
The Impact of Chemical Companies on the Environment and Local Communities in the Aspect of Business Model

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Magdalena Wójcik-Jurkiewicz¹, Marek Masztalerz²,
Grzegorz Lew³, Adam Lulek⁴, Beata Sadowska⁵

Abstract:

Purpose: The article aims to demonstrate the correlation between the activities of chemical companies and environmental pollution, to indicate the impact of chemical companies' activities on local communities, and to present the possibilities in which chemical companies could have a positive impact on the environment and local communities.

Design/Methodology/Approach: In the article, the authors used methods commonly used by scientists, such as, critical analysis of domestic and foreign literature, method of induction and deduction, descriptive and comparative analysis method, and desk research analysis. It should be emphasized that when selecting the title of the article, research companies and research methodology, the authors used the Delphi method - and as a team of 5 experts, they discussed the legitimacy of using the indicated areas, scopes and research methods.

Findings: The work analyses the annual reports of ten companies listed in terms of information on corporate social responsibility

Practical implications: Chemical companies should pursue a transparent information policy so that local communities have knowledge of the activities carried out by entities in the areas concerned.

Originality/Value: Chemical companies are a very important branch of the global economy. Due to the activities related to the production of chemicals, it can be argued that these companies may have a negative impact on the natural environment and local activities.

Keywords: Chemical companies, natural environment, local communities, accounting.

JEL classification: M41, Q56, Q51.

Paper Type: Research article.

¹Cracow University of Economics, Department of Accounting, College of Management Sciences and Quality, Cracow, ORCID ID: 0000-0001-7177-2540, magdalena.wojcik-jurkiewicz@uek.krakow.pl

²Poznań University of Economics and Business, Department of Accounting & Financial Audit, ORCID ID: 0000-0003-3122-2717, marek.masztalerz@ue.poznan.pl

³Rzeszow University of Technology, The Faculty of Management Department of Finance, Banking and Accountancy, ORCID ID: 0000-0002-0067-8562
lewgrzes@prz.edu.pl

⁴University of Szczecin, Faculty of Economics, Finance and Management, Szczecin, ORCID ID: 0000-0001-6709-1291, adam.lulek@usz.edu.pl

⁵University of Szczecin, Faculty of Economics, Finance and Management, Szczecin, ORCID ID: 0000-0003-4190-9440, beata.sadowska@usz.edu.pl

1. Introduction

Corporate social responsibility is an important topic that covers such issues as environmental protection and the impact of enterprises on local communities (Sadowska, 2016). There is little information in the literature on the impact of chemical companies' activities on the environment and local communities. Due to the nature of activities carried out by these types of companies, it can be argued that chemical companies have a negative impact on the natural environment and local communities. An extensive OECD report discusses this topic and assesses this correlation. The report, entitled "Environmental Outlook for the Chemicals Industry", treats about the environmental impact of chemical companies, the use of natural resources and pollution control. Moreover, the document presents trends and tools for managing chemicals. It also notes that the public should be informed about the environmental impact of chemical companies (OECD Report, 2020).

The foreign literature on the research subject is dominated by the term "green chemistry". It is associated with catalysis, which is a key technology to achieve the goals of sustainable (green) chemistry (Centi and Perathoner, 2003). In Polish literature, there is no correlation between chemical companies and the natural environment. Aspects of environmental financial information have been presented in an article (Dyduch, 2015), although the article does not strictly concern the correlation of chemical companies' activities on the natural environment. However, there are many articles that deal with the subject of activity reports as a source of information about the impact of companies on the environment (Hońko, 2014).

The problems of the chemical industry and environmental impact are presented in articles available on the Internet. For example, the chemiaibiznes.com website claims that "caring for the environment has become a priority for European chemical companies. Fortunately, they have learned that ecology is not only a costly obligation, but also an opportunity for further development. In Poland, the contribution that chemical companies have made to environmental protection in recent years is difficult to overestimate. This is the effect of not only stricter law, but also an increase in the awareness of companies themselves, which a few decades ago were considered the major polluters of the environment" (Chemia i Biznes, 2020).

2. Materials and Methods

In the article, the authors used methods commonly used by scientists, such as:

- critical analysis of domestic and foreign literature,
- method of induction and deduction,
- descriptive and comparative analysis method,
- desk research analysis.

