

SUSTAINABLE DEVELOPMENT ACTIVITIES IN CHEMICAL COMPANIES IN POLAND: LINKS BETWEEN SDGs AND ESG

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Purpose: The main aim of the article is to explore sustainable development activities undertaken by the chemical companies in Poland. Three research objectives were established: (1) identification of key Sustainable Development Goals (SDGs) for chemical companies, (2) identification of activities related to each of the three ESG (Environmental, Social, Governance) elements in chemical companies, and (3) linking specific SDGs and ESG elements in the case of the chemical industry.

Design/methodology/approach: To achieve the aim of the article, the content analysis was used. Documents of chemical companies regarding sustainable development were analyzed, i.e. strategies, policies and reports.

Findings: Firstly, the analysis of strategies and policies allowed to identify 13 key SDGs for the Polish chemical companies. Secondly, analysis of the reports, allowed the discovery of numerous activities of the chemical companies in the environmental, social and governance areas. Finally, the links between specific SDGs and ESG elements in the chemical sector were presented.

Practical implications: The paper contributes to the better understanding of the chemical companies' sustainable development activities. In terms of practical implications, the results could guide chemical companies in the development of their ESG strategies.

Originality/value: The review of the literature has shown that problems such as SDGs and ESG in the context of the chemical industry have rarely been addressed so far. The links between SDGs and ESG in the chemical industry have also not been studied. To the best knowledge of the author, this is one of the first known studies to investigate the SDGs and ESG issues in chemical companies in Poland. The article is intended for researchers and practitioners interested in the sustainable development issues.

Keywords: Chemical industry, ESG, SDGs, Sustainable development, Sustainable development goals.

Category of the paper: Research paper.

1. Introduction

The issues of sustainable development are becoming more and more popular among researchers and since 2015 this process has intensified (Allen et al., 2016; Sarangi, 2017; Sullivan et al., 2018; Mio et al., 2020; Krasodomska et al., 2022; Budzanowska-Drzewiecka et al., 2023). This is due to the adoption of the 2030 Agenda for Sustainable Development by the United Nations (United Nations, 2015), including a declaration of 17 Sustainable Development Goals (SDGs). Topics related to the SDGs discussed in the literature of management most often cover the role of specific organizations and sectors in taking action to implement SDGs and the incorporation of SDGs into business strategies (Krasodomska et al., 2022). However, some scholars admit that the ways in which SDGs can be integrated into business strategies remains an unsolved problem (Berrone et al., 2023).

Sustainable development aspects in managing organizations are not only about incorporating SDGs into the business strategies, CSR strategies or ESG (Environmental, Social, Governance) strategies. Sustainable development calls for financial discipline and greater transparency (PwC, 2022). The response to this requirement manifests itself in the disclosure of sustainable development information in various types of reports (e.g. integrated reports, non-financial reports). Interestingly, the first separate environmental reports were published in 1989 (Kolk, 2004). Then, the number of organizations that publish sustainability reports have been increasing significantly (Kolk, 2004). In 2021, 96% of the S&P 500 companies, published a sustainability report (G&A, 2022). Since 2006, when the framework of ESG was integrated by the United Nations into the Principles for Responsible Investment, ESG became a hot topic in academia and practice (Lee et al., 2022; Tylec, 2022; Zyznarska-Dworczak, 2022; Yu, Xiao, 2022; Wang et al., 2023). This is due to e.g. growing regulatory and market pressure, ownership requirements and the possibility of obtaining financing.

The chemical industry plays a key role in the implementation of the ESG concept and the 17 SDGs. The chemical industry is very diverse and has a significant impact on the global economy, the environment, and society. It provides products and materials that are the basis for production processes in almost all industries. Moreover it is a source of fuel, enabling the functioning of the transport sector. Thousands of substances that are present in countless chemicals play a fundamental role in everyday people's lives. Among them, there are consumer goods and chemicals which contribute to water and food security and help protect health. However, some substances that can cause adverse effects. Additionally, production plants are often perceived as places that harm environment and emit dangerous substances. To change these negative chemical industry perceptions, companies are engaging in environmental issues. In particular, some enterprises belonging to environmentally sensitive industries, such as the oil industry, present sustainable development activities information more often than other organizations, mainly in order to legitimize their activities and neutralize the stigma of

poisoners (Tylec, 2022). Notwithstanding, it is to be hoped that the true motivation of chemical companies is the pursuit of sustainable development which “meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987, p. 16).

Although the issue of sustainable development in the context of the chemical industry has been and is taken up by researchers (Beloff et al., 2005; Jianchun et al., 2011; Mitra et al., 2015; Chen, Reniers, 2020; Kostal et al., 2022), topics such as SDGs and ESG have so far been rarely addressed (e.g. Pan Fagerlin et al., 2019; Nechita et al., 2020). Since there are limited studies that focus on SDGs and ESG in the chemical industry, this paper fills the gap. Therefore, the main aim of this article is to explore sustainable development activities undertaken by the chemical companies in Poland. Three research objectives were established: (1) identification of key SDGs for chemical companies, (2) identification of activities related to each of the three ESG elements in chemical companies, and (3) linking specific SDGs and ESG elements in the case of the chemical industry. To achieve the goal, the content analysis was used. Documents of chemical companies in Poland regarding sustainable development were analyzed.

