PISTOIA ALLIANCE

Sustainability White Paper 2025

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The changing climate

Climate change is widely recognized as one of the most pressing global challenges of our time, with far-reaching consequences for human health, ecosystems, and industries. The World Health Organization (WHO) has warned that climate change will have severe implications for global health.[1] An additional 250,000 deaths per year are predicted between 2030 and 2050 due to heat stress, malnutrition, malaria, and diarrhoea.[1] Rising temperatures, changing weather patterns, and the increasing frequency of extreme weather events such as floods and droughts are already putting strain on healthcare systems worldwide. This phenomenon exacerbates the spread of infectious diseases, and disproportionately affects vulnerable populations.[1,2]

Pharmaceutical industry and climate change

The pharmaceutical industry, as a central component of healthcare, faces unique challenges and responsibilities in this climate crisis. Not only must it adapt to the growing need for new treatments to combat climate-sensitive diseases, but it also must address the environmental impact of its own operations. Addressing these sustainability challenges is essential not only for the industry's long-term viability but also to mitigate climate change.[3,4]

In response to this growing threat, international frameworks like the Paris Agreement and the United Nations Sustainable Development Goals (UN SDGs) have been established to unite governments and industries in the fight against global warming.

Pharmaceutical industry and climate change cont...

Adopted in 2015, the Paris Agreement aims to limit global temperature rise to well below 2°C, with efforts to keep it to 1.5°C above pre-industrial levels. Meeting these targets requires significant reductions in greenhouse gas emissions across all sectors, including the pharmaceutical industry.[5] The 17 UN SDGs provide a blueprint for shared peace and prosperity by 2030;[6] by setting ambitious targets to contribute to the UN SDGs, the pharmaceutical industry can have a significant positive impact through adapting their industrial practices and minimizing their negative environmental impact.[7]

The, need for a shift towards sustainable practices in pharmaceutical R&D has never been more urgent. Innovations such as green chemistry, which is focused on the reduction of waste and pollution, circular economy, to improve resource efficiency and recycling, and safe and sustainable drug formulations can help reduce the negative environmental impact of pharmaceutical production.[8] Moreover, the adoption of energy-efficient technologies, waste minimization strategies, and better resource management practices can play a crucial role in aligning the industry with global climate targets.[9,10]

Beyond the environmental implications, climate change also poses significant health risks that require a focus on prevention along with new solutions from pharmaceutical R&D. Changing climate conditions are altering the geographic distribution and frequency of diseases, leading to the emergence of new diseases and the exacerbation of existing ones. Additionally, the increasing frequency of extreme weather events has an enormous impact on our healthcare systems, including significant supply chain disruption and increases in patient numbers through climate migration. As pharmaceutical companies consider investments in the research and development of vaccines, treatments, and diagnostic tools to address these emerging threats, this will require a coordinated global effort, strengthening partnerships across sectors to develop resilient healthcare systems that can withstand the challenges posed by a changing climate.[11]

The environmental impact of pharmaceutical R&D

The healthcare sector in most industrialized nations accounts for nearly 10% of the national Greenhouse Gas GHG emissions, and a 2023 report by McKinsey stated that the emissions intensity in terms of tons of CO2 per million dollars of revenue for life sciences companies could be two to three times higher than that of healthcare delivery organizations.[12] Additionally, the healthcare sector is responsible for 5% of total global emissions or about 2.4 gigatons of CO2-equivalent emissions worldwide.[13] This is the equivalent of the healthcare sector being the fifth highest-emitting country after countries such as China, the US and India. A 2022 report by the Sustainable Markets Initiative Health Systems Task Force stated that 5% of these total healthcare emissions can be attributed to pharmaceutical R&D, with clinical development being a particularly high contributor.[14] Thus, pharmaceutical R&D has a considerable environmental footprint, contributing significantly to global greenhouse gas emissions.