It should be emphasized that when selecting the title of the article, research companies and research methodology, the authors used the Delphi method - and as part of a team of 5 experts, they discussed the legitimacy of using the indicated areas, scopes and research methods. The correct selection of methods for the selected type of article was supported by previous studies of scientific articles on similar topics and the following compact studies were used:

1. "Fundamentals of research methodology in management research" - Ed. W. Czakon, Wydawnictwo Nieoczywiste 2016 - in the field of qualitative methods in order to avoid subjectivism in assessing empirical material.
2. "Fundamentals of social research" - E. Babbie, Polish Scientific Publishers PWN, Warsaw 2013 - in the field of social science research, quantitative and economic approach, covering such a current topic as the impact of the activities of chemical companies on the natural environment and local communities.

The authors argue that "chemical companies have a negative impact on the natural environment and local communities". During the research, the financial statements of selected chemical companies with the largest capitalization in the world were analysed (according to data from 2019). The authors also examined the literature on the subject. On this basis, conclusions have been drawn in an attempt to present activities that chemical companies could take to minimize environmental impacts or compensate local communities for a degraded environment.

3. Results

Chemical companies are economic entities that produce chemicals. Polymers and plastic, especially polyethylene, polypropylene, polyvinyl chloride, polyethylene terephthalate, polystyrene and polycarbonate account for about 80% of global industry production (Singh, 2012). Chemicals are used in a wide variety of consumer goods, as well as in many other sectors, including agricultural production, construction and services. Chemical production is an advanced technology industry in which competitiveness is based more on the ability to invest in research and development than on the labour cost (Centi, 2012).

From the point of view of chemical engineers, the chemical industry involves the use of various chemical processes, namely: chemical reactions and refining methods to produce a wide range of solid, liquid and gaseous materials. Most of these products are used for production of other products, although fewer are directly distributed to consumers. Solvents, pesticides, lyes, carbonated drinks and Portland cement are some examples of consumer products. All chemical products have a value of almost USD 3 trillion, with chemical companies in the EU and the USA being the largest producers in the world. The largest chemical producers today are global companies carrying out international operations and having plants in many countries.

What impact do these companies have on the environment? The answer is provided by the financial statements of such enterprises. The key to their selection was their capitalization on global stock exchanges. In November 2019, the largest chemical companies were:

- BASF (Germany) – USD 68.45 billion
- Bayer (Germany) – USD 50.17 billion,
- Dow (USA) – USD 47.36 billion,
- Du Pont de Nemours (USA) – USD 36.41 billion,
- LyondellBasell Industries (USA) – USD 35.42 billion,
- Mitsubishi Chemical Holdings (Japan) – USD 35.16 billion,
- Linde (Germany) – USD 26.96 billion,
- LG Chem (South Korea) – USD 24.28 billion,
- Air Liquide (France) – USD 24.01 billion,
- Toray Industries (Japan) – USD 21.3 billion.

The above-mentioned chemical companies, whose market value is the largest in the world, were the basis for the analysis of reports. The work analyses the annual reports of the ten companies listed in terms of information on corporate social responsibility. First, it is worth taking a closer look at the characteristics of selected enterprises presented in Table 1.

Table 1. Description of selected chemical companies

Company name	Description
BASF	Approximately 122 000 BASF Group employees contribute to the success of clients representing almost all industries and countries in the world. The company operates in six segments: chemicals, materials, solutions for industry, surface technologies, nutrition and hygiene, solutions for agriculture. In 2018, BASF achieved a turnover of EUR 63 billion.
Bayer	Bayer is a world-class innovative company with over 150 years of history, operating primarily in the field of health care and agriculture. Innovative products allow the company to respond to the most pressing challenges. A growing and aging population needs even better medical care and adequate food supplies.
Dow	Dow is a world leader in the production of plastics and chemicals for the processing industry. The company brings together scientific knowledge and modern technologies to help clients create innovative products. The company's solutions are used in many industries and can be found in, among others, paints, binding materials, packaging, cables, household appliances, cars and plant protection products. Dow also cares for the environment and efficient use of energy and raw materials. The company wants to be not only a global partner for its clients, but also a good neighbour in the region.
Du Pont de Nemours	From probiotics, protective equipment, to clean water supply and access to smarter, faster electronic solutions. The company uses science and innovation to create devices that customers use every day. DuPont works to change the world for a safer, healthier and better place.

