended for disclosures within the scope of the environmental impact of business activities, the requirements defined in Article 49b Paragraph 3–11 of the AA mentioned above and, above all, their usefulness for potential financial statement users should be considered as well.

Presenting the provisions of the Polish balance sheet law, in terms of environmental disclosures, it is necessary to mention the National Accounting Standard No. 9, “Business Activity Report” (hereinafter referred to as NAS No. 9),¹² which contains “a hint regarding the presentation of environmental information by some (unspecified) entities in this part of the annual report” (Dyduch, 2017, p. 36).¹³ The scope of the information disclosed, regarding the entity’s actual and possible impact on the natural environment, includes information on (NAS No. 9, Point 8.14):

- 1) pollution prevention and control effectiveness of these activities,
- 2) the impact of energy consumption on the environment,
- 3) the direct and indirect emissions into the air (greenhouse gases, toxic substances, eutrophying and acidifying substances, etc.),
- 4) natural resource (e.g., water, land) exploitation and protection and the related protection of biodiversity,
- 5) waste management,
- 6) the environmental impact generated by transport or the use of products, goods and services, and their disposal,
- 7) the development of ecological products and services.

It should be remembered, however, that NAS No. 9 is not obligatory because, under Article 10 Paragraph 3 of the AA, an entity's management board does not have to apply the NAS.¹⁴

The analysis of the legal regulations in the field of accounting allows for a positive response to RQ1. Entities dealing with mass passenger transportation should disclose:

- financial information related to environmental protection (environmental assets and liabilities, environmental costs) in their financial statements and
- non-financial information related to environmental protection in their management board reports (including information on the emitted carbon footprint as a significant part of the information on the environmental impact of activities), creating non-financial reporting.

¹² The original Polish title of the document is *Krajowe Standardy Rachunkowości* (National Accounting Standards).

¹³ See *Krajowe Standardy Rachunkowości* No. 9, Point 6.31.

¹⁴ The provision states that entities may apply the IAS/NAS but they are not obliged to do so.

3. The disclosure of the carbon footprint in the financial statements of Polish mass transportation carriers

Mass transportation refers to widely available regular passenger transportation carried out at specified intervals and along a specific transport line or network. This type of transport is contrasted with individual transport, which is characterized by particular transportation conditions and a lack of regularity (Kołodziejski, 2007, p. 12). A sustainable transportation policy, which constitutes an important element of a sustainable development strategy, assumes an increase in the role of public transport, as opposed to the development of individual transport.

3.1. Carbon footprint definitions and measurements

The term “carbon footprint” began to be popularized along in the 21st century, and it is expressed as the carbon dioxide equivalent per functional unit of the product (CO₂/functional unit). Although the concept of carbon footprint is often used in the context of climate change, according to Wiedmann and Minx (2007, p. 1), “there is an apparent lack of academic definitions of what exactly a ‘carbon footprint’ is meant to be” and “the scientific literature is surprisingly void of clarifications, despite the fact that countless studies in energy and ecological economics that could have claimed to measure a ‘carbon footprint’ have been published over decades”. Based on a literature review¹⁵ from 1960–2007, they concluded that:

- 1) most articles deal with the question of how much carbon dioxide emissions can be attributed to a certain product, company, or organization, although none of them provides an unambiguous definition of the term carbon,
- 2) in most cases, “carbon footprint” is used as a generic synonym for emissions of carbon dioxide or greenhouse gases expressed in CO₂ equivalents (Wiedmann, Minx, 2007, p. 3).

Examples of definitions they collected are presented in Table 2.

Table 2. Definitions of “carbon footprint” from the grey literature

Source	Definition
BP (2007)	“The carbon footprint is the amount of carbon dioxide emitted due to your daily activities – from washing a load of laundry to driving a carload of kids to school”

¹⁵ A literature search for the term “carbon footprint” (i.e., where these two words are next to each other in this order) in all scientific journals and all search fields covered by Scopus and ScienceDirect for 1960 to 2007.

cont. tab. 2

Source	Definition
British Sky Broadcasting (Sky) (Patel, 2006)	The carbon footprint was calculated by “measuring the CO ₂ equivalent emissions from its premises, company-owned vehicles, business travel and waste to landfill”.
Carbon Trust (2007, p. 4)	“[...] a methodology to estimate the total emission of greenhouse gases (GHG) in carbon equivalents from a product across its life cycle from the production of raw material used in its manufacture, to disposal of the finished product (excluding in-use emissions)”. “[...] a technique for identifying and measuring the individual greenhouse gas emissions from each activity within a supply chain process step and the framework for attributing these to each output product (we [The Carbon Trust] will refer to this as the product’s ‘carbon footprint’)”.
Energetics (2007)	“[...] the full extent of direct and indirect CO ₂ emissions caused by your business activities”
ETAP (2007)	“[...] the ‘Carbon Footprint’ is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in tonnes of carbon dioxide”
Global Footprint Network (2007)	“The demand on biocapacity required to sequester (through photosynthesis) the carbon dioxide (CO ₂) emissions from fossil fuel combustion”. (see also text)
Grub & Ellis (2007)	“A carbon footprint is a measure of the amount of carbon dioxide emitted through the combustion of fossil fuels. In the case of a business organization, it is the amount of CO ₂ emitted either directly or indirectly as a result of its everyday operations. It also might reflect the fossil energy represented in a product or commodity reaching market”
Parliamentary Office of Science and Technology (POST 2006)	“A ‘carbon footprint’ is the total amount of CO ₂ and other greenhouse gases, emitted over the full life cycle of a process or product. It is expressed as grams of CO ₂ equivalent per kilowatt hour of generation (gCO ₂ eq/kWh), which accounts for the different global warming effects of other greenhouse gases”

Source: Wiedmann and Minx (2007, p. 3).