The article consists of five parts. Firstly, the main findings of the literature review on incorporating SDGs and ESG into business strategies and reports are presented. Secondly, the research method is explained. The results of the study are summarized in the following section. The article ends with the discussion and summary.

2. Incorporating SDGs and ESG into business strategies and reports

Sustainability is often understood as a long-term goal, while sustainable development refers to the many activities to achieve it. To create a more sustainable world, Sustainable Development Goals, which describe major development challenges for humanity, are to be reached. The 2030 Agenda for Sustainable Development includes a declaration of 17 SDGs and 169 targets, along with monitoring and review measures. SDGs were designed to eliminate poverty, preserve the planet and ensure prosperity. They address for a collective action to achieve more sustainable future for all, solving the social, economic, and environmental issues that hinder global progress towards sustainability (United Nations, 2015). The 17 SDGs are (United Nations, 2015, p. 14):

“Goal 1. End poverty in all its forms everywhere.

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Goal 3. Ensure healthy lives and promote well-being for all at all ages.

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

- Goal 5. Achieve gender equality and empower all women and girls.
- Goal 6. Ensure availability and sustainable management of water and sanitation for all.
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Goal 10. Reduce inequality within and among countries.
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.
- Goal 12. Ensure sustainable consumption and production patterns.
- Goal 13. Take urgent action to combat climate change and its impacts.
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
- Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development”.

SDGs are “integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities” (United Nations, 2015, p. 13). Additionally, SDGs are interrelated (Fonseca et al., 2020). All countries have committed to SDGs, but each sets its own national targets, taking into account national circumstances. However, governments of both developed and developing countries do not have the resources to ensure the implementation of all actions necessary to achieve SDGs (Sullivan et al., 2018). On the one hand, Sullivan et al. (2018) point out that the private sector will play the first fiddle in actions for sustainable development. On the other hand, the management literature does not provide a full answer to the question of to what extent enterprises contribute to sustainable development (van der Waal et al., 2021). What can be observed, is the trend of enterprises including SDGs in their business strategies and informing about completed activities related to these goals in their sustainability reports.

Incorporating sustainability into an organization’s strategy is not an easy task. One may come up with an endless list of environmental, economic, and societal needs that should be addressed. Depending on the sector in which the company operates, specific SDGs will be more or less important. This is why organizations set priorities due to their business activities. Mhlanga et al. (2018) show that there are industries where a direct link between a particular

SDG and the specific products and services offered by the enterprise within the sector can be easily identified. For example, this connection manifests itself as follows: food companies and SDG 2 Zero hunger, pharmaceutical companies and SDG 3 Good health and well-being, or energy companies and SDG 7 Affordable and clean energy. Some enterprises prioritize several SDGs in their strategies. Others have either decided to engage with most of SDGs or do not provide any information about priority SDGs at all (Mhlanga et al., 2018). Mhlanga et al.'s (2018) studies have proven that there is a lack of consistency in how specific organizations determine which SDGs are key ones, as well as there is limited sector-level consistency.

Organizations disclose information on their sustainable development activities in relation to SDGs in their reports. Among the reasons that lead them to do so, there are engagement in social and environmental issues, the use of Global Reporting Initiative (GRI) standards and the requirements of stakeholders (Krasodomska et al., 2022). Calvo-Centeno et al. (2022) shows that the enterprises incorporated an average of ten SDGs in their 2019 reports. Wherein the largest number of entities took into account four goals, i.e. SDG 8 Decent work and economic growth, SDG 13 Climate action, SDG 4 Quality education and SDG 9 Industry, innovation and infrastructure. The companies studied were the least likely to refer to the goals: 14 Life below water and 2 Zero hunger (Calvo-Centeno et al., 2022).

In addition to the fact, that organizations in their strategic documents and sustainability reports refer to SDGs, they also relate to three elements of ESG. This is reflected in management literature, however mainly in the context of reporting (e.g. Tylec, 2022; Zyznarska-Dworczak, 2022; Yu, Xiao, 2022). ESG elements in development strategies are rarely the subject of research (e.g. Cho, 2022). Cho (2022) notices that the primary drivers for companies to adopt the concept of ESG at the strategic level are probably the following: interest in social contribution, government policies and the belief that ESG activities will have a positive impact on the company's performance. She determined that ESG strategies have a positive effect on enterprise value (Cho, 2022).

ESG is a framework made up of factors that should be taken into account in the organization's activities in the field of environmental, social and corporate governance. Tylec (2022), after analyzing the meanings attributed to the three ESG elements in the literature on this subject, summed them up accurately. Namely, the "E" stands for striving to care for the environment and responsible use of natural resources. "S" is referred to as the concept of corporate social responsibility, which is an obligation of the organization to be consistent with the objectives and values of the society. The "G" element includes the structure of the organization and its management, taking into account the requirements of stakeholders (Tylec, 2022).

The concept of ESG is becoming more and more important to organizations. This is due to the market pressure, regulatory pressure (e.g. The Corporate Sustainability Reporting Directive that has entered into force on 5 January 2023 in the EU), ownership requirements and the possibility of obtaining financing. Especially the latter premise is valid, as investors and rating

agencies expect greater visibility of non-financial metrics to better understand diverse environmental, social and governance risks. Non-financial information can contribute to a true reflection on the sustainable development activities of the organizations (Calvo-Centeneo, 2022).

