

# Analysing the Scope 3 Emissions of the Cement Industry

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## Abstract

The purpose of this article is to investigate the Scope 3 emissions of the cement sector. Scope 3 emissions include indirect greenhouse gas (GHG) emissions that arise from the manufacturing and usage of cement. It is essential to conduct an analysis of Scope 3 emissions since the cement industry is a major contributor to the world emissions of greenhouse gases. The purpose of this study is to provide a complete review of the Scope 3 emissions produced by the cement sector, their impact on the environment, and related issues. In addition to this, it discusses the actions that have already been taken by the cement industry to lower Scope 3 emissions and makes suggestions for further actions that can be taken to lower emissions..

## Introduction

The cement industry is a global contributor to greenhouse gas emissions, with carbon dioxide (CO<sub>2</sub>) being released during the heating of limestone used in cement production. However, the environmental impact of the cement industry extends beyond the direct emissions from cement production. Upstream and downstream activities, including the production of raw materials, transportation of materials, and use of cement in construction, also play a significant role in emissions.

These indirect emissions, known as Scope 3 emissions, result from processes that are outside of the company's direct control but are associated with its operations. While the organization may not be directly responsible for these emissions, they are still a consequence of its activities. Factors such as cement manufacturing, transportation of raw materials, utilization of cement in construction projects, and cement consumption in the construction sector all contribute in a major way to the Scope 3 emissions of the cement industry.

This highlights the requirement for a comprehensive approach to address greenhouse gas emissions in the cement industry, considering not only the direct emissions from cement production but also the entire supply chain and life cycle of cement. Efforts to reduce emissions must encompass a holistic approach that addresses all stages of the cement production process and associated activities, including raw material extraction, transportation, and utilization, to effectively mitigate the environmental impact of the cement industry on a global scale.

## Purpose and scope of study

There is a growing consensus that air pollution and climate change are critical challenges that pose risks to long-term sustainability. As a result, businesses around the world are increasingly recognizing the need to better manage and reduce their air pollution levels in response to government

regulations and voluntary initiatives. In order to stay competitive in the face of rising competition and the impacts of climate change, it is crucial for businesses to have the necessary resources to understand and control their air pollution.

One potential solution for businesses in India is the use of an application that can help them achieve various objectives related to managing their corporate emissions inventory. This includes identifying and managing air emissions, identifying opportunities for emissions reduction, developing compliance strategies for air emissions regulations, participating in voluntary emissions reduction programs, engaging in market-based mechanisms, and gaining recognition for early voluntary action on air quality management.

The cement industry in India, in particular, is a significant source of both conventional and greenhouse gas emissions. While businesses in India are not currently required by law to track and report their air emissions, voluntarily doing so can bring about several benefits. This includes internal benchmarking to drive improvements, public reporting to enhance transparency and stakeholder engagement, creating product profiles that showcase sustainability efforts, and potentially participating in the nascent market for selling emissions credits. Voluntary measures to increase energy efficiency and mitigate greenhouse gas emissions are expected to gain traction, especially in major organized industrial sectors like cement.

By proactively managing air emissions and taking voluntary action to reduce their environmental impact, businesses in India can not only contribute to global efforts to counter air pollution and climate change but also position themselves as leaders in sustainability, which can have long-term benefits in a competitive business landscape

### **The concept of ‘scope’**

To track and report air emissions, they are categorized into different "scopes." These scopes, namely Scope 1, Scope 2, and Scope 3, are defined as follows:

1. Scope 1 pertains to the direct air emissions from sources that the company owns or controls. This includes emissions from various process activities such as the use of fossil fuels in stationary combustion or diesel generator sets, and company-owned vehicles. CO<sub>2</sub> emissions from biomass combustion are also included in Scope 1 but are reported separately in the summarized plant-level GHG inventory because biomass combustion is considered carbon neutral.
2. Scope 2 covers indirect air emissions resulting from the generation of purchased electricity that the company uses. These emissions are generated by third-party entities from whom the company purchases electricity.
3. Scope 3 pertains to other indirect air emissions that are not under the control of the company. These emissions include those associated with the production and extraction of materials purchased by the company, emissions from transportation of purchased fuels, emissions from clinker imports, and emissions from the use of sold products and services.

