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# SUSTAINABLE MANAGEMENT OF CARBON EMISSION REDUCTION IN AN INDUSTRIAL COMPANY: A CASE STUDY

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**Abstract**: Industrial activities are major contributors to greenhouse gas (GHG) emissions, significantly driving environmental degradation and climate change. In this context, organizations are increasingly required to adopt effective carbon management strategies aligned with sustainable development objectives. This study investigates carbon emission reduction strategies in the industrial sector using the SWOT (Strengths, Weaknesses, Opportunities, and Threats) framework. A pharmaceutical manufacturing company in Algeria is used as a case study, with emissions assessed across Scope 1, Scope 2, and Scope 3 in accordance with the Greenhouse Gas Protocol. The results reveal that Scope 3 emissions represent the dominant share of the company's carbon footprint, followed by Scope 2, while Scope 1 emissions remain relatively limited. The analysis identifies internal strengths such as advanced technologies and operational efficiency, as well as weaknesses including high investment costs and dependence on fossil fuels. Externally, opportunities such as access to green financing and technological innovation are highlighted, while threats include stricter environmental regulations and energy price volatility. The study provides a strategic framework to support decision-making for improving environmental performance and promoting sustainable industrial transition.

**Keywords**: SWOT analysis, Carbon footprint, Greenhouse gas emissions, Decarbonization strategy, Continuous environmental improvement.

## 1. INTRODUCTION

Faced with the growing environmental challenges the world confronts today, measuring carbon footprint has become essential for organizations wishing to assess their environmental impacts and contribute to sustainable development (Bouchouit et al., 2025; Saraswati, 2020; Díaz, 2014). As a strategic tool, the carbon footprint makes it possible to identify and analyze

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the main sources of greenhouse gas (GHG) emissions related to organizational activities, in order to implement targeted and effective actions for their reduction. The use of this data facilitates the development of concrete action plans, such as improving energy efficiency, adopting more sustainable modes of transport and optimizing waste management (Díaz, 2014; Zubair et al., 2023). However, environmental problems result from the implementation of these development activities and initiatives, which are often neglected (Yakubu, 2017; Howes et al., 2017). As a result, companies are now at the heart of a major environmental transition. Thus, companies are led to effectively manage their GHG emissions to neutralize carbon while optimizing their direct and indirect footprint (Ghouse et al., 2025; Yaman, 2024). Now, this has become an essential strategic tool. Initiated by ADEME (Vidalenc et al., 2022; Thiriot, 2022). This system allows organizations to assess their carbon impact and to guide their transition plan towards a more sustainable model. In this context, the management of greenhouse gas (GHG) emissions offers significant opportunities for cost reduction, enhancement of brand image, and improved competitiveness, particularly through energy audits, energy efficiency measures, remote work, and circular economy practices (reduction and recycling). While GHG accounting is mandatory for certain organizations, it is gradually becoming a strategic necessity for all. This leads to the need to carefully select the most appropriate course of action, not only to reduce the environmental carbon footprint but also to optimize data and resource management.

This transformation involves all stakeholders, including employees and internal processes, in order to build a more agile and resilient organization. As a methodological tool, the SWOT approach is applied, and as a case study, an Algerian company operating in the pharmaceutical industry was selected.

## 2. DATA AND METHODOLOGY

In line with efforts to reduce carbon footprint and meet the requirements of sustainable development, it is becoming essential to identify and evaluate the most effective strategies for decarbonizing economic activities. This work examines the different approaches adopted by companies to reduce their greenhouse gas emissions, while taking into account the specific characteristics of their sector of activity, their resources and their capacity for innovation. To assess the suitability of these strategies, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was proposed to identify actions to be taken in order to develop the business while enhancing its competitiveness (Figure 1). It helps to identify competitive advantages (strengths), areas for improvement (weaknesses), market opportunities to seize and risks to anticipate (Saker et al., 2022; Berrachedi et al., 2025). It helps in decision-making and the definition of sound strategies.




*Figure 1.* Principle of SWOT analysis (Bpifrance Création, 2025)

SWOT Analysis is a tool used for strategic planning and strategic management in organizations. It can be used effectively to build organizational strategy and competitive strategy. In accordance with the System Approach, organizations are wholes that are in interaction with their environments and consist of various sub-systems (Gürel et al., 2017). This analytical method provides a clear and structured overview of the company's overall environment by integrating both internal and external factors.

❖ **Basic principles of SWOT analysis**

Fundamentally, SWOT analysis allows organizations to analyze their internal environment (strengths and weaknesses) and external environment (opportunities and threats), empowering them to pursue strategies that maximize their strengths, overcome weaknesses, take advantage of opportunities, and minimize threats (Figure 1).