Wiedmann and Minx also suggested a scientific definition based on commonly accepted accounting principles and modeling approaches, which reads as follows: “The carbon footprint is a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product” (2007, p. 4).

The second problem related to the issue of companies disclosing information on their carbon footprint is the lack of a universal and widely accepted method of calculating the carbon footprint. As Wiedmann and Minx (2007, p. 4) write: “There is no

consensus on how to measure or quantify a carbon footprint. The spectrum of definitions ranges from direct CO₂ emissions to full life-cycle greenhouse gas emissions and not even the units of measurement are clear”.

Another problem of the measurement itself is “disagreements in the selection of gases, and the order of emissions to be covered in footprint calculations” (Pandey et al., 2011, p. 130). Although there are standards, procedures, tools, and even online computer programs for calculating the carbon footprint,¹⁶ it is still not clear enough how to measure the carbon footprint. Specialists are still asking if the carbon footprint should:

- include just carbon dioxide (CO₂) emissions or other greenhouse gas emissions as well, e.g., methane
- be restricted to carbon-based gases or if it can include substances that do not have carbon in their molecule, e.g., N₂O, another powerful greenhouse gas (Wiedmann and Minx, 2007, p. 2).¹⁷

To sum up this part:

1. The lack of unambiguous rules for measuring the carbon footprint cannot be a reason for companies not to disclose information about their emissions in their annual reports. In addition to information on the amount of the carbon footprint itself, companies should explain the methods, principles, and procedures adopted in calculating the carbon footprint, which will allow stakeholders to make comparisons.
2. Even if the obligation to make disclosures in Polish accounting is optional for many companies, information on the company's environmental impact, including emission of carbon footprints, is relevant to a significant number of stakeholders, and it should be disclosed by companies in their annual reports.

3.2. The mass transportation market in Poland

In Poland, the primary issues related to public mass transportation are regulated by the abovementioned Act of 16 December 2010 on Collective Public Transport, according to which public mass transport may take place on the basis of (Article 5 Paragraph 2):

- 1) a contract for the provision of public transportation services between the organizing party and the carrier,
- 2) confirmation of a transportation declaration or open access confirmation.

Primary means of collective transport include:

- 1) in rail transport: train, metro, tram;
- 2) in road transport: bus, trolleybus;
- 3) in inland waterway and seawater transport: passenger ship;
- 4) in air transport: airliner.

¹⁶ For programs that calculate the carbon footprint, along with their groups, see Łasut and Kulczycka (2014, p. 140).

¹⁷ For more on calculating the carbon footprint and related problems, see, e.g., the Carbon Trust; Matthews et al. (2008), Kulczycka, Wernicka (2015a), Hertwich, Peters (2009), ISO 14067: 2018.

The mass transportation market in Poland predominantly includes public automobile transportation (urban buses and trolleybuses, and intercity coaches) and public rail-based transport (city tram lines, local railway lines, e.g., Szybka Kolej Miejska and Regio).¹⁸

In the era of the recent climate changes, the growing street traffic congestion, and the increasingly common traffic jams, it seems that the role of mass transportation should definitely expand in the next several years. One additional argument for the expansion of the role of public transportation is the fact that an increasing number of Polish cities are trying to limit cars in city centers due to high traffic congestion and poor air quality.

3.3. Justification for the selection of the entities surveyed

To examine the issue of disclosing the impact of transport activities on the environment, including carbon footprint, financial statements of the three largest railway transportation carriers – with regard to the turnover – were selected for analysis:

- 1) POLREGIO Sp. z o.o.,
- 2) Koleje Mazowieckie Sp. z o.o., and
- 3) PKP Intercity S.A.

To effectively compare the railway carriers with the air carriers, the financial reports of the largest Polish air carrier, PLL LOT S.A. (LOT), were also selected since air travel has a much greater impact on the environment than road or rail travel. Additionally, the financial statements and management board reports of Enter Air S.A. were also chosen. It is the largest private airline in Poland, operating for nine years, and it is one of the largest charter airlines in Europe in terms of its fleet.

POLREGIO Spółka z o.o. is the largest railway carrier in Poland, with many years of experience in the passenger transportation market. The company was founded in 2001 on the basis of the PKP¹⁹ Sector of Passenger Transport. In December 2008, it was separated from the PKP Group, with the local governments of all voivodships becoming shareholders. On 4 November 2015, Agencja Rozwoju Przemysłu S.A. (Eng. Industrial Development Agency) took over the majority of the company's shares (50% + one share). The remaining part of the shares is held by 16 local voivodship governments. The vast majority of the tasks carried out by the company are of a public service nature, which is provided on the order of the voivodships and the regional railway transportation providers, based on public service contracts.²⁰

¹⁸ Szybka Kolej Miejska is a generic Polish name for municipal rail transport network. Regio is the name of the railway lines serving POLREGIO passenger trains.