Lyondell Basell Industries	LyondellBasell (NYSE: LYB) is one of the largest plastics, chemicals and refining companies in the world. Driven by its employees around the globe, LyondellBasell produces materials and products that are key to advancing solutions to modern challenges like enhancing food safety through lightweight and flexible packaging, protecting the purity of water supplies through stronger and more versatile pipes, improving the safety, comfort and fuel efficiency of many of the cars and trucks on the road, and ensuring the safe and effective functionality in electronics and appliances.
Mitsubishi Chemical Holdings	Mitsubishi Chemical Holdings globally operates a wide range of businesses grouped under three domains: Performance Products, Industrial Materials and Health Care. The company works together with 70,000 fellow co-workers in over 40 countries and regions.
Linde	The Linde Group is a global company that produces and distributes gases, provides comprehensive technological solutions that use gases, as well as constructs industrial installations. It employs approx. 62 000 employees and is present in over 100 countries in the world.
LG Chem	LG Chem is literally the company leading the chemical industry in Korea. The company has built a global network for production, sales and R&D not only in Korea but also in main bases across the world, and has provided globally competitive products including ABS, polarizers and EV battery cells, raising its global position as a material supplier.
Air Liquide	Established in 1902, the Air Liquide Group is a global leader in the field of gases, technologies and services for industry and healthcare. The group, present in 80 countries and employing approximately 66 000 employees, combines global experience with local specificity for over 3.6 million of its clients and patients.
Toray Industries	Toray Industries is a company producing basic materials. In addition to fibers and textiles, it produces high value plastic resins, fine chemicals, films, as well as carbon fiber composite materials, electronic & information related products, pharmaceutical and medical products and products for the water treatment and environmental fields.

Source: Own elaboration based on information from company websites and annual reports.

It is worth noting that the activities of chemical companies are very diverse, as they include the production of:

- Medical products,
- Synthetic materials,
- Food,
- Industrial materials,
- Textiles,
- Gases.

Chemical products are made during chemical processes that are a complex combination of reaction, distillation, absorption, filtration, extraction, drying and screening operations. To reduce costs, most chemical processes must be efficient, which is why many manufacturing operations focus on controlling and reducing the

loss of valuable materials. Therefore, ecological efficiency, including the avoidance of releasing of substances to land, water or air, is crucial for the economic survival of the industry (National Academy of Engineering and National Research Council, 1999).

Chemical companies have a significant impact on the environment. Each of the above companies is aware of this fact. The websites of chemical companies include basic information on activities related to environmental protection or the company's impact on local communities (Table 2).

Table 2. Impact on the environment - the most important factors

Company name	Impact on the environment - the most important factors
BASF	The company emits CO ₂ into the atmosphere, consumes electricity, produces waste.
Bayer	The company uses carbon as a source of energy, emits greenhouse gases into the atmosphere, including CO ₂ , produces sewage and waste.
Dow	The company uses hazardous materials, emits CO ₂ , hazardous waste, consumes a large amount of clean water.
Du Pont de Nemours	The company emits CO ₂ into the atmosphere, consumes electricity, produces waste.
Lyondell Basell Industries	The company manufactures products that can cause damage such as flammability, corrosivity, reactivity and toxicity
Mitsubishi Chemical Holdings	The company emits greenhouse gases, produces waste, consumes significant amounts of water, emits substances that pose environmental hazard.
Linde	The company emits significant amounts of gases into the atmosphere (including CO ₂), consumes electricity and clean water, produces waste.
LG Chem	The company produces chemical products and their waste, consumes electricity and water and emits gases into the atmosphere.
Air Liquide	The company emits CO ₂ into the atmosphere, consumes electricity, produces waste.
Toray Industries	The company emits greenhouse gases, waste, consumes significant amounts of water, emits substances that pose environmental hazard.

Source: Own elaboration based on information from company websites and annual reports.