The mentioned Corporate Sustainability Reporting Directive (CSRD) (Directive (EU) 2022/2464) obliges large companies, as well as listed small and medium enterprises, to report on sustainability, in accordance with the proposed reporting standards. These standards ensure that investors and other stakeholders have access to the information to assess investment risks arising from environmental, social and governance issues. The sustainability reporting standards specify the information that organizations are to disclose regarding to three groups of factors (Directive (EU) 2022/2464):

- environmental factors: (1) climate change mitigation; (2) climate change adaptation; (3) water and marine resources; (4) resource use and the circular economy; (5) pollution; (6) biodiversity and ecosystems,
- social factors: (7) equal treatment and opportunities for all; (8) working conditions; (9) respect for the human rights, (10) fundamental freedoms, democratic principles and standards,
- governance factors: (11) the role of the organization's bodies with regard to sustainability matters, and their composition; the main features of the organization's internal control and risk management systems; (12) business ethics; (13) activities related to exerting its political influence; (14) the management and quality of relationships with stakeholders.

The above 14 ESG factors largely overlap with the SDGs. Both SDGs and ESG are concepts for resolving environmental and social problems to achieve a more sustainable world. The difference between them is that SDGs are more general as they apply to all countries, although the burden of implementing them rests with enterprises. Whereas, ESG framework concerns companies and how they communicate activities undertaken in the areas of environmental, social and governance. Interestingly, the pressure from the United Nations to overlay ESG data with SDGs is noticed.

An attempt to link specific SDGs with the economic, social and ecological aspects was made by Rockström and Sukhdev (2016). On the one hand, Rockström and Sukhdev have assigned specific SDGs to one of the three areas. The ecological area (biosphere) includes SDG 6 Clean water and sanitation, SDG 13 Climate action, SDG 14 Life below water and SDG 15 Life on land. Society area involves SDGs numbered 1 No poverty, 2 Zero hunger, 3 Good health and well-being, 4 Quality education, 5 Gender equality, 7 Affordable and clean energy, 11 Sustainable cities and communities and 16 Peace, justice and strong institutions. In turn SDGs numbered 8 Decent work and economic growth, 9 Industry, innovation and infrastructure, 10 Reduced inequalities and 12 Responsible consumption and production are associated with the area of economy. On the other hand, the vision of Rockström and Sukhdev

is a move away from the sectorial approach where social, economic, and ecological development are seen as separate parts, as SDG 17 Partnerships for the goals pervades these three areas.

To sum up, the review of the literature shows that both SDGs and ESG framework are becoming more and more important for organizations. They are incorporating SDGs and ESG into strategies and then strive to achieve them. Subsequently, the activities implemented in the field of sustainable development are disclosed in reports. In this way, organizations contribute to sustainable development in the economic, social and environmental fields.

3. Method

The review of the literature shows that problems such as SDGs and ESG in the context of the chemical industry have rarely been addressed so far. To the best knowledge of the author, the links between SDGs and ESG in the chemical industry have also not been studied. This research gap encouraged the author to pose three research questions:

RQ1: Which of the 17 SDGs are crucial for companies in the chemical sector?

RQ2: What activities are carried out within each of the three ESG elements in companies in the chemical sector?

RQ3: How are specific SDGs linked to ESG elements in the case of the chemical industry?

To answer the above questions, the content analysis was used. The content of the various documents on sustainable development as well as the websites of entities operating in the chemical sector in Poland were analyzed, as of January 2023.

The Polish chemical industry has a rich past. Its history goes back to the 19th century, when Łukasiewicz, a pioneer of the oil industry processed crude oil and used it on a massive scale. The chemical industry occupies one of the key positions among the sectors of the economy in Poland. It consists of four areas: (1) bulk chemistry (mass chemistry, high-volume chemicals), (2) chemical processing, (3) fuels and refined petroleum products, and (4) low-tonnage chemistry (PCCI, 2022). In 2021, its input in industrial production was valued at approximately PLN 341.3 billion, which was 16.9% of the Polish industrial production sold. It was the third largest industrial sector in Poland in terms of employment, creating an average of 335,000 jobs, which is 12% of total employment in the Polish industry. Furthermore, 13 thousand chemical companies operated in Poland (PCCI, 2022). Among them there are entities of various sizes and specializations, from large integrated chemical groups to medium and small chemical processing plants. For example, the segment of fuels and refined petroleum products is dominated by PKN ORLEN S.A. Other largest entities producing mainly high-volume chemicals are the AZOTY Group, the CIECH Group, SYNTHOS S.A. and PCC ROKITA S.A.

The first step in the research procedure was to select the cases for analysis. A list of members of the Polish Chamber of Chemical Industry (PCCI) was used for this purpose. This choice is justified by the fact that it is the only organization in Poland representing the chemical industry in public administration bodies and international organizations. To select chemical companies, the range of activities of all 148 organizations belonging to the PCCI was considered. Among the PCCI's members, there are chemical producers, consulting agencies, law firms, industrial installation and construction companies, scientific institutes, representative offices of foreign companies, transport and distribution companies, and a few NGOs (Figure 1).