The internal environment consists of the following elements:

- **Strengths (S):** these are the internal attributes and resources that support an organization in achieving its objectives. Strengths can include a strong brand, skilled workforce, unique technology, efficient processes, or financial stability. Identifying these allows businesses to leverage what they do well in order to maintain a competitive advantage (Farag, 2025; Denchev et al., 2022).
- **Weaknesses (W):** These are internal factors that may hinder the organization's ability to achieve its goals. Weaknesses could involve limited resources, outdated technology, poor brand reputation, or inefficiencies in processes. Recognizing weaknesses is crucial for addressing them and minimizing their impact on the organization's performance (Farag, 2025; Denchev et al., 2022).

The external environment consists of the following elements:

- **Opportunities (O):** These are external factors or trends in the market that the organization can exploit to its advantage. Opportunities could arise from changes in consumer behavior, emerging technologies, shifts in market demand, or regulatory changes that open up new avenues for growth (Farag, 2025; Denchev et al., 2022).
- **Threats (T):** These are external factors that could jeopardize the organization's success. Threats can come from various sources, including economic downturns, new competitors, changing government regulations, or technological disruptions. Identifying

these threats helps businesses prepare for potential challenges (Farag, 2025; Denchev et al., 2022).

Developing a SWOT matrix relies on in-depth questioning to explore growth drivers and vulnerabilities. The key questions guiding this analysis are as follows:

- **Strengths:** What are the company's major strengths? What distinctive resources or skills constitute a competitive advantage?
- **Weaknesses:** What are the main internal shortcomings or vulnerabilities that could hinder development?
- **Opportunities:** What changes in the environment (market, regulations, consumer behavior, technological advances) could be strategically exploited?
- **Threats:** What external risks or obstacles could jeopardize the organization's sustainability or growth?

This work aims to establish an overall strategic diagnosis in order to define orientations consistent with the organization’s internal capabilities and the dynamics of its environment. It is one of the first analytical tools used to make important strategic decisions in an Algeriancompany within its field of activity. Thus, once this analysis is completed, it enables the organization to formulate informed strategic choices by identifying priority levers for action, high-potential projects, risks to anticipate, and areas requiring rapid corrective measures, with the aim of maintaining or sustainably improving its overall performance.

## 3. RESULTS AND DISCUSSION

The SWOT analysis is presented in the form of a four-part matrix, structured around strengths, weaknesses, opportunities, and threats. Its implementation is based on a three-stage approach: analysis of the internal environment, analysis of the external environment, then integrating them into a SWOT matrix and strategic formulation.

### 3.1. Analysis of the internal environment

This first stage consists of identifying the strengths and weaknesses specific to the organization, its products, or its services. These elements fall within the company’s internal sphere of control and can be addressed directly (Table 1). In general, economic companies possess several strengths that support sustainability, including advanced infrastructure and technologies that reduce carbon emissions and improve operational efficiency. In addition, lower carbon emissions positively affect corporate image and help strengthen the company’s competitive position in the market. Organizational flexibility also facilitates the adoption of green practices and supports the transition toward sustainability. However, companies also face key weaknesses, such as high initial investment costs for sustainable technologies, continued reliance on fossil fuels, limited expertise in emissions management, outdated equipment, and weak environmental monitoring systems.

### 3.2. Analysis of the external environment

The second stage consists of assessing the external environment, which includes factors over which the organization has little direct control but which may significantly influence its

strategy. This stage aims to identify opportunities that can be exploited and threats that should be anticipated within the context of the company's changing overall environment (Table 1).

### 3.3. SWOT matrix and strategic formulation

The final stage consists of synthesizing the results of the diagnosis in the form of a SWOT matrix. This synthesis makes it possible to cross-reference internal and external factors in order to define coherent strategic orientations. It serves as a basis for formulating corrective measures, identifying priority action plans, and making development choices aligned with the identified challenges. The ultimate objective is to align internal resources with external dynamics in order to strengthen the organization's strategic position (Table 1).