¹⁹ PKP stands for the Polskie Koleje Państwowe (Polish State Railways), and it is the dominant railway operator in Poland. The company was founded when the former PKP state-owned operator was divided into several units based on the requirements laid down by the European Union. It is the dominant company in the PKP Group that resulted from the split, and it maintains a 100% share control, being fully responsible for managing all of the other PKP Group companies.

²⁰ The Management Board's report on the operations of POLREGIO Sp. z o.o. (PolRegio, 2018).

Koleje Mazowieckie was established on 29 July 2004 by the Local Government of the Mazovian Voivodeship (51% shares) and POLREGIO Sp. z o.o. (49% of shares). It began its transportation operations on 1 January 2005. On 8 January 2008, the Extraordinary Meeting of the Koleje Mazowieckie Shareholders approved the sale of all the shares held by POLREGIO to the Mazovian Voivodeship. As a result, the Mazovian Voivodeship Local Government holds 100% of shares in Koleje Mazowieckie. Since 2005, Koleje Mazowieckie has provided the public service of regional railway passenger transportation on the commission of the Mazovian Voivodeship Local Government.²¹

PKP Intercity is the largest Polish railway operator connecting the centers of large cities with popular tourist resorts in the country. It also enables convenient travel around Europe. Every day, the carrier runs around 360 trains. In 2015, PKP Intercity completed its rolling-stock investment program, worth nearly PLN 5.5 billion. Under the projects, it purchased new Pendolino, FLIRT3, and PesaDART trains. In September 2016, the carrier developed a new rolling-stock strategy for 2016–2020, under which it planned to invest about PLN 2.5 billion in rolling stock and technical facilities. In December 2017, an updated strategy was adopted for 2016–2020, with an implementation perspective of up to 2023. The total expenditure on its implementation will amount to over PLN 7 billion.²²

LOT Polish Airlines, established on 29 December 1992, is the largest Polish air carrier, as a result of the transformation of a state-owned enterprise under the same name. LOT's activities include the air transportation of passengers, luggage, mail, and goods, as part of domestic and international transport, the provision of air transport-related services, air tourism, flight training, and aircraft rental. Some airline organizational units are based at Warsaw Chopin Airport (passenger and cargo terminals). Additionally, the company has several sales offices and station manager services located domestically and abroad.²³

Enter Air S.A. carries out connections for leading Polish and foreign travel agencies, flying to over 30 countries and over 250 airports. Enter Air's fleet consists of 21 Boeings 737–800s and two Boeings 737 MAX-8s. In 2018, Enter Air carried nearly two million passengers in Poland. In addition to the Polish market, Enter Air also operates, on the British, French, Spanish, Czech, Scandinavian, Italian, and Israeli markets, among others. In May 2019, Enter Air signed an investment agreement worth USD 2 million (about PLN 7.7 million) and took over 49% of the shares of Chair Airlines, thanks to which it became its strategic partner and gained access to the Swiss tourism market. The agreement also includes a call option that entitles Enter Air to take up additional shares of the airline, giving it a total share of up to 80% of shares.

²¹ <https://www.mazowieckie.com.pl/pl/o-nas>.

²² <https://www.intercity.pl/pl/site/o-nas/o-firmie/>.

²³ The Management Board's report on the operations of the Polskie Linie Lotnicze LOT S.A. (LOT, 2018).

Table 3 shows the criteria set, together with their values, which oblige entities to include the environmental information part in the management board report on activity.

Table 3. Values for the established criteria within the meaning of Article 49 Paragraph 1 of the AA in the period 2017–2018 for the surveyed companies

Criteria included in Article 49b Paragraph 1 of the Accounting Act	PKP Intercity S.A.	Polskie Linie Lotnicze LOT S.A.	Koleje Mazowieckie Sp. z o.o.	POLREGIO Sp. z o.o.	Enter Air S.A.
2018					
Employment	8, 111	1, 717	2, 837	6, 817	< 500
Total balance sheet assets (thousands of PLN)	7,567,734	4,746,121	2,098,728	1,449,235	164,090
Net revenues from sales (thousands of PLN)	2,796,729	6,190,282	706,410	1,365,401	24,000
2017					
Employment	7, 851	1, 687	2, 771	7, 224	< 500
Total balance sheet assets (thousands of PLN)	7,591,146	4,372,076	2,148,304	1,358,984	152,814
Net revenues from sales (thousands of PLN)	2,667,053	4,797,927	654,505	1,334,710	18,000

Source: authors' own elaboration based on the financial statements of the entities surveyed.

Therefore, each of the surveyed companies, excluding Enter Air, should include a section on environmental information in its management board report.

3.4. Analysis of the selected entities' financial statements

To assess the occurrence of environmental protection matters in the financial reporting of the entities surveyed, particularly with regard to the information on their carbon footprint, financial statements for the year 2018, i.e., the latest financial statements (as of the analysis date) of the entities, were selected for the analysis.