It should be noted that in connection with the conducted operating activities, all of the above-mentioned companies significantly pollute the natural environment. Their impact on nature is invaluable and incalculable. The management boards of the world's largest chemical companies are aware of the negative impact on ecology. Therefore, these entities try to perform a number of activities related to reducing the negative impact on the surrounding nature. These types of activities include, but are not limited to:

- Reduction of CO₂ emission,
- Use of renewable energy and overall reduction in energy consumption,
- Recycling,

- Changes in the production process,
- Reduction of sewage and waste emissions,
- Use of safer materials,
- Preservation of biodiversity,
- Implementation of ISO certificates,
- Limitation of raw material consumption,
- Better water and sewage management,
- Reduction of coal consumption.

Selected examples of activities carried out by individual chemical companies to protect the environment and reduce pollution are presented in Table 3.

Table 3. *Selected examples of activities carried out by individual chemical companies to protect the environment and reduce pollution*

Company name	Selected activities aimed at environmental protection
BASF^[10]	<ul style="list-style-type: none"> • The company wants to reduce CO₂ emission. It focuses on processes that emit less CO₂. By 2030, the company will not emit CO₂. It successively converts non-renewable energy into renewable energy. Produces recycled plastic products.
Bayer^[11]	<ul style="list-style-type: none"> • The company shall become carbon-neutral. To accomplish this, Bayer will implement energy efficiency measures, switch to 100 percent electricity from renewable energies and offset the remaining emissions through biodiversity-enhancing carbon capture. In addition, the company will encourage its suppliers and the entire value-added chain even more to reduce greenhouse gas emissions. • A 30 percent reduction of field greenhouse gas footprint (per kilogram of yield) of the most emitting cropping systems in regions Bayer operates. This includes Bayer helping farmers to use climate-friendly methods, such as reducing plowing, which can release CO₂ sequestered in the soil. • A 30-percent reduction of the environmental impact of crop protection everywhere we operate. We aim to achieve this by developing new technologies that enable farmers to scale down crop protection product volumes and enable more precise application. • The company uses means to make production processes more resource-friendly and lower the emissions they generate. Bayer is also committed to minimizing wastewater pollution. Systematic waste management and recycling activities reduce the amount of materials to be disposed of, • The company intends to reduce sewage and waste emissions. • Conducting actions to prevent possible environmental incidents and accidents in transport.

<p>Dow^[12]</p>	<ul style="list-style-type: none"> • Dow collaborated with Conceptos Plasticos to combat waste using a technology that turns hard-to-recycle plastics into bricks for an innovative new school, • Safer materials for a sustainable planet, • Dow delivers breakthrough sustainable chemistry innovations that enhance the well-being of humanity, • The company applies a business-decision process that values nature, which will deliver business value and natural capital value. We are committed to projects that are good for the company—and better for ecosystems, • Dow maintains world-leading operations performance in natural resource efficiency, environment, health, and safety.
<p>Du Pont de Nemours^[13]</p>	<ul style="list-style-type: none"> • The company helps provide clean water to the community as well as increase the energy efficiency of products and reduce rainfall while maximizing the use of current resources. • The company is committed to developing new business models that design out waste, keep materials in use, and support more regenerative and restorative systems, • The company will act to drive down our GHG emissions at a pace that is aligned with climate science. The entity will procure electricity from more renewable sources, ramp up our work on energy efficiency projects that deliver the most value and advocate for consistent, predictable policy and regulatory environments that foster innovation, investment and economic growth, • The company will implement holistic water strategies across all facilities prioritizing manufacturing plants and communities in high-risk watersheds.
<p>LyondellBasell Industries^[14]</p>	<ul style="list-style-type: none"> • The company works closely with suppliers, carriers, distributors and customers to help them maintain high safety and environmental standards; providing technical assistance, training and logistic support as well as health, safety and environmental advice, • The entity participates in the worldwide Global Product Strategy (GPS) program, which is a voluntary initiative championed by the International Council of Chemical Associations (ICCA) that aims to improve the safety of chemical products during their use and handling. • The company monitors and manages environmental risk and complies with all regulations and permits. It aims to operate efficiently, which means using valuable resources responsibly, producing less waste and generating fewer emissions.
<p>Mitsubishi Chemical Holdings^[15]</p>	<ul style="list-style-type: none"> • With respect to climate change, the Group has made a concerted effort to reduce GHG emissions from its production activities, while developing products that will help reduce GHG emissions of our customers, • Mitsubishi Chemical Holdings Group is focusing on providing environmentally friendly products and services along with