Pharmaceutical R&D involves complex and resource-intensive activities, ranging from laboratory-based research and clinical testing to large-scale production of drugs. These activities require significant energy consumption, particularly in laboratories that use specialized equipment and maintain strict environmental controls, such as temperature regulation and air filtration. Laboratories in pharmaceutical R&D are known to use five to ten times more energy per square meter than an average commercial building such as an office building. Additionally, the production of active pharmaceutical ingredients (APIs) is energy-intensive and generates emissions through heating, cooling, and chemical synthesis, further contributing to the industry's carbon footprint.[15]

Beyond direct energy use, pharmaceutical R&D relies on complex supply chains, which also add to the environmental burden. Raw materials for drug production often need to be transported across long distances, and the packaging, storage, and distribution of finished pharmaceutical products generate additional emissions. Indirect, or Scope 3, emissions from pharmaceutical supply chains have been shown to account for more than 70% of the industry's total carbon footprint, along with being incredibly challenging to report.[16] This includes emissions from the production and transport of raw materials, intermediates, and packaging, as well as the final distribution of drugs to markets worldwide.[17]

The environmental impact of pharmaceutical R&D

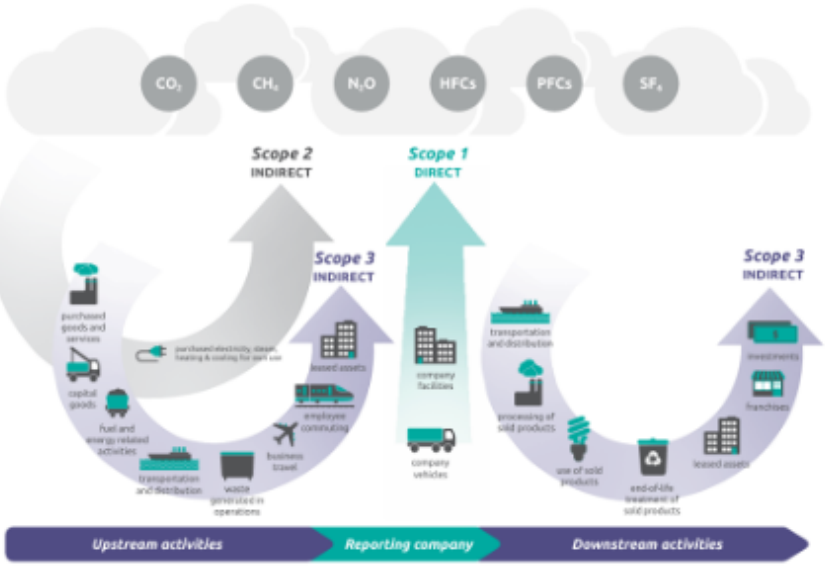

Figure 1: Scope 1, 2 and 3 emissions25

Recognizing these challenges, many pharmaceutical companies are beginning to take steps toward reducing their environmental impact. Industry leaders have made public commitments to reach net-zero carbon emissions by 2030, investing in renewable energy and energy-efficient technologies for their R&D facilities and production sites. These companies are also exploring more sustainable manufacturing practices, such as continuous manufacturing, which streamlines drug production and reduces energy consumption and waste.[18]

To further reduce the environmental impact of pharmaceutical R&D, the industry is increasingly turning to green chemistry principles, which focus on designing processes that minimize the use of hazardous substances and reduce waste. Energy efficiency is also being improved through the adoption of new technologies, including automation and digitalization, which can optimize drug development processes and reduce resource use.

Challenges of sustainability in pharmaceutical R&D

While the pharmaceutical industry is increasingly aware of the need to adopt sustainable practices, implementing these changes faces several significant challenges. To better understand these challenges, interviews were conducted by the Pistoia Alliance with key leaders working on increasing sustainability across pharmaceutical R&D, offering firsthand insights into the complexities and opportunities for advancing sustainable practices.