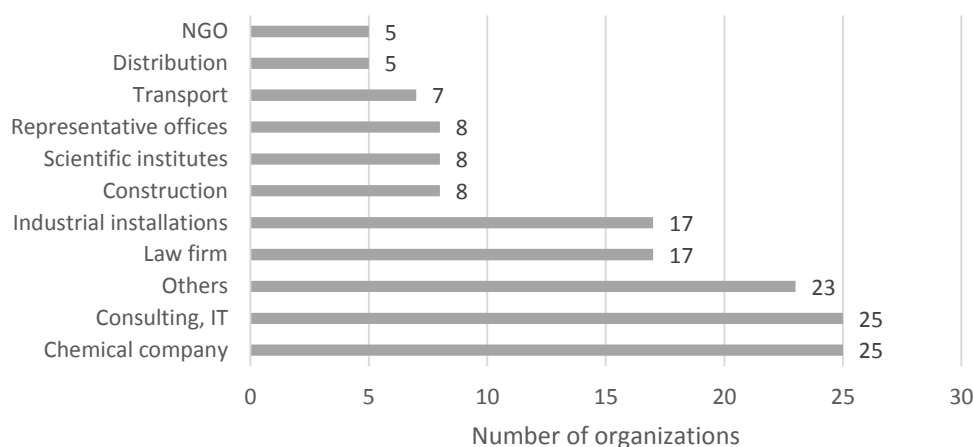


Figure 1. Types of organizations of the PCCI members, as of 15 February 2023.

Source: own study based on: Polska Izba Przemysłu Chemicznego. Retrieved from: <https://pipc.org.pl/czlonkowie/>, 15.02.2023.

As a result of recognizing the activity profile of the PCCI members, 25 chemical companies were identified, which are cases for further research. This group includes entities from all areas of the chemical industry, and most of them represent mass chemistry.

In the next stage of the study, the text material was selected. Available on 25 chemical companies' websites, documents were searched. These were all documents related to sustainable development and general documents, which contain issues related to sustainable development in the separate sections (Table 1).

Table 1.

Types of sustainable development documents in the analyzed chemical companies

Name of the company	Name of the group	Name of the document (valid for january 2023)
CIECH S.A.	CIECH Group	ESG Strategy, Annual Non-Financial Report 2021
GRUPA AZOTY S.A.	AZOTY Group	ESG Strategy (part of the GRUPA AZOTY Strategy for 2021-2030), CSR Policy, GRUPA AZOTY's integrated report for 2021
GRUPA AZOTY Zakłady Azotowe „PUŁAWY” S.A.		
GRUPA AZOTY Zakłady Azotowe Kędzierzyn S.A.		
GRUPA AZOTY Zakłady Chemiczne „POLICE” S.A.		

Cont. table 1.

ANWIL S.A.	ORLEN Group	Strategy of the ORLEN Group until 2030, ORLEN Group Sustainable Development Strategy for 2021-2023, Report on Non-Financial Information of the ORLEN Group and PKN ORLEN S.A. for 2021
ORLEN Południe S.A.		
PKN ORLEN S.A.		
BASF Polska Sp. z o.o.	Not applicable	Integrated Policy
PCC ROKITA S.A.	Not applicable	Diversity Policy, Sustainable Purchasing Policy, Environmental Policy, CSR and Sustainable Development Policy
PETROCHEMIA-BLACHOWNIA S.A.	Not applicable	Integrated Management System Policy, Environmental and Health and Safety Report
SYNTHOS S.A.	Not applicable	CSR Strategy

Note. BASF Polska Sp. z o.o. belongs to BASF Group, however, due to the adopted limitation to the Polish chemical industry, BASF Group documents were not analyzed.

Source: own study based on the websites of the analyzed chemical companies.

Table 2 presents only the most important and selected documents related to sustainable development. For example, the ORLEN Group also has the following documents in place: Charity Policy, Purchasing Instructions, Code of Conduct for Suppliers, Anti-Corruption Policy, Diversity Policy, Principles of Accepting and Giving Gifts, Integrated Management System Policy, Code of Ethics, Remuneration Policy for Members of the Management and Supervisory Boards, Age Management Policy, Wellbeing Policy, Energy Policy, Enterprise Risk Management Policy and Procedure, Anti-Corruption Policy, that do not appear in the above Table. Table 1 also does not include the names of the 13 companies (out of 25) that did not publish information on sustainable development activities on their websites at all, or provided only partial descriptions of these activities, without publishing documents.

In the case of companies belonging to the group, documents prepared for the group were analyzed. As a result, documents of seven entities were submitted for further analysis. The cases for analysis were: CIECH Group, AZOTY Group, ORLEN Group, BASF Polska Sp. z o.o., PCC ROKITA S.A., PETROCHEMIA-BLACHOWNIA S.A. and SYNTHOS S.A. Taking into account the types of published documents, the entities under study were divided into two groups: (1) large integrated chemical groups that publish both strategic documents and reports (hereinafter referred to as integrated groups) and (2) other chemical companies (hereinafter referred to as other companies), which provide one of the documents: strategy or report, as well as other documents such as policies.

Then, as part of operationalization, textual units of analysis were established. In this study, the content of complete documents concerning sustainable development was the topic of discussion and the selected phrases regarding sustainable development in general documents. Code categories were also adopted, namely 17 SDGs and ESG elements with its 14 factors.

4. Results

4.1. Key SDGs for the chemical companies in Poland

The first research question concerned key SDGs for chemical enterprises. The 2030 Agenda for Sustainable Development (United Nations, 2015), shows that all goals have the same importance in the pursuit of sustainable development. However, specific organizations adopt in their strategies selected SDGs that are closest to the profile of their business activities. Since the chemical sector is one of the most diversified and complex of all industries, large integrated chemical groups often contribute to all SDGs. For example, due to the wide scope of multi-utility ORLEN Group's activities, mainly in the area of energy and fuel, all 17 SDGs are being supported (ORLEN Group Sustainable Development Strategy for 2021-2023, 2021), but a particular emphasis is on key goals for the fuel and energy industry.