The primary purpose of the audit was to determine whether the audited entities disclose valuable and qualitative environmental information, in particular, information related to the carbon footprint, such as:

- 1) whether the carbon footprint is calculated and disclosed;
- 2) whether information on the value of environmental assets, liabilities, and costs related to the carbon footprint is disclosed (e.g., the costs of development works related to carbon footprint emissions, expenditures aimed at limiting the carbon

footprint emissions, costs of environmental fees, environmental penalties, provisions for environmental liabilities related to carbon footprint, etc.).

The supplementary objective of the audit was to identify those elements of the financial statements in which environmental disclosures occurred.

The subject of the audit was financial statements, i.e., balance sheet, profit and loss account, additional information, and activity reports of the management board. The analysis was conducted in terms of the scope, value, and quality of disclosed environmental information, and it was carried out in the following order:

- 1) in the first step, the balance sheet and profit and loss account were analyzed in terms of separate information on the value of environmental assets, liabilities, and costs associated with the carbon footprint;
- 2) in the next step, additional information to the financial statements was examined in terms of:
 - a) the occurrence of information on the value of environmental assets, liabilities, and costs related to the carbon footprint,
 - b) whether additional information and explanations contain item 2.9 as set out in Annex 1 to the Accounting Act, i.e., incurred in the last year and planned for the next year on non-financial fixed assets (in accordance with the aforementioned point, incurred and planned expenditure on environmental protection should be separately presented) and
- 3) Finally, management board reports were reviewed for environmental information, in particular, information on the carbon footprint.

As a result of the audit financial statements, it was found that:

- 1) based on the analysis of the balance sheets, only the LOT balance sheet contained a separate item, "Carbon Emission Rights", with a value of 5,259 thousands of PLN, found in Part A. Fixed assets, I. Intangible assets (FS LOT, 2018, p. 11). The balance sheets of the remaining companies did not contain any information about environmental assets and environmental liabilities;
- 2) based on an analysis of the profit and loss accounts, the companies did not include any separate items related to environmental costs and fees in their profit and loss accounts;
- 3) based on an analysis of additional information to the financial statements:
 - a) only LOT included information about environmental assets related to the carbon footprint in the additional information and explanations, i.e., changes in the gross value and depreciation of "Carbon Emission Rights" (FS LOT, 2018, p. 28). Other companies did not disclose any information on the value of environmental assets, liabilities, or costs related to the carbon footprint;
 - b) all companies, except for Enter Air, disclosed expenditures on environmental protection incurred in the last year and planned for the next year, which results

from the obligation set out in Article 48 Paragraph 2 of the AA. The amounts of expenditure are presented in Table 4.

Table 4. Incurred and planned outlays on environmental protection of the surveyed entities

Year	PKP Intercity S.A.	Polskie Linie Lotnicze LOT S.A.	Koleje Mazowieckie Sp. z o.o.	POLREGIO Sp. z o.o.
2018	8,710.00 ^a	0.00 ^b	0.00 ^c	--- ^d
2019	672,000.00	0.00	0.00	---

^a FS Intercity (2018, p. 20); ^b FS LOT (2018, p. 40); ^c FS KolMaz (2018, p. 31); ^d Table 3 contains no amounts for POLREGIO Sp. z o.o., as the additional information and explanations to the company's financial statement do not contain separate expenditure on environmental protection – only total expenditure on non-financial fixed assets is given. See FS PolRegio (2018, p. 11).

Source: own elaboration based on the financial statements of the entities surveyed.

Regarding the analysis of management board reports, the situation is slightly different than in the case of the financial statements examined. Following Article 49, Paragraph 3, Point 2 of the Accounting Act, the audited entities should disclose information about the natural environment. Therefore, management board reports were analyzed to see to what extent the companies fulfilled their obligations in this respect. In addition, we verified whether there were any carbon footprint disclosures in the management board reports of the companies.

In four out of the five cases, i.e., PKP Intercity, LOT, Koleje Mazowieckie, and Enter Air, the reports of the management board of contained information on environmental protection. POLREGIO does not provide any information on the environmental issues or carbon footprint associated with its operations.

The management board's report on the activities of PKP Intercity provides the most complete information on environmental protection, including greenhouse gas emissions. To prepare this information, the company applied the GRI Reporting Guidelines, G4.²⁴ According to PKP Intercity, applying these guidelines will enable future data comparison, allow change management, and the possible implementation of recovery programs, which will contribute to the company's sustainable development. Based on the ISO 14064 standard, the abovementioned guidelines specify that calculating an organization's carbon footprint is related to Scope 1 and Scope 2, namely:

²⁴ GRI (Global Reporting Initiative) provides guidelines for sustainable development reporting. They constitute an international benchmark for responsible business reporting and the sustainable development of companies. The Polish version of the G4 Non-Financial Reporting Guidelines can be downloaded from, e.g., the Polish Chamber of Statutory Auditors website <https://www.pibr.org.pl/pl/aktualnosci/263,Polskawersja-wytucznych-raportowania-niefinansowego-G4-juz-dostepna>. See also: (GRI G4a) and (GRI G4b).