	<p>efforts to steadily reduce the environmental impact of its own business activities,</p> <ul style="list-style-type: none"> • Each Mitsubishi Chemical Holdings Group company is working to implement environmental management systems. Many of our production sites worldwide have acquired ISO 14001 certification. Moreover, Mitsubishi Chemical Holdings ensures effective environmental management by conducting internal and external audits of these production sites regularly, • As a member of the Japan Chemical Industry Association (JCIA), Mitsubishi Chemical Holdings is involved in investigating and researching safety and environmental issues and developing related countermeasures. • Additionally MCH is: reducing emissions of substances that impact the environment, preserving water resources and biodiversity, as well as reducing greenhouse gas emissions and waste.
Linde^[16]	<ul style="list-style-type: none"> • Location certification for, among others, compliance with ISO 14001 • Reducing energy consumption • Reducing direct and indirect emissions of greenhouse gasses and other air emissions • Proper waste management • Environmentally friendly water and sewage management, • Reduction in the consumption of raw materials (metals, packaging materials).
LG Chem^[17]	<ul style="list-style-type: none"> • Strengthening product liability • Responding to climate change and reducing energy consumption • Limiting the impact of activities on the environment, • LG Chem is contributing to solving the problem of water shortage around the world by supplying clean water through products such as reverse osmosis (RO) membranes, which are widely used in water treatment. • Development of the company's energy management system (EnMS and ISO50001). • Promoting the use of energy storage systems (ESS) and New and Renewable Energy, and improved energy intensity in the production process.
Air Liquide^[18]	<ul style="list-style-type: none"> • Air Liquide will increase its renewable energy purchases by nearly 70%, from 6 to 10 TWh • The company will improve the energy efficiency of its production units: by automating and centralizing operations, the Group can optimize the performance of its plants, and notably its energy consumption, leading to both efficiency gains and a reduction in its environmental footprint (avoiding CO2 emissions), • The company will achieve a 10% reduction of the carbon footprint of its products through the optimization of both

	<p>production and transportation. For instance, Air Liquide aims to convert 20% of its global fleet of trucks to alternative fuels,</p> <ul style="list-style-type: none">• The Group intends to dedicate around EUR 100 million of its Innovation expenses every year to reduce its own carbon footprint and that of its customers. In addition to Innovation expenses, cumulative capital expenditure since 2014 totalled around EUR 300 million in biomethane and hydrogen mobility.
Toray Industries ^[19]	<ul style="list-style-type: none">• Toray actively strives to reduce CO emissions in manufacturing, through process improvements that conserve energy, use renewable energy and reduce the use of coal,• The company implements measures to use resources more effectively, practices recycling, and works to reduce waste,• Toray pursues greater reuse of water, purification of exhaust ventilation and wastewater, and appropriate management of chemical substances at its plants. In areas where water resources are particularly scarce, Toray takes additional steps to curb water intake.

Source: Own elaboration based on financial statements and websites of selected companies.

According to the nature.com report, chemical companies (and in particular those that manufacture medical products) should take seven steps to become better for the environment (Nature, 2020):

- Strengthen masters – create a high-quality team specializing in green chemistry, which should popularize the idea in the company,
- Raise awareness - the green chemistry team should organize meetings with employees and people from outside the company to increase environmental awareness,
- Expand cooperation – bringing together other companies and focusing on the problem of environmental pollution by chemical companies can help learn the principles of green chemistry faster and implement them in many companies,
- Define metrics – large chemical companies (including pharmaceuticals) track the wastage of their chemical portfolios using indicators such as the E factor, which measures the ratio of waste generated (in kilograms) per kilogram of product. Other metrics should also be introduced,
- Identify achievements – the funds spent on green chemistry research and the popularization of this idea among employees should be increased,
- Invest in new technologies – an example is the transition to the use of enzymes as reagents in the synthesis of small molecules, moving away from conventional reactions catalysed by transition metals.
- Promote green chemistry – working together with scientists to prepare a new generation of green chemicals, and with regulators to assess and reward efforts will be key to spreading sustainable thinking in the industry.