Lack of data and standardization

Among these is the lack of comprehensive data and standardization when it comes to measuring and reporting environmental impacts. Unlike other sectors, pharmaceutical R&D lacks a unified approach to measure sustainability efforts, making it difficult for companies to identify key areas for improvement, track progress, and benchmark their environmental performance against industry standards. A major hurdle when trying to overcome this challenge is the lack of consistent data collection and reporting across the sector. Many pharmaceutical companies lack the infrastructure to collect detailed environmental data on their R&D activities, especially when it comes to indirect emissions from their supply chains (scope 3 emissions). A report by the Carbon Trust found that while many pharmaceutical companies have begun disclosing their greenhouse gas emissions, there is considerable variation in how emissions are calculated, particularly when it comes to non-manufacturing activities like research and clinical trials.19 Shamilka Samarasinha, lead of global ESG and sustainability at Quantori and Jason LaRoche, Director of Innovative Health and Environmental Sustainability in Clinical Research at Johnson & Johnson, both Pistoia Alliance membership companies, highlighted the importance of data in advancing sustainability within pharmaceutical R&D. Shamilka identified the lack of consistent data collection as a major challenge, noting that the sector's competitive, profit-driven nature makes the standardized measurement of emissions, waste, and renewable energy use more difficult, limiting shared learning. Jason, from his perspective at J&J, underscored that without robust data, identifying greenhouse gas hotspots in operations becomes increasingly more difficult, making data the essential first step toward meaningful environmental improvements in clinical trials.

The complexity of pharmaceutical R&D

An additional challenge in adopting sustainable practices is the complexity and fragmentation of pharmaceutical R&D itself. The drug development process spans several stages - from basic research and preclinical studies to clinical trials and manufacturing - each with its own distinct environmental impacts. For example, laboratories that conduct early-stage research tend to consume large amounts of energy due to the use of highly specialized equipment and the need to maintain controlled environmental conditions. Later stages of the process, such as clinical trials, require the coordination of multiple global trial sites and generate significant waste from single-use medical devices and packaging. The diversity of these activities makes it difficult to apply a one-size-fits-all approach to sustainability, as each subdivision of R&D may require tailored solutions.[19]

Regulatory hurdles

A third challenge is the regulatory landscape, which places strict requirements on the pharmaceutical industry for quality and safety but does not yet reference sustainability. In R&D, processes are typically optimized for compliance with regulatory standards which do not account for environmental impact. For example, good manufacturing practices (GMP) and good clinical practices (GCP) ensure the safety and efficacy of drugs, but they do not set expectations for energy efficiency or waste reduction. A shift toward regulatory frameworks that integrate sustainability into compliance requirements is required to guide the industry towards more sustainable practices.[20] Adriana Zupa-Fernandez, who is working in the sustainability team at Bristol Myers Squibb, an active Pistoia Alliance membership company, explained that the pharmaceutical industry is a highly regulated industry, focused on maintaining product safety and efficacy. Implementing sustainable practices is therefore challenging in pharmaceutical R&D, and it needs to be interwoven through all operations. Adriana also highlighted that incorporating sustainability within these regulatory boundaries may require significant short and long-term resources, which can be a challenge for some companies.

Financial contraints and risks

Perceived financial burden and misunderstood risks further complicate the implementation of sustainable practices. Sustainable initiatives, such as transitioning to renewable energy or adopting green chemistry principles, can require significant upfront investment. While these investments lead to long-term cost savings, the initial expense can be a deterrent, especially in a highly competitive industry like pharma, where the focus is often on reducing time-to-market for new drugs. The high cost of failure in drug development means that companies are hesitant to change processes or materials if they believe it could impact the speed at which their product goes to market. This is especially true in the clinical trials, where the pressure to deliver results quickly may discourage innovative approaches to increase sustainability.[21,22]

Financial contraints and risks cont...

As Carly Santer, Strategic Initiatives Project Leader at Bayer, a Pistoia Alliance membership company, noted, a perceived trade-off between sustainability and profit can be misleading; many sustainable practices, like reducing waste in clinical trials or ongoing optimization of shipping logistics, offer both short- and long-term benefits, including cost savings and business resilience. While some sustainable investments may initially increase costs, they may ultimately offer a competitive advantage as regulatory transparency around greenhouse gas emissions grows. Carly emphasized that clarity in the communication about these long-term benefits is essential to encourage stakeholder support for sustainability initiatives.