To identify the key SDGs for the chemical industry, the strategic documents of seven chemical entities were examined, namely business strategies, CSR strategies, ESG strategies and, where strategies were unavailable, other relevant documents, as policies. It was assumed that the key SDGs are those that have been referred to directly or indirectly in the strategies and policies of the companies under study. As a result of the analyzes carried out, it was observed that in the documents of integrated groups there are direct references to key SDGs. While other companies indirectly refer to the SDGs. They present the plans for sustainable development activities, which comply with the description of the specific SDGs, but they do not indicate them. For other companies, the key SDGs were identified based on the content analysis applied to the accessible documents (Table 2).

Table 2.

Key SDGs in the analyzed documents of the chemical companies

COMPANY NAME SDGS	CIECH	AZOTY	ORLEN	BASF	ROKITA	PETRO	SYNTHOS	TOTAL
SDG 1								0
SDG 2	✓	✓						2
SDG 3	✓		✓	✓				3
SDG 4	✓	✓		✓				3
SDG 5	✓			✓				2
SDG 6	✓	✓						2
SDG 7	✓		✓				✓	3
SDG 8	✓	✓			✓		✓	4
SDG 9	✓	✓	✓				✓	4
SDG 10								0
SDG 11	✓		✓					2

Cont. table 2.

SDG 12	✓	✓	✓	✓	✓	✓	✓	7
SDG 13	✓	✓	✓				✓	4
SDG 14								0
SDG 15	✓							1
SDG 16								0
SDG 17	✓				✓		✓	3
TOTAL	13	7	6	4	3	1	6	40

Note. Abbreviations used in the table: CIECH = CIECH Group, AZOTY = AZOTY Group, ORLEN = ORLEN Group, BASF = BASF Polska Sp. z o.o., ROKITA = PCC ROKITA S.A., PETRO = PETROCHEMIA-BLACHOWNIA S.A., SYNTHOS = SYNTHOS S.A.

✓ means that, in the entity's document, there is a direct reference to SDG or there is an indirect reference to SDG (the general notation refers to a specific SDG).

Source: own study based on the documents of the analyzed chemical companies.

The analysis of strategies and policies of the chemical companies allowed to identify 13 key SDGs. All seven studied entities considered SDG 12 Responsible consumption and production, therefore the SDG 12 seems to be the most important for the chemical industry.

Integrated groups contribute to SDG 12 Responsible consumption and production by planning numerous activities in their strategies. In the responsible consumption category, the AZOTY Group's priorities refer to reduction of coal consumption and to incorporating gas-fired sources into the energy mix. The CIECH Group declares using less raw materials. The AZOTY Group and the CIECH Group will use less energy per unit of production. The ORLEN Group plans significant pro-ecological investments and using hydrogen technologies in transport and hydrogen-based energy consumption. It is also important for the integrated groups to consider responsible production. For example, the AZOTY Group's intends to recover waste energy from chemical processes and to implement recycling technology in production. Its priorities refer to decarbonization of production and to the reduction in CO₂ emissions. The CIECH Group declares reducing waste in production processes. The ORLEN Group's strategy incorporates a commitment to CO₂ reduction targets, less emissions from its existing refining and petrochemical assets and basing power generation business mainly on renewables and gas-fired sources.

Other companies also refer to SDG 12 Responsible consumption and production, but indirectly. Planned contribution of SYNTHOS S.A. to responsible consumption consists in using ecological and carbon-free energy sources. All examined companies, i.e. BASF Polska Sp. z o.o., PCC ROKITA S.A., PETROCHEMIA-BLACHOWNIA S.A. and SYNTHOS S.A., present the aims in the responsible production category. They all anticipate reduction of: waste, wastewater, CO₂ emissions and pollutants. Some of the companies foresee monitoring of the carbon footprint. Additionally, BASF Polska Sp. z o. o. intends to improve the energy result and implement sustainable energy management.

Taking into account the frequency of indicated SDGs, mention should be made of SDG 8 Decent work and economic growth, SDG 9 Industry, innovation and infrastructure and SDG 13 Climate action, which were indicated four times each. Interestingly, no references to

SDG 1 No poverty, SDG 10 Reduced inequalities, SDG 14 Life below water and 16 Peace, justice and strong institutions were found in the analyzed documents.

The analysis also shows that the entity that mentions the most key SDGs in its strategy, as many as 13, is the CIECH Group. The presence of so many SDGs in the CIECH Group's ESG Strategy is probably due to the wide range of products offered, that is: soda ash, baking soda, salt, polyester and epoxy resins, crop protection products, glass products, silicates and other chemicals (CIECH Group). These products are used in the production of countless articles necessary in the everyday life of people, hence the CIECH Group contributes to many SDGs. Indirect reference to only one SDG is included in the Integrated Management System Policy of the PETROCHEMIA-BLACHOWNIA S.A. It may result from a narrow range of products compared to other enterprises.