Society and investors value corporate social responsibility (although in a way that is difficult to assess), therefore it is important for them to know how the company is committed to protecting the environment and working for local communities. In order to achieve this, corporate reporting must be transparent and provide an accurate picture of what is really going on. Due to the fact that chemical companies have a negative impact on the natural environment, they should support local communities to make this impact less noticeable among people. Chemical companies carry out a number of activities to improve knowledge, well-being and the overall standard of living of the people in the area. These actions are presented in Table 4.

Table 4. *The most important activities of chemical companies carried out for the benefit of local communities*

Company name	The most important activities carried out for the benefit of local communities
BASF	<ul style="list-style-type: none"> • “As a founding member of the UN Global Compact, we concentrate our global social engagement on supporting the United Nations to achieve the Sustainable Development Goals”. • With our Social Engagement Strategy we want to open up learning opportunities. This means we want to empower people and organizations to learn from and with one another. Together with our partners, we align our social engagement in an impact-oriented way. This means we agree on clear objectives and measure success according to its long-term impact on society. • In 2015, the BASF Group supported projects totalling EUR 56.2 million (2014: EUR 45.4 million), 46% of which we donated (2014: 32%). • BASF focuses its social engagement efforts on education. The organization engages in a large number of projects – from daycare to university level – all over the world, especially near company sites. • Public health support: goal – a world free of malaria by 2040 and the elimination of Guinea worm disease.
Bayer	<ul style="list-style-type: none"> • Bayer supports a variety of social innovation initiatives and partnerships. • Through making our expertise, resources, ideas and innovations available, the company plans to positively impact at least 100 million people – smallholder farmers and their families – across the world in the longer term. • With a funding of more than USD 600,000, Bayer achieves to help expand social innovation throughout regions of Africa. • The One Acre Fund is a non-profit social enterprise supplying smallholder farmers with the financing, tools

	<p>and training they need to succeed.</p>
Dow	<ul style="list-style-type: none"> • With everything Dow does, it strives to make positive impact on society and the planet. • Dow collaborates with organizations like Habitat for Humanity, The Nature Conservancy and the United Way to find solutions for community challenges in economic development, sustainability and education. Dows community projects are: “Leadership in Action Vietnam”, “Ecosmar”, “Green Classrooms”, “Thai Forest”, “Mann Deshi Foundation”, “Habitat for Humanity”. • Dow will strive to eliminate all process safety events that impact our people, communities and the environment.
Du Pont de Nemours	<ul style="list-style-type: none"> • The Du Pont de Nemours's goal is to introduce the necessary innovations to enable development - it is the company's commitment to the community. • The company will enable millions of people access to clean water, • The company is impacting communities, for example: maintaining natural beauty in Sasakami in Japan, empowering people to realize their full potential, helping to beautify the community in Midland, Michigan.
LyondellBasell Industries	<ul style="list-style-type: none"> • The company invests in charitable organizations around the world through its Global Corporate Philanthropy Programs. • Key focus areas enable it to advance communities; improve education, promote good health, support first responders and protect the environment. • Each fall, LyondellBasell launches a month long U.S.-wide campaign in support of United Way’s mission to support education, assist in the financial stability of others and make communities healthy and strong.
Mitsubishi Chemical Holdings	<ul style="list-style-type: none"> • The company conducts corporate citizenship activities in communities and countries where it operates from a viewpoint of sustainability [green], health, and comfort. • It deepens our understanding of social needs through communication with various stakeholders and other organizations. • Supports employees in their volunteer activities.
Linde	<ul style="list-style-type: none"> • Linde has teamed up with the University of Monterrey (UEM) to introduce the “Linde Scholars” scholarship programme supported by the Mexican Secretary of Education. The company sponsors a total of 40 young people between the ages of 17 and 20, who come from low-income families and could not otherwise afford to go to university. • The company is improving road safety in Australia. • Linde planted thousands of trees in Asia in recent years. In Colombia, Linde employees and their families every year participate in a programme aimed at combining family activities with positive action for the planet and its