By categorizing air emissions into these scopes, companies are able to better understand and report on their direct and indirect emissions, and identify opportunities for emission reduction across their entire value chain, from their own operations to their suppliers and customers. This comprehensive approach to accounting for emissions allows companies to take a more holistic and transparent approach to managing their environmental impact and contributing to global efforts to combat climate change

### Need for accounting Scope 3 emissions

Companies can leverage Scope 3 accounting to gain insights into their value chain footprint and understand the full effects of their operations. In the context of cement companies, tracking Scope 3 emissions can provide valuable information to:

- 1. Determine Emission Hotspots:** By analyzing Scope 3 emissions, cement companies can identify which stages of their value chain are the most significant sources of emissions. This can help them prioritize efforts to reduce emissions in those specific areas, such as optimizing raw material transportation or improving energy efficiency in cement usage in construction.
- 2. Recognize Risks:** Understanding the potential threats associated with their use of energy and resources can enable cement companies to proactively address sustainability risks. For example, identifying dependencies on high-emitting vendors or regions can help them develop contingency plans to mitigate those risks and ensure a more sustainable supply chain.
- 3. Identify Sustainability Leaders:** Tracking Scope 3 emissions can help cement companies identify vendors or partners in their value chain who are leading in sustainability practices. This can provide insights on best practices and opportunities for collaboration to drive sustainability improvements throughout the value chain.
- 4. Identify Energy Savings and Cost Reduction Opportunities:** Analyzing Scope 3 emissions can help cement companies identify areas of the value chain where energy savings and cost reduction opportunities can be realized. For instance, optimizing transportation routes or promoting circular economy practices in the use of sold products can result in emission reductions and cost savings.
- 5. Collaborate with Vendors:** By involving vendors and offering assistance with sustainability program development, cement companies can work collaboratively with their partners to drive sustainability improvements across the value chain. This can include initiatives such as joint carbon reduction projects, sharing of best practices, and providing resources for sustainable procurement.
- 6. Promote Sustainable Transportation:** Cement companies can also take measures to make it easier for their workers to take public transport to and from work. By providing incentives, infrastructure, and support for sustainable transportation options, companies can contribute to reducing emissions associated with employee commuting and promote sustainable commuting practices.

Overall, utilizing Scope 3 accounting allows cement companies to take a more comprehensive approach to sustainability, considering not only their direct emissions but also the indirect emissions associated with their value chain. This can enable them to identify opportunities for emission reduction, collaborate with stakeholders, and contribute to a more sustainable future.

### Relevance to the cement industry

Scope 3 emissions can vary depending on the company and industry. In some cases, Scope 3 emissions can account for a large fraction of a company's total emissions, as you mentioned in the financial services industry. However, in the cement industry, Scope 3 emissions typically constitute around 17% of the total emissions, according to statistics.

Scope 3 emissions in the cement industry can arise from various stages of the value chain, including the production of raw materials, transportation of materials and products, energy consumption in

manufacturing, and product use and disposal. Factors such as the origin of fuels, the nature of purchases (e.g., transportation modes, energy sources), and the volume of transportation can all contribute to Scope 3 emissions in the cement industry.

It's important for cement companies to carefully track and manage their Scope 3 emissions, as these emissions can significantly impact their overall environmental footprint and sustainability performance. By identifying the sources of Scope 3 emissions and implementing strategies to reduce them, cement companies can effectively address their indirect emissions and contribute to mitigating climate change and achieving long-term sustainability goals

### Scope 3 accounting Principles

The guidelines outlined in the Scope 3 Standard for recording and reporting greenhouse gas (GHG) emissions are important for ensuring accuracy, transparency, and consistency in reporting. Let's take a closer look at each guideline:

- 1. Relevance:** It is essential to ensure that the GHG inventory accurately reflects the company's emissions and meets the needs of users, both internal and external, who will be using the data to make decisions. This involves identifying and including all relevant sources and activities within the inventory boundary, considering the materiality of emissions sources, and addressing stakeholder expectations.
- 2. Completeness:** All sources and activities that produce GHG emissions within the defined inventory boundary must be identified and reported. If there are specific exclusions, they should be clearly explained and justified. It's important to avoid cherry-picking or omitting emission sources that could materially impact the accuracy and comprehensiveness of the inventory.
- 3. Consistency:** Maintaining a consistent approach to monitoring emissions over time is crucial for effective trend analysis and performance tracking. "Any changes to data, inventory boundary, methods, or other factors in the time series should be clearly documented to ensure transparency and enable accurate comparison of emissions data across different reporting periods."
- 4. Transparency:** Dealing with all relevant issues in a methodical and factual manner, based on a transparent audit trail, is critical. This involves specifying the assumptions made, citing the accounting and calculation methods, and providing clear references to data sources used. Transparent reporting enables stakeholders to understand the basis for the reported emissions and assess the reliability of the data.
- 5. Accuracy:** Ensuring that GHG emission estimates are not consistently too high or too low, and mitigating uncertainties to the greatest extent possible, is important for reliable reporting. This may involve using appropriate measurement techniques, applying emission factors or calculations based on best available data and science, and conducting quality assurance and quality control measures to improve the accuracy of the reported data.

By adhering to these guidelines, companies can enhance the reliability, transparency, and comparability of their Scope 3 emissions reporting, which in turn can support informed decision-making, stakeholder engagement, and progress towards sustainability goals.

### Literature Review: "Cement Sector Scope 3 Emissions Accounting and Reporting"

The document titled "Cement Sector Scope 3 Emissions Accounting and Reporting" is a report published by the World Business Council for Sustainable Development (WBCSD) in November

2016. The report focuses on the scope 3 emissions of the cement sector, which includes indirect emissions from the production and use of purchased goods and services, as well as the transportation of materials and products.

The report begins by providing an overview of the cement sector's contribution to global greenhouse gas emissions, highlighting that cement production is responsible for approximately 5-7% of global CO<sub>2</sub> emissions. It also emphasizes the importance of addressing scope 3 emissions, as they often constitute a significant portion of a company's total emissions and can be challenging to measure and manage.

The report then reviews existing literature and methodologies for accounting and reporting scope 3 emissions in the cement sector. It discusses various approaches, including the "cradle-to-gate" and "cradle-to-grave" methodologies, as well as the use of life cycle assessment (LCA) and environmental product declarations (EPDs) to quantify emissions. The report also highlights the challenges and limitations of these approaches, such as data availability, accuracy, and consistency, as well as the need for standardized methodologies and reporting frameworks.

Furthermore, the report discusses the importance of engaging with the value chain and stakeholders to address scope 3 emissions. It emphasizes the need for collaboration among cement producers, suppliers, customers, and other stakeholders to identify and implement emission reduction opportunities throughout the entire value chain. The report also highlights the role of innovation and technology in reducing scope 3 emissions, such as the use of alternative fuels, energy efficiency measures, and carbon capture and storage (CCS) technologies.

The report also includes several case studies from cement companies that have implemented strategies to address scope 3 emissions. These case studies provide practical examples of how companies have approached emissions accounting and reporting, engaged with stakeholders, and implemented emission reduction measures. They also highlight the benefits and challenges associated with such initiatives, including the potential for cost savings, improved reputation, and increased competitiveness, as well as the need for long-term commitment and collaboration among stakeholders.

Finally, the report provides recommendations for companies in the cement sector to improve their scope 3 emissions accounting and reporting practices. These recommendations include establishing a robust and transparent emissions accounting and reporting system, engaging with stakeholders to identify and prioritize emission reduction opportunities, integrating emission reduction targets into business strategies, and promoting innovation and technology adoption. The report also highlights the need for industry-wide collaboration, standardization, and policy support to accelerate emission reduction efforts in the cement sector.

In conclusion, the "Cement Sector Scope 3 Emissions Accounting and Reporting" report published by WBCSD provides a comprehensive review of the existing literature, methodologies, challenges, and opportunities related to scope 3 emissions in the cement sector. It emphasizes the importance of addressing scope 3 emissions and engaging with stakeholders to identify and implement emission reduction measures. The report also provides practical recommendations for companies in the cement sector to improve their emissions accounting and reporting practices and accelerate emission reduction efforts. Overall, the report serves as a valuable resource for policymakers, industry practitioners, and other stakeholders interested in addressing climate change in the cement sector.