4.2. ESG activities of the Polish chemical companies

The second research question involved the activities carried out within each of the three ESG elements in the chemical companies. To identify these activities, various reports of the chemical entities were investigated. In the case of the integrated groups, these were integrated reports and non-financial reports. These documents contain sections in which environmental, social and governance activities are presented directly. In the case of the other companies, only one enterprise posted a report on the website, i.e. PETROCHEMIA-BLACHOWNIA S.A. posted the Environmental and Health and Safety Report. In the process of analyzing reports, categories of ESG factors compatible with the sustainability reporting standards were applied (Directive (EU) 2022/2464) (Table 3).

Table 3.

ESG activities in the analyzed documents of the chemical companies

COMPANY NAME		CIECH	AZOTY	ORLEN	PETRO
ESG FACTORS					
Environmental factors	1. Climate change mitigation	✓	✓	✓	✓
	2. Climate change adaptation	✓	✓	✓	
	3. Water resources	✓	✓	✓	✓
	4. Resource use and the circular economy	✓	✓	✓	
	5. Pollution	✓	✓	✓	✓
	6. Biodiversity and ecosystems		✓	✓	
Social factors	7. Equal treatment and opportunities for all	✓	✓	✓	
	8. Working conditions	✓	✓	✓	✓
	9. Respect	✓	✓	✓	
Governance factors	10. Sustainability matters in management	✓	✓	✓	
	11. Internal control and risk management	✓	✓	✓	
	12. Business ethics	✓	✓	✓	
	13. Exerting political influence	✓		✓	
	14. Relationships with stakeholders	✓	✓	✓	

Note. Abbreviations used in the table: CIECH = CIECH Group, AZOTY = AZOTY Group, ORLEN = ORLEN Group, PETRO = PETROCHEMIA-BLACHOWNIA S.A.

✓ means that, in the entity's document ESG activity has been identified.

Source: own study based on the documents of the analyzed chemical companies.

The analysis of the reports allowed to identify countless activities of the chemical entities carried out within environmental, social and governance elements.

Table 3 clearly shows, that in 2021, studied integrated groups implemented activities related to three ESG elements. The ORLEN Group disclosed information on all 14 ESG factors in the report, while the other two entities referred to 13 factors each. The CIECH Group did not disclose data on biodiversity and ecosystems, while the AZOTY Group omitted its activities and obligations related to exerting political influence, including lobbying.

The first group of six factors concerns the environmental element. As part of climate change mitigation (1), integrated groups reduced the consumption of hard coal, reduced greenhouse gas emissions into the atmosphere and made significant investments in the best available environmental techniques and innovative, low-emission technologies. Two entities reduced their carbon footprint and invested in the development of renewable energy sources and emission-free sources. All integrated groups have also taken action to adapt to climate change (2). Primarily, they analyzed the risks and opportunities related to climate change, in accordance with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). Another factor concerns water resources (3). In this case, all enterprises reduced water consumption in the plants, e.g. as a result of using closed water circuits. In addition, wastewater in the ORLEN Group is directed to industrial and rainwater sewage systems, and then subjected to treatment processes. Resource use and the circular economy (4) is the next factor. All companies operated in accordance with the principles of the circular economy and reduced electricity consumption. The CIECH Group reduced energy intensity, which was measured by the amount of energy consumed per unit of revenue, reduced the amount of waste and used less raw materials. All integrated groups have also reduced pollution (5). They reduced emissions of pollutants into the atmosphere, water and soil, conducted rational waste management and maintained the highest possible ecological neutrality of production processes. They have made significant investments to eliminate pollution. For example, the CIECH Group started the construction of a thermal waste processing installation, modernized electrostatic precipitators, built a flue gas denitrification installation and a flue gas desulfurization installation in several plants. the AZOTY Group continued work on developing an environmentally friendly technology for the production of succinic acid. The ORLEN Group carried out a series of investments in the area of wastewater management, moreover, a modern flue gas desulfurization installation was built, an exhaust gas monitoring system was installed, just to name a few. The sixth factor relates to the biodiversity and ecosystems (6). The CIECH Group, unlike other companies, did not include this issue in the report. The AZOTY Group constantly cares about the protection of ecosystems and natural resources. In 2021, it took numerous preventive and compensatory measures for the negative impact on nature. The ORLEN Group continually pays attention to the natural environment, protects biodiversity and develops ecological sensitivity.

The second group of factors concerns the social element. As part of equal treatment and opportunities for all (7) the CIECH Group eliminated disproportions in the remuneration of women and men in the same positions. The AZOTY Group did not allow discrimination in employment and did not differentiate salaries based on gender. Particularly, in 2021, 31% of women in the AZOTY Group held managerial positions and the average number of training hours per employee was 6.6 for women and 7.0 for men. It is important for the ORLEN Group to give employment opportunities to people with disabilities. In the ORLEN Group a number of projects were implemented to educate managers and employees in counteracting discrimination and managing diversity. Information campaigns were also carried out to raise awareness of disability in the workplace. The next factor relates to working conditions (8). In all investigated entities the highest safety standards were implemented, preventive measures were developed to reduce the accident rate, information on incidents was analyzed and safety risks were assessed. In the CIECH Group, as part of Performance Management, objectives related to safety were included in the process of evaluating managers. The issue of working conditions also includes the professional development of employees. Numerous training sessions were conducted in all studied organizations. Other examples of implemented activities include: development of e-learning and language platforms, employee engagement and satisfaction surveys, implementation of programs promoting a healthy lifestyle. The last social factor is the respect for human rights and fundamental freedoms (9). The studied entities ensure that in the analyzed period they attached importance to caring for the dignity of each employee, showing them due respect, regardless of, among others, religion, skin colour, beliefs, sex or age. Training courses were also conducted in this area, e.g. in the ORLEN Group, 67% of employees were trained in the subject of respect for human rights.