- 1) Scope 1 – the need to calculate the amount of greenhouse gas emissions resulting from the combustion of fuels and from the organization’s direct activities; and
- 2) Scope 2 – the greenhouse gas emissions resulting from the use of energy (electricity, heat) supplied by external providers.

In terms of specific data regarding the natural environment, in 2018, information on three important aspects was identified and presented (MBR Intercity, 2018, pp. 98–102), i.e.:

1. Energy – the total energy consumption within the organization amounted to 2,863,047.52 GJ (the indicator used: G4-EN3 - Energy consumption within the organization). The main types of energy used are:
 - a) electricity, 97% of which involves the traction energy consumed for rolling stock operations, while the remaining 3% is the electricity used for real estate purposes;
 - b) the thermal energy from combined heat and power plants, used for central heating systems in buildings;
 - c) the oil fuel used in boilers for central heating systems in buildings;
 - d) the high-methane natural gas used for central heating systems in buildings;
 - e) the fuels used in boilers to heat railway cars, such as light oils and hard coal;
 - f) the fuels used in combustion locomotives, company cars, and other vehicles, as well as the fuels used in the engine equipment owned or managed by the organization, i.e., motor gasoline (also with biocomponents content of up to 10%), liquefied petroleum gas (LPG), diesel fuel.

Traction energy accounted for 86.6% of the total energy consumption and amounted to 2,478,936.04 GJ, although the management board informs that, at the current stage of energy management, the amount of traction electricity consumption is determined via indirect calculations carried out in accordance with the detailed principles set out in the annex to the electricity sales and distribution agreement, using an algorithm adopted by PKP Intercity. Successive equipping of traction vehicles with devices that measure the amount of the energy consumed will make it possible to determine precise quantities desired in the future and to give a more precise estimation of the energy consumed by the company's traction vehicles outside Poland.

2. Greenhouse gas emissions:
 - a) Scope 1 – the total value of direct greenhouse gas emissions amounted to 26,434.19 tons of CO₂ equivalent (the indicator used is G4-EN15 – Direct greenhouse gas emissions);
 - b) Scope 2 – the total value of indirect greenhouse gas emissions was 630,613.67 tons of CO₂ equivalent (the indicator used: G4-EN16 – Indirect greenhouse gas emissions).
3. Compliance with regulations (the following indicator was used: G4-EN29 – Value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations), as the Board informs:
 - a) The Company is fully compliant with laws and regulations, and

- b) The Company has obtained and observes all the administrative decisions, installation notifications, and permits required by law in connection with its operations and its impact on the natural environment.²⁵

The management board reports of other companies did not contain any information on the carbon footprint, although they did contain some information related to environmental protection:

- 1) Koleje Mazowieckie disclosed activities for ecology (MBR KolMaz, 2018, p. 26);
- 2) LOT disclosed costs related to environmental protection and listed types of activities related to environmental protection (MBR LOT, 2018, pp. 6–7);
- 3) the management board of Enter Air described the risks associated with environmental protection in terms of protection against noise and carbon dioxide emissions (MBR Enter, 2018, p. 12);
- 4) as mentioned above, POLREGIO Sp. z o.o. does not provide any information on environmental issues.

Regarding RQ2, it should be stated that the surveyed companies:

- 1) do not disclose almost any environmental information in the financial part of their financial statements (the exception is LOT, but even their information is very poor),
- 2) in the non-financial part of the annual reports analyzed (management board reports), only PKP Intercity disclosed a wider range of information on environmental protection, including information on greenhouse gas emissions. The scope of disclosures of other entities was unsatisfactory.

Conclusion

One of the most important functions of reporting is to provide stakeholders with useful and relevant information for decision-making purposes. In the era of climate change, stakeholders use financial statements expecting specific data on the environmental impact of entities operating in the mass passenger transport sector, allowing them to make decisions in terms of entering into potential relationships with these companies. Knowledge about the impact of operations on the environment is also of great importance for the entities themselves. Periodically measuring the impact they have on the natural environment allows them to take action in subsequent periods to reduce this impact and evaluate their activities.

The following conclusions can be drawn from the research:

1. Existing legal regulations in the field of accounting (Directive 2014/95/EU and the Accounting Act) allow entities that deal with mass passenger transportation to

²⁵ For more detail see MBR Intercity (2018, pp. 98–102).

disclose financial and non-financial information on the impact of their business activities on the natural environment. On the example of the audited entities, it was found that current disclosures in this area are not satisfactory.

2. Financial statements prepared by mass passenger transportation carriers should contain separate items regarding environmental assets, liabilities, and costs, if they represent significant value. Such valuable information helps stakeholders to assess both the impact of their activities on the environment and the actions taken to eliminate any negative impact.
3. It is very important that management board reports prepared by mass passenger transportation carriers include:
 - a) a description of the policy and strategy adopted by the management board in the area of environmental protection and the approach to the carbon footprint. It is particularly important to obtain information on how the companies reduce the negative impact of their activities on the environment,
 - b) information on the amount of carbon emitted with explanations of the methods, principles, and procedures adopted in calculating the carbon footprint, which will allow stakeholders to make comparisons.