Global industry

Finally, the global nature of pharmaceutical supply chains adds to the challenge of standardizing sustainability practices. Pharmaceutical R&D relies on a vast network of suppliers, many of whom operate in countries with varying environmental regulations and practices. This makes it difficult to control the environmental impact of the entire supply chain, especially when some suppliers may be less inclined or able to adopt sustainable practices. Over 70% of pharmaceutical companies' carbon footprints come from indirect emissions, such as those from suppliers and logistics. Yet, few companies have a comprehensive strategy for reducing these Scope 3 emissions, in part due to the difficulty of obtaining reliable environmental data from their supply chain partners. The concept of pre-competitive collaboration is paramount in addressing sustainability challenges, as articulated by Michael Cohen, Senior Director of Environmental Sustainability at the PPD clinical research business of Thermo Fisher Scientific, a Pistoia Alliance membership company. By engaging participants across the entire value chain, from clinical trials to lab operations and shipping partners, collective commitment to sustainability can be catalyzed. This collaborative spirit allows companies to focus on common issues, ensuring that shared challenges can lead to shared solutions. Adriana (Bristol Myers Squibb) echoed this sentiment, emphasizing that the weight of many companies addressing a common issue amplifies its significance, thereby convincing industry leaders to prioritize sustainability.

The role of the Pistoia Alliance in advancing sustainability in pharmaceutical R&D

The Pistoia Alliance, a global organization committed to collaborative innovation in life sciences, is uniquely positioned to support sustainability initiatives in pharmaceutical R&D. By fostering cooperation between pharmaceutical companies, academic institutions, and regulatory bodies, the Pistoia Alliance can help accelerate the adoption of sustainable practices within the industry. Pre-competitive collaboration can include the development of open-access platforms for sharing leading practices, partnerships to explore sustainable supply chain solutions, and the creation of standards for reducing waste and emissions in drug development processes. As the pharmaceutical industry confronts the climate change threat, the Pistoia Alliance can serve as a catalyst for transformative change, guiding the industry toward a more sustainable future while ensuring it meets the growing healthcare needs of a world experiencing the effects of climate change. Will Clark, Senior Director of Sustainability in Chemistry, Manufacturing, and Controls at GSK, a Pistoia Alliance membership company, highlighted this unique position, noting that the Pistoia Alliance combines various companies and expertise from across the drug development timeline, enabling members to learn from one another's experiences in sustainability.

Carly (Bayer) further elaborated on the Pistoia Alliance's potential to align its members toward a common goal. Given the significant membership of the Alliance, it serves as an excellent platform for collaboration, and collective horizon scanning, particularly in light of the urgent need for the reduction of pharmaceutical R&D's impact on the environment to mitigate climate change. By creating a timeline for companies and reducing duplication of efforts, the Alliance can help members work more efficiently and effectively. Jason (J&J) pointed out that sharing challenges among members prepares them for upcoming obstacles, emphasizing the need for a supportive framework that offers a roadmap for sustainable practices.

The role of the Pistoia Alliance in advancing sustainability in pharmaceutical R&D

Shamilka (Quantori) underscored the importance of producing white papers and other resources that reflect the industry's perspective. By gathering insights from various stakeholders, the Alliance can highlight commonalities in challenges faced, promoting a deeper understanding of sustainability needs. Furthermore, collaboration with organizations like the Sustainable Healthcare Coalition to develop standardized approaches will be vital for the industry.[23] This would address the current gaps in sustainability metrics, allowing companies to develop actionable guidelines.

In conclusion, the Pistoia Alliance has the potential to be a transformative force in the pharmaceutical sector's journey toward sustainability. By leveraging its unique position to foster collaboration, share knowledge, and develop standardized yet ambitious objectives, the Pistoia Alliance can guide its members in implementing effective and sustainable R&D practices. As the industry moves forward, the collective efforts facilitated by the Pistoia Alliance will be crucial in addressing the environmental challenges that lie ahead.[24]

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