*Table 1.* SWOT Matrix of Decarbonization

| **Strengths** | **Weaknesses** |
|---|---|
| **S1.** Sustainable infrastructure and advanced technologies<br>**S2.** Reduction of long-term operating costs<br>**S3.** Improved brand image and corporate social responsibility<br>**S4.** Industrial experience supporting environmental performance<br>**S5.** Organizational flexibility to adopt green practices | **W1.** High investment costs for low-carbon technologies<br>**W2.** Strong dependence on fossil fuels<br>**W3.** Lack of expertise in carbon emissions management<br>**W4.** Difficulty in upgrading or replacing outdated industrial equipment<br>**W5.** Weak systems for monitoring and measuring emissions |
| **Opportunities** | **Threats** |
| **O1.** Availability of government support and green financing<br>**O2.** Development of renewable energy and energy efficiency technologies<br>**O3.** Increasing demand for low-carbon products<br>**O4.** Environmental regulations encouraging energy transition<br>**O5.** Partnerships for innovation in sustainable industrial solutions | **T1.** Introduction of carbon taxes and stricter environmental regulations<br>**T2.** Rising costs of conventional energy sources<br>**T3.** Strong competition from more sustainable companies<br>**T4.** Policy uncertainty in environmental frameworks<br>**T5.** Difficulties in adapting quickly to technological change |

### 3.4. Development of corrective measures and action plan

The collected information enables the identification of priority actions that must implemented in order to design an appropriate and coherent strategy. This method helps structure the assessment of internal factors, such as resources, organizational structure, technologies, and energy management practices, as well as external factors, including regulatory frameworks, environmental pressures, societal expectations, and sectoral innovations. By doing so, it highlights priority action levers, enhances existing strengths, and guides strategic choices toward the continuous improvement of the company's environmental performance (Table 1).

Based on the SWOT analysis, the industrial company can develop a practical carbon emission reduction strategy by aligning internal strengths with external opportunities, while addressing weaknesses and mitigating threats, which is summarized in the Table 2.

*Table 2.* Strategic Framework for Decarbonization (SWOT Approach)

| **SO Strategy (Strengths ‑Opportunities) Growth Strategy** | **WO Strategy (Weaknesses ‑Opportunities) Improvement Strategy** |
|---|---|
| ➢ Leverage existing energy-efficient infrastructure (S1) to adopt renewable energy technologies (O2)<br>➢ Use cost-saving capabilities (S2) to invest in green innovation projects (O5)<br>➢ Strengthen corporate image (S3) to access green financing and government subsidies (O1)<br>➢ Apply industrial experience (S4) to develop lowcarbon production processes<br>➢ Use organizational flexibility (S5) to respond to increasing demand for green products (O3) | ➢ Use green financing (O1) to overcome high investment costs (W1)<br>➢ Adopt renewable energy technologies (O2) to reduce dependence on fossil fuels (W2)<br>➢ Develop partnerships (O5) to improve technical expertise in carbon management (W3)<br>➢ Invest in modern equipment using environmental regulations (O4) to replace outdated systems (W4)<br>➢ Implement digital monitoring tools supported by innovation programs to improve emissions tracking (W5) |
| **ST Strategy (Strengths ‑Threats) Defensive Strategy** | **WT Strategy (Weaknesses ‑Threats) Survival Strategy** |
| ➢ Use energy efficiency (S1) to reduce the impact of rising energy prices (T2)<br>➢ Strengthen corporate reputation (S3) to mitigate reputational risks (T3)<br>➢ Apply industrial experience (S4) to adapt to stricter environmental regulations (T1)<br>➢ Improve operational flexibility (S5) to manage policy uncertainty (T4) | ➢ Reduce fossil fuel dependence (W2) to limit exposure to carbon taxes (T1)<br>➢ Upgrade outdated equipment (W4) to remain competitive in green markets (T3)<br>➢ Improve emission monitoring systems (W5) to comply with environmental regulations (T1)<br>➢ Strengthen internal skills (W3) to adapt to technological and regulatory changes (T5) |

The SWOT analysis is not only diagnostic but also a strategic roadmap that guides the company toward a structured and realistic carbon reduction transition.

### 3.5. Environmental impact of the company

To assess the environmental impact of the company, a greenhouse gas (GHG) emissions assessment was conducted. According to the Greenhouse Gas Protocol, these emissions were categorized across the three reporting scopes: Scope 1, Scope 2, and Scope 3. Table 3 presents a summary of greenhouse gas emissions across Scope 1, Scope 2, and Scope 3.

*Table 3.* Summary of greenhouse gas emissions by scope (2025)

| **Scope** | **Emission Sources** | **Emission Relevance** | **GHG Results 2025** | **Unit** |
|---|---|---|---|---|
| Scope 1 | Direct emissions from fixed sources | High priority | 827.63 | $tCO_2e$ |
| Scope 2 | Indirect emissions from electricity consumption | High priority | 3,455.91 | $tCO_2e$ |
| Scope 3 | Waste | High priority | 154,001.45 | $tCO_2e$ |
| Scope 3 | Employee commuting | High priority | 592.93 | $tCO_2e$ |
| **Total** | | | **158,877.92** | **$tCO_2e$** |

The table shows that Scope 3 emissions dominate the total carbon footprint, mainly driven by waste management activities, which represent the overwhelming majority of emissions. Scope 2 (electricity consumption) is the second largest contributor, while Scope 1 emissions remain relatively limited. This distribution highlights that the organization's environmental impact is primarily indirect, emphasizing the need to focus mitigation efforts on value-chain and waste-related activities.