Finally, the third group of governance factors is opened by the component concerning sustainability matters in management (10). In all reports, the description of the role of the organization's bodies with regard to sustainability matters and their composition, was not given due attention. Only designated persons on the boards responsible for sustainability issues were indicated. But, the ORLEN Group reported that ESG management structures were strengthened in the analyzed period. In terms of the subsequent factor, main features of the organization's internal control and risk management systems (11), all entities reported the implementation of risk management systems, and interestingly, in the ORLEN Group this system was integrated with climate risks. In addition, the AZOTY Group conducted a review of ESG factors. The ORLEN Group's report mentioned that the internal audit function was performed by an independent Audit Office. Business ethics (12) is the following factor described in the studied reports. It is worth noting, that the codes of ethical conduct have been implemented in all integrated groups. The CIECH Group signed a declaration of adoption of the Standard of the United Nations Global Compact. Risks in the area of counteracting corruption and bribery, embezzlement and abuse were identified and assessed in the ORLEN Group and a number of projects were implemented to educate managers and employees in the field of ethics. Unlike

the business ethics, not much space was devoted in the reports to the problems of exerting political influence, including lobbying (13). The CIECH Group emphasized that it did not carry out lobbying activities other than as part of participation in national and international industry organizations, while the ORLEN Group stressed that it did not make donations to political parties, politicians and institutions of a similar nature. Finally, the last factor concerned the management and quality of relationships with stakeholders (14). The scale of the activities of the studied entities makes them cooperate with many groups of stakeholders. All integrated groups identify stakeholders and work with them for sustainable development. The ORLEN Group and the AZOTY Group presented stakeholder maps in their reports. The CIECH Group constantly operates on the basis of the CIECH Group Code of Conduct and the Business Partner Code, and additionally, in 2021, it started analyzing the ESG level among its suppliers.

Table 3 shows, that only one enterprise belonging to the category other companies posted a report on its website, i.e. PETROCHEMIA-BLACHOWNIA S.A. and only this report was subject to analysis. It does not mean, that the remaining companies belonging to the other companies group have not implemented activities in the ESG areas, quite the contrary. The information available on their websites proves that many such projects have been realized. However, in this study it was assumed that reports posted on websites were analyzed.

PETROCHEMIA-BLACHOWNIA S.A. disclosed information on three environmental factors and one social factor. The analyzed report shows activities related to climate change mitigation (1). The company constantly monitors the volume of carbon dioxide emissions, and in the period under review, it achieved a significant decrease in the volume of these emissions. PETROCHEMIA-BLACHOWNIA S.A. also monitors the condition of the water resources, which falls within the range of water resources factor (3). The condition of groundwater did not deteriorate in the reporting period. The studied entity is constantly improving technological solutions that contribute to reduced pollution (5). It modernized its production installations, thanks to which the emission of gaseous and dust pollutants into the air was reduced. In the analyzed document, the company referred to working conditions (8) as the only factor within the social element. The records show, that great importance was attached to the issue of safety and protection of health and life of the employees.

4.3. The links between SDGs and ESG elements in the Polish chemical companies

The third research question referred linking specific SDGs and ESG elements in the case of the chemical industry. The analysis of the sustainable development documents of the CIECH Group, the AZOTY Group and the ORLEN Group allowed to present these linkages in Table 4.

Table 4.*The links between SDGs and ESG elements in the chemical companies*

COMPANY NAME ESG ELEMENTS	CIECH	AZOTY	ORLEN
Environmental	SDG 12 Responsible consumption and production SDG 13 Climate action SDG 15 Life on land	SDG 12 Responsible consumption and production SDG 13 Climate action	SDG 12 Responsible consumption and production SDG 13 Climate action
Social	SDG 2 Zero hunger SDG 3 Good health and well-being SDG 4 Quality education SDG 5 Gender equality SDG 6 Clean water and sanitation SDG 7 Affordable and clean energy SDG 8 Decent work and economic growth SDG 9 Industry, innovation and infrastructure SDG 11 Sustainable cities and communities	SDG 2 Zero hunger SDG 4 Quality education SDG 6 Clean water and sanitation SDG 8 Decent work and economic growth SDG 9 Industry, innovation and infrastructure	SDG 3 Good health and well-being SDG 7 Affordable and clean energy SDG 9 Industry, innovation and infrastructure SDG 11 Sustainable cities and communities
Governance	SDG 17 Partnerships for the goals	-	-
TOTAL	13	7	6

Note. Abbreviations used in the table: CIECH = CIECH Group, AZOTY = AZOTY Group, ORLEN = ORLEN Group.

Source: own study based on the documents of the analyzed chemical companies.

Table 4 presents specific SDGs in connection with three ESG elements according to the opinion of the author of the article. First of all, SDGs were assigned to the social element. But also many of them are related in scope to the environmental area. Only one SDG has been allocated to the governance element. Most SDGs have been identified in the CHECH Group documents. Other entities did not indicate goals other than the CIECH Group.

5. Discussion

This study contributes to the literature on sustainable development activities undertaken in companies and focuses on the chemical industry in Poland. The article presents answers to three research questions, one of which is about the key SDGs for the chemical companies, the other is about the ESG activities of the chemical companies, and the last one concerns the links between SDGs and ESG elements in the chemical companies.