Finally, the limitations of the study should be indicated. They include the short study period and the small sample size, which constituted only the five largest entities in the mass transport market in Poland. The research should be repeated, expanding the research sample with new entities and more periods.

References

- Ahmad Y.J., Serafy E.S., Lutz E. (1989), *Environmental accounting for sustainable development*, The World Bank, Washington, DC.
- Antczak J. (2014), *Informacje o środowisku w systemie rachunkowości*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 329, pp. 11–18.
- Bek-Gaik B., Gad J., Walińska E. (2016), *Sprawozdawczość finansowa i niefinansowa przedsiębiorstwa, w kierunku integracji*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.
- Boyd J., Banzhaf S. (2006), *What are ecosystem services? The need for standardized environmental accounting units*, Discussion Paper, RFF DP 06–02, January Resource for the Future, pp. 1–24.
- Cho C.H., Patten D.M. (2013), *Green accounting: Reflection from a CSR and environmental disclosure perspective*, "Critical Perspective on Accounting", 24 (6), p. 443–447.
- Dyduch J. (2016), *Pomiar w rachunkowości finansowej wpływu przedsiębiorstwa na środowisko naturalne*, "Finanse, Rynki Finansowe, Ubezpieczenia", 2 (80/2), pp. 55–63.
- Dyduch J. (2017), *Zmiany poziomu ujawnień środowiskowych informacji finansowych w raportach rocznych wybranych spółek publicznych*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 479, pp. 34–43.
- Dyłał R., Puchalska E. (2014), *Raportowanie zagadnień środowiskowych i społecznych*, "Zeszyty Teoretyczne Rachunkowości", 75 (131), pp. 23–45.
- Fijałkowska J., Krasodomska J., Macuda M., Mućko P. (2019), *Sprawozdawczość niefinansowa. Regulacja i standaryzacja raportowania niefinansowego przedsiębiorstw*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.

- Gray R., Laughlin R. (2012), It was 20 years ago today: Sgt Pepper, Accounting, Auditing & Accountability Journal, green accounting and the Blue Meanies, "Accounting, Auditing & Accountability Journal", 25 (2), p. 228–255.
- Gray R., Bebbington J., Walters D., Thompson I. (1995), The greening of enterprise: an exploration of the (non) role of environmental accounting and environmental accountants in organizational change, "Critical Perspective on Accounting", 6, pp. 211–239.
- Hernadi B.H. (2012), *Green Accounting for Corporate Sustainability*, "Club of Economics in Miskolc", 8 (2), pp. 23–30.
- Hertwich E.G., Peters G.P. (2009), *Carbon Footprint of Nations: A Global, Trade-Linked Analysis*, "Environmental Science & Technology", 43 (16), pp. 6414–6420.
- Hońko S. (2014), Sprawozdanie z działalności jako źródło informacji o oddziaływaniu jednostki na środowisko, "Ekonomia i Środowisko", 3 (50), pp. 144–155.
- IFAC (2005), International Guidance Document. Environmental Management Accounting, International Federation of Accountants, New York.
- ISO 14067:2018, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for qualification, Reference number ISO 14067:2018(E).
- Kołodziejcki H. (2007), *Pojęcie, zakres i zasięg działania transportu miejskiego*, [in:] Wyszomirski O., *Transport miejski. Ekonomia i organizacja*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk.
- Krasodomski J. (2009), *Znaczenie informacji niefinansowych w rocznych raportach spółek*, [in:] Sobańska I., Wnuk-Pel T., *Rachunkowość w procesie tworzenia wartości przedsiębiorstwa*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.
- Krasodomski J. (2010), *Informacje niefinansowe jako element rocznego raportu spółki*, "Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie", 816, pp. 45–57.
- Krasodomski J. (2011), *Komentarz zarządu w świetle wytycznych Rady Międzynarodowych Standardów Rachunkowości*, "Zeszyty Teoretyczne Rachunkowości", 75 (131), pp. 89–106.
- Krasodomski J. (2014), *Informacje niefinansowe w sprawozdawczości spółek*, Uniwersytet Ekonomiczny w Krakowie.
- Krasodomski J. (2017), *Raportowanie informacji niefinansowych w świetle procesów konsultacyjnych*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 479pp. 99–107.
- Kryk B. (2014), *Narzędzia rachunkowości zarządczej w pomiarze/ocenie działalności ekologicznej przedsiębiorstw*, "Optimum. Studia Ekonomiczne", 3 (69), pp. 69–86.
- Kryk B. (2017), *Informacje środowiskowe w sprawozdaniu z działalności*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 479, pp. 108–117.
- KSR No. 9 (2017), *Krajowy Standard Rachunkowości nr 9. Sprawozdanie z działalności (National Accounting Standard 9)*, Annex to Resolution No. 22/2017 Accounting Standards Committee of 19 December 2017 (Journal of Laws 2018, item 17).
- Kulczycka J., Wernicka M. (2015a), *Metody i wyniki obliczania śladu węglowego działalności wybranych podmiotów branży energetycznej i wydobywczej*, "Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk", nr 18, pp. 133–142.
- Kulczycka J., Wernicka M. (2015b), *Zarządzanie śladem węglowym w przedsiębiorstwach sektora energetycznego w Polsce – bariery i korzyści*, "Polityka energetyczna – Energy Policy Journal", 18 (2), pp. 61–72.
- Lehman G. (1999), *Disclosing new worlds: a role for social and environmental accounting and auditing*, "Accounting, Organisations and Society", 24, pp. 217–241.
- Lohmann L. (2009), *Toward a different debate in environmental accounting: The case of carbon and cost benefit*, "Accounting, Organizations and Society", 34, pp. 499–534.
- Łasut P., Kulczycka J. (2014), *Metody i programy obliczające ślad węglowy*, "Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk", 87, pp. 137–146.
- Macuda M. (2015), *Rachunkowość odpowiedzialności społecznej – raportowanie zagadnień środowiskowych*, "Studia Oeconomica Posnaniensia", 3 (1), pp. 97–111.