### 3.6. Carbon Emission Reduction Strategies

Based on the results obtained for each scope, strategies were proposed to reduce carbon emissions across the company's various operational levels.

### 3.7. Strategies to reduce Scope 1 emissions

To reduce Scope 1 emissions, which are direct greenhouse gas (GHG) emissions from sources controlled by the company, the following strategies are proposed:

- **Improve energy efficiency:** Enhance facility performance by improving insulation, upgrading motors, or using automated control systems helps reduce energy losses and therefore lowers fuel use.
- **Replacing drying and sterilization equipment with low-emission technologies:** Old boilers and furnaces consume large amounts of fuel and produce high emissions of carbon dioxide. Therefore, replacing them with modern and efficient systems allows for better energy performance and reduced environmental impact.
- **Reduce fugitive emissions:** Implement preventive maintenance programs to minimize leaks of refrigerants, gases, and other harmful substances.

### 3.8. Strategies to reduce Scope 2 emissions

To reduce Scope 2 emissions, which are indirect greenhouse gas (GHG) emissions associated with the consumption of purchased electricity, heat, or steam by the organization, the following strategies are proposed:

- **Transition to renewable energy:** Decrease reliance on fossil fuels by adopting renewable energy, or purchase renewable energy certificates (RECs) or green electricity through contracts.
- **Improve electricity efficiency (LED lighting, smart energy management systems):** Improving electricity efficiency in the pharmaceutical industry contributes to reducing energy consumption and therefore lowering carbon emissions. This includes the use of LED lighting and smart energy management systems, which effectively control electricity use by operating equipment only when needed and optimizing power distribution.
- **Improve building energy performance:** Improving the energy performance of buildings in the pharmaceutical industry plays a key role in reducing overall energy use and carbon emissions. This can be achieved through better thermal insulation, which minimizes heat loss or gain, and high-efficiency windows that improve temperature control inside facilities.

### 3.9. Strategies to reduce Scope 3 emissions

Reducing Scope 3 emissions, which are indirect emissions related to the company's activities but beyond its direct control, can be challenging as it often requires collaboration with stakeholders across the value chain. The following strategies are proposed:

- **Manage waste effectively:** Implement waste reduction, recycling, and composting programs to minimize GHG emissions associated with waste management. This may include reducing packaging, recycling materials, and utilizing waste-to-energy solutions.
- **Educate and raise awareness:** Educate employees, suppliers, customers, and other stakeholders about the importance of reducing Scope 3 emissions and encourage their active participation in sustainability efforts.
- **Promote sustainable transportation practices:** Encourage the use of low-carbon and more sustainable transportation modes for business travel and commuting, such as carpooling, cycling, public transit, and electric vehicles.
- **Monitor and report regularly:** Establish a systematic approach for continuous monitoring, tracking, and reporting of emissions to ensure progress and support ongoing improvement.

## 4. CONCLUSION

This study highlights the importance of a structured approach to reducing greenhouse gas emissions within a pharmaceutical industrial company. By applying the Greenhouse Gas (GHG) Protocol and the SWOT analysis framework, emissions were assessed across the three scopes, and key strategic levers for carbon reduction were identified.

The results show that Scope 3 emissions represent the largest share of the company's carbon footprint, followed by Scope 2 emissions, while Scope 1 emissions remain relatively limited. This distribution indicates that the organization's environmental impact is largely indirect and strongly linked to its value chain.

The SWOT analysis identified internal strengths such as advanced technologies and operational efficiency, as well as weaknesses including reliance on fossil fuels and high costs of low-carbon technologies. In addition, significant opportunities were highlighted, particularly access to green financing and the development of clean technologies, while threats include stricter environmental regulations and energy price volatility.

Therefore, the transition toward a low-carbon industrial model requires an integrated approach combining technological innovation, strategic investment, energy efficiency improvements, and organizational adaptation. Such a transition not only reduces environmental impact but also enhances the company's competitiveness and resilience.

Finally, this research opens avenues for future studies, such as:

- Leveraging digital technologies and artificial intelligence for real-time monitoring, prediction, and optimization of greenhouse gas emissions;
- Expanding the analysis to multiple companies or industrial sectors to enable benchmarking and broader generalization of decarbonization strategies;
- Integrating advanced quantitative assessment tools to improve the accuracy and reliability of environmental impact evaluation.

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