The analysis of strategies and policies of the Polish chemical companies allowed to identify 13 key SDGs. All studied entities considered SDG 12 Responsible consumption and production. This is a goal closely related to the chemical industry, because it includes target 12.4, concerning the achievement of “the environmentally sound management of chemicals and

all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment” (United Nations, 2015, p. 22). The great importance of SDG 12 in the chemical industry was also noticed in Nechita et al. (2020) research. Beyond the SDG 12, the following goals were also identified in this investigation among the key SDGs: SDG 2 Zero hunger, SDG 3 Good health and well-being, SDG 4 Quality education, SDG 5 Gender equality, SDG 6 Clean water and sanitation, SDG 7 Affordable and clean energy, SDG 8 Decent work and economic growth, SDG 9 Industry, innovation and infrastructure, SDG 11 Sustainable cities and communities, SDG 13 Climate action, SDG 15 Life on land and SDG 17 Partnerships for the goals. The list of 13 key SDGs is largely in line with ten priority SDGs for the chemical sector which were identified by the World Business Council for Sustainable Development (WBCSD, 2018). The main difference is that more SDGs have been identified in this study. However, the chemical sector, being one of the most diversified and complex of all industries, interacts with a wide number of SDGs. For example, the largest companies in the world, e.g. the BASF Group, or in Poland, e.g. the ORLEN Group, declare meeting all 17 goals, although only some are a priority for them. The results of this study are also in line with the studies of Mhlanga et al. (2018). Namely, they observed lack of consistency in how companies determine which SDGs to prioritize, e.g. some companies take an approach by prioritizing two or three SDGs, while others decide to engage with most of the goals (Mhlanga et al., 2018).

The analysis of reports of the Polish chemical companies allowed the discovery of countless activities related to three ESG elements and its 14 factors. However, there is a noticeable difference between the analyzed medium size company and other large integrated groups. Integrated groups disclosed information on all 14 ESG factors in their reports, while the smaller enterprise disclosed information on four factors, including three environmental and one social factor. In the analyzed period, most activities were observed in the environmental and social area. Noteworthy is the fact that, among the governance factors, integrated groups strengthened their ESG management structures, conducted a review of ESG factors or started analyzing the ESG level among the suppliers. This indicates an increased interest in ESG issues, which is consistent with the research by the Polish Chamber of Chemical Industry (PCCI, 2022). According to the PCCI publication, 71% of the surveyed chemical companies in Poland indicated that their business partners pay attention and put pressure on adaptation of ESG elements into the various documents (PCCI, 2022).

The results of the analysis of sustainable development documents, made it possible to find the links between specific SDGs and ESG elements in the chemical companies in Poland. Most SDGs were assigned to social and environmental areas. Only one SDG has been allocated to the governance element. The proposed links are largely consistent with the research results of Rockström and Sukhdev (2016), especially in the case of social and environmental elements. Both proposals, by Rockström and Sukhdev as well as by the author of this article, suggest

connecting the social area with the following SDGs: SDG 2 Zero hunger, SDG 3 Good health and well-being, SDG 4 Quality education, SDG 5 Gender equality and SDG 7 Affordable and clean energy. In turn, the environmental field was linked with SDG 13 Climate action and SDG 15 Life on land. Minor differences between the linkages proposed in this article and in the approach of Rockström and Sukhdev may result from the specificity of the chemical industry and from including the economic perspective by Rockström and Sukhdev.

6. Summary

In recent years, Poland has made progress in the field of sustainable development. For example, in 2020 Poland achieved a reduction of 35% in the emission of greenhouse gases, in relation to the base year level, what exceeded the level required under the Kyoto Protocol (GUS, 2022). Companies representing the chemical sector contributed to a large extent to this result. Therefore, it is justified to explore sustainable development activities undertaken in the chemical industry enterprises in Poland. Especially in the context of the new Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464) that obliges some companies to report on sustainability. Through those reports, organizations provide a clear picture of undertaken sustainable development activities to the stakeholders. Among stakeholders there are investors for whom reports relating to ESG issues are becoming more and more important (PwC, 2022).

Firstly, the analysis of strategies and policies allowed to identify 13 key SDGs, wherein SDG 12 Responsible consumption and production, seems to be the most important for the Polish chemical companies. Secondly, analysis of the reports, allowed the discovery of numerous activities, undertaken by the studied entities, in the environmental, social and governance areas. Research has shown that large integrated entities develop ESG strategies and disclose ESG data in the reports, but this is still a challenge for smaller chemical companies, in Poland. Finally, the links between specific SDGs and ESG elements in the chemical sector were presented.

The paper contributes to the better understanding of the chemical companies' sustainable development activities, thus offering findings that are potentially useful for both theory and practice. From the point of view of the theory, the results provide a more complete view about the priority SDGs, ESG elements and links between them, in the context of the chemical industry. In terms of practical implications, the results could guide chemical companies in the development of their ESG strategies.

The article is not free from limitations. One of them concerns the research method used. The content analysis was limited to examining the strategies, policies and reports available on the websites of the studied chemical companies. The records contained therein certainly do not

show all the sustainable development activities carried out by the chemical industry enterprises in Poland. In future research, other materials published on websites, such as information on current events, could be analyzed. It would be also interesting for the author to extend the scope of the analysis to other industries, as it may provide a deeper understanding of the sustainable development activities.

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