- Macuda M., Matuszak Ł., Różańska E. (2015), *The concept of CSR in accounting theory and practice in Poland: an empirical study*, "Zeszyty Teoretyczne Rachunkowości", 84 (140), pp. 115–137.
- Majchrzak I. (2018), *Wykorzystanie instrumentów rachunkowości na potrzeby zarządzania kosztami ochrony środowiska*, "Rynki Finansowe. Ubezpieczenia", 4 (94/1), pp. 231–241.
- Matthews S.H., Hendrickson C.T., Weber C.L. (2008), *The importance of carbon footprint estimation Boundaries*, "Environmental Science & Technology", 42 (16), pp. 5839–5842.
- Moorthy K., Yacob P. (2013), *Green Accounting: Cost Measures*, "Open Journal of Accounting", 2, pp. 4–7.
- Mućko P., Hońko S. (2013), *Sprawozdanie z działalności – raport z pogranicza rachunkowości*, "Rachunkowość", 10, pp. 2–13.
- Pandey D., Agrawal M., Pandey J.S. (2011), *Carbon footprint: current methods of estimation*, "Environmental Monitoring and Assessment", July, pp. 135–160.
- Patel J. (2006), *Green sky thinking*, "Environment Business", 122, p. 32.
- Pramanik A.K., Shil N.Ch., Das B. (2007), *Environmental accounting and reporting with special reference to India*, "The Cost and Management", 3, pp.16–28.
- Reizinger-Ducsai A. (2018), *Accounting for Sustainability and Social Responsibility*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 515pp. 185–196.
- Schaltegger S., Burritt R. (2000), *Contemporary Environmental Accounting. Issues, Concepts and Practice*, Greenleaf Publishing Ltd., Sheffield.
- Sobczyk M. (2012), *Zintegrowane raportowanie – nowy model raportowania biznesowego*, "Przedsiębiorczość i Zarządzanie", XIII (1), pp. 155–170.
- Sojak S. (2011), *Rachunkowość przymiotnikowa*, "Zeszyty Teoretyczne Rachunkowości", 62 (118), pp. 265–288.
- Steurer R. (2010), *The role of governments in Corporate Social Responsibility: characterizing public policies on CSR in Europe*, Discussion Paper 2–2010, Institute of Forest, Environmental and Natural Resource Policy, Vienna.
- Stępień M. (2002), *Rachunkowość a ochrona środowiska*, "Zeszyty Naukowe Akademii Ekonomicznej w Krakowie", 565pp. 53–68.
- Stępień M. (2008), *Problemy ewidencji ochrony środowiska w rachunkowości jednostki gospodarczej*, "Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie", 785, pp. 157–173.
- Stępień M., Pramanik A.K. (2006), *Sprawozdawczość środowiskowa – przegląd rozwiązań w różnych krajach*, "Zeszyty Naukowe Akademii Ekonomicznej w Krakowie", 702 pp. 93–114.
- Szadziewska A. (2013), *Sprawozdawcze i zarządcze aspekty rachunkowości środowiskowej*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk.
- Szadziewska A., Spigarska E., Majerowska E. (2018), *The disclosure of non-financial information by stock-exchange-listed companies in Poland, in the light of the changes introduced by the Directive 2014/95/EU*, "Zeszyty Teoretyczne Rachunkowości", 99 (155) pp. 65–95.
- Thornton D.B. (2013), *Green accounting and green eyeshades twenty years later*, "Critical Perspective on Accounting", 24, pp. 438–442.
- Walińska E. (2015), *Zintegrowany raport – początek końca sprawozdania finansowego?*, "Zeszyty Teoretyczne Rachunkowości", 82 (138), pp. 151–165.
- Wiedmann T., Minx J. (2007), *A definition of 'carbon footprint'*, ISA^{UK} Research Report 07–01, Durham.
- Wiszniewski E. (2011), *Rachunkowość finansowa a ekologia*, "Ekonomia. Economic", 5 (17), pp. 391–404.
- Wojciechowska A. (2009), *Rachunek kosztów ochrony środowiska w zarządzaniu przedsiębiorstwem produkcyjnym* (rozprawa doktorska), Uniwersytet Ekonomiczny w Poznaniu, Poznań.
- Wydmus Z., Stępień M. (2007), *Rola rachunkowości w kształtowaniu społecznej odpowiedzialności jednostki gospodarczej*, "Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie", 750, pp. 79–99.
- Yakhou M., Dorweiler V.P. (2004), *Environmental accounting: an essential component of business strategy*, "Business Strategy and the Environment", 13, pp.65–77.
- Zrnica A., Starcevic D.P., Mijic I. (2020), *Evaluating environmental accounting and reporting: the case of Croatian listed manufacturing companies*, "Pravni Vjesnik God", 36 (1), pp. 47–63.