	<p>inhabitants.</p> <ul style="list-style-type: none"> • Linde is the main sponsor of the dragon festival in Kraków. The company has been providing the Grotteska Theatre with financial and organisational support for years. In addition, helium from Linde is what brings the dragons to life.
LG Chem	<ul style="list-style-type: none"> • Youth education through the LG Chem Fun Chemistry Park and the LG Chem Chemical Camp as well as the Chemistry Frontier Festival. • LG Chem focused on "Ecological and Energy" projects that solve the problems of biodiversity and energy, as well as contribute to the good of society. • Creating a "Green Marker" to protect the Bamseom Islands (a group of volunteers comprising employees). • Opening Bamseom Ecological Experience Hall (over the Mapo bridge).
Air Liquide	<ul style="list-style-type: none"> • Air Liquide commits itself to developing local economies, protecting life and the environment, and contributing to communities. Under the CSP umbrella, Air Liquide in Mainland China promotes a program called "Air Liquide Care" that includes several initiatives such as "Road Safety Lectures", "Marathon First Responder Program", yearly tree planting program "Green Action" and the recycled computer donation program "Air Liquide Computer Classroom".
Toray Industries	<ul style="list-style-type: none"> • Toray Group creates a variety of opportunities for communication with nearby residents. Some examples of these activities include regular community meetings with local residents, participation in events sponsored by local governments, and inviting local residents to summer festivals held on plant premises. • Toray Group has developed original environmental education programs for elementary and junior high school students. Group employees from diverse professional backgrounds including engineering, research, sales, and management give workshops. In fiscal year 2017, the Group organized workshops at 28 schools in local communities, • The Group helps promote employee understanding of environmental issues by including talks by non-profit organizations in conjunction with these activities, • The Toray Group continues to provide support for areas affected by disasters through initiatives that make the most of its own resources.

Source: Own elaboration based on financial statements and websites of selected companies.

Chemical companies carry out a number of activities to compensate local communities for the negative impact of their activities on the environment. The most popular activities include organizing festivals, expanding knowledge in the field of environmental protection, employee support, health protection, community support in Africa, financing workshops and training.

4. Conclusions

According to the authors of the paper, the activities of companies in the field of environmental protection and local communities can be assessed as good. The activities of companies were rated on a scale of 1 to 5, where 1 is the lowest and 5 is the highest score. The summary of assessments is presented in Table 5.

Table 5. Evaluation of companies' activities for environmental protection and local communities

Company name	Evaluation of environmental protection measures	Evaluation of activities for local communities
BASF	4	5
Bayer	5	5
Dow	4.5	4.5
Du Pont de Nemours	4	4
LyondellBasell Industries	4	4
Mitsubishi Chemical Holdings	5	4
Linde	5	5
LG Chem	5	5
Air Liquide	5	4
Toray Industries	5	4.5
Average score	4.65	4.5

Source: Own elaboration.

From the point of view of specific actions carried out by companies in the examined aspects, it can be stated that they are good or very good. However, it is difficult to objectively assess company's activities in reducing environmental impact. This is due to the fact that companies do not provide information about specific amounts of money they spend on environmental protection or local communities. A monetary measure would be a great comparison tool for major global chemical polluters.

Moreover, it is worth noting that chemical companies could reduce the negative impact on the environment through biotechnology. Biotechnology is "the application of scientific and engineering principles to the processing of materials by biological agents". Some of the key technologies of modern biotechnology include, but are not limited to: genetic engineering; the cultivation of recombinant microorganisms, animal and plant cells; metabolic engineering; hybridoma technology; bioelectronics; nanobiotechnology; protein engineering; transgenic animals and plants; tissue and organ engineering; immunological tests; genomics and proteomics; bioseparation and bioreactor technologies. The environmental and economic benefits that biotechnology can offer in production in chemical companies are invaluable (Gavrilescu, 2005). These benefits include: significantly reduced dependence on non-renewable fuels and other resources, reduced potential for pollution of industrial processes and products; the ability to safely destroy accumulated pollutants for

environmental reclamation; improved production economics; and sustainable production of existing and innovative products.

Regarding activities for the benefit of local communities, chemical companies could perform a number of activities, including but not limited to:

- Reclaiming areas degraded by chemical waste,
- Planting new plants and trees,
- Financing the private health care of people who live in areas where the company operates,
- Organizing educational training on environmental issues for children and young people,
- Equipping schools with the latest educational equipment,
- Organizing global cultural events,
- Equipping employees with the best protective equipment.

It is also very important to provide adequate information on actions taken. Chemical companies should pursue a transparent information policy so that local communities have knowledge of the activities carried out by entities in the areas concerned.

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