Legal regulation

- Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003 amending Directives 78/660/EEC, 83/349/EEC, 86/635/EEC and 91/674/EEC on the annual and consolidated accounts of certain types of companies, banks and other financial institutions and insurance undertakings (L 178/16, 17.7.2003).
- Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings, amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 83/349/EEC (L 182/19, 29.6.2013).
- Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups (L 330/1, 15.11.2014).
- Ustawa z dnia 29 września 1994 r. o rachunkowości, Dz.U. 2019.351 [Act of 29 September 1994 on Accounting, Journal of Laws 2019.351].
- Ustawa z dnia 27 kwietnia 2001 r. *Prawo ochrony środowiska*, Dz.U. 2019.1396 [Act of 27 April 2001, *Environmental Protection Law*, Journal of Laws 2019.1396].
- Ustawa z dnia 16 grudnia 2010 r. o publicznym transporcie zbiorowym, Dz.U. 2019, nr 5 poz. 13 [Act of 16 December 2010 on Collective Public Transport, Journal of Laws 2019, no. 5 item 13].
- Ustawa z dnia 11 maja 2017 r. o biegłych rewidentach, firmach audytorskich i nadzorze publicznym, Dz.U. 2017.1089 [Act of 11 May 2017 on Statutory Auditors, Audit Firms and Public Supervision, Journal of Laws 2017.1089].

Internet sources

- Carbon Trust, taken from: <https://www.carbontrust.com/resources/carbon-footprinting-guide> (access 30.04.2020).
- Czuma B. (2019), *Posel elekt Franciszek Sterczewski zamiast samolotu wybral pociag*, <https://wiadomosci.wp.pl/posel-elekt-franciszek-sterczewski-zamiast-samolotu-wybral-pociag-imponuje-mi-greta-thunberg-6436158134061185a> (access 20.10.2019).
- FS Enter (2018), *Sprawozdanie finansowe za rok 2018. Enter Air S.A.*, <https://www.pibr.org.pl/pl/aktualnosci/263,Polska-wersja-wytycznych-raportowania-niefinansowego-G4-juz-dostepna> (access 30.04.2020).
- FS Intercity (2018), *Sprawozdanie finansowe za rok 2018. PKP Intercity S.A.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- FS KolMaz (2018), *Sprawozdanie finansowe za rok 2018. Koleje Mazowieckie Sp. z o.o.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- FS LOT (2018), *Sprawozdanie finansowe za rok 2018. Polskie Linie Lotnicze LOT S.A.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- FS PolRegio (2018), *Sprawozdanie finansowe za rok 2018. Przewozy Regionalne Sp. z o.o.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- GRI G4a, *Wytyczne dotyczące raportowania G4 – Podręcznik stosowania wytycznych*, <http://odpowiedzialnybiznes.pl/wp-content/uploads/2016/06/Polish-G4-Part-Two-1.pdf> (access 30.04.2020)
- GRI G4b, *Wytyczne dotyczące raportowania G4 – Zasady raportowania i wskaźniki*, <http://odpowiedzialnybiznes.pl/wp-content/uploads/2016/06/Polish-G4-Part-Two-1.pdf> (access 30.04.2020)
- Koleje Mazowieckie Sp. z o.o., <https://www.mazowieckie.com.pl/pl/o-nas> (access 10.01.2020).
- MBR Enter (2018), *Sprawozdanie z działalności zarządu za rok 2018. Enter Air S.A.*, <https://www.pibr.org.pl/pl/aktualnosci/263,Polska-wersja-wytycznych-raportowania-niefinansowego-G4-juz-dostepna> (access 30.04.2020).
- MBR Intercity (2018), *Sprawozdanie z działalności zarządu za rok 2018. PKP Intercity S.A.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).

-
- MBR KolMaz (2018), *Sprawozdanie z działalności zarządu za rok 2018. Koleje Mazowieckie Sp. z o.o.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- MBR LOT (2018), *Sprawozdanie z działalności zarządu za rok 2018. Polskie Linie Lotnicze LOT S.A.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- MBR PolRegio (2018), *Sprawozdanie z działalności zarządu za rok 2018. Przewozy Regionalne Sp. z o.o.*, <https://ekrs.ms.gov.pl/web/wyszukiwarka-krs/strona-glowna/index.html> (access 18.01.2020).
- PKP Intercity, <https://www.intercity.pl/pl/site/o-nas/o-firmie/> (access 10.01.2020)
- Wieczorek A. (2015), *Policzmy swój ślad, czyli w jaki sposób podróżować*, <https://post-turysta.pl/arttykul/policzmy-swoj-slada> (access 11.12.2019).