## Methodology

The "Cement Sector Scope 3 Emissions Accounting and Reporting" report by the WBCSD provides a methodology for accounting and reporting scope 3 emissions in the cement sector. The methodology is based on the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, which is a widely accepted framework for measuring and reporting greenhouse gas emissions along the entire value chain of a company, including both direct and indirect emissions. The methodology in the report consists of the following steps:

- 1. Defining the scope of emissions:** The first step in the methodology is to define the scope of emissions to be accounted for. Scope 3 emissions in the cement sector are categorized into 15 different categories, which include both upstream and downstream emissions. These categories cover a range of activities, including raw material extraction, transportation of raw materials, transportation of cement products, production of fuels used in cement production, and use of cement in construction and infrastructure projects.
- 2. Identifying emissions sources:** The next step is to identify the specific emissions sources associated with each category of scope 3 emissions. This involves conducting a thorough inventory of the emissions sources along the entire value chain of the cement sector, including emissions from activities such as raw material extraction, cement production, transportation, and use in construction.
- 3. Collecting data:** Once the emissions sources are identified, the next step is to collect data on the emissions associated with each source. This may involve collecting data from internal company records, as well as from external sources such as suppliers, contractors, and other stakeholders in the value chain. Data collection may include measurements of direct emissions, such as those from cement kilns, as well as indirect emissions, such as those from the production of electricity or other fuels used in cement production or transportation.
- 4. Calculating emissions:** After data collection, the emissions associated with each source are calculated using appropriate emission factors or other calculation methods. Emission factors are values that represent the amount of greenhouse gases emitted per unit of activity or input, and they are typically derived from established emission estimation methods or from industry-specific databases. The report provides default emission factors for each category of scope 3 emissions in the cement sector, which can be used as a starting point for calculations. However, companies are encouraged to use more accurate and relevant emission factors based on their specific operations and activities.
- 5. Applying data quality and completeness checks:** To ensure the accuracy and reliability of the calculated emissions, data quality and completeness checks are applied. This may involve verifying the accuracy of data inputs, checking for data gaps or inconsistencies, and conducting sensitivity analyses to assess the robustness of the results. Companies are encouraged to disclose the assumptions and uncertainties associated with their calculations to provide transparency and enable stakeholders to assess the reliability of the reported emissions.
- 6. Reporting emissions:** Once the emissions are calculated and verified, the final step is to report the scope 3 emissions in a transparent and comprehensive manner. The report provides guidance on the content and format of scope 3 emissions reporting, including the use of standardized reporting templates and disclosure requirements. The report emphasizes the importance of transparency, accuracy, and comparability of reported emissions to enable stakeholders to assess

the progress and performance of companies in managing their scope 3 emissions. It's important to note that the methodology provided in the report is intended as a starting point and may need to be customized by companies to reflect their specific operations, activities, and data availability. Companies are encouraged to continually improve their emissions accounting and reporting processes, and to engage in stakeholder dialogue and feedback to ensure the accuracy and transparency of their scope 3 emissions reporting

### Accounting methodology for categories

Scope 3 emissions can be accounted for in a number of ways, and the most appropriate method will depend on the category. Although primary data approaches are favoured in theory, in practise their utilisation will depend on the quantity and quality of data that is actually available.s

Table 5: Use of primary and secondary data for reporting Scope 3 emissions

Category	Expected approach
1. Purchased goods and services	Most likely approach is a secondary data method, combined with some supplier data if available.
2. Capital goods	Most likely approach is a secondary data method, combined with some supplier data if available.
3. Fuel and energy-related activities (not included in Scope 1 or 2)	Most likely approach is a secondary data method, combined with some supplier data if available.
4. Upstream transportation and distribution	Combination of primary data sources where company operates its own fleet and a secondary data method, using some supplier data if available—boundaries can be complex for this category and are discussed in detail in Category 4 (Upstream transportation and distribution).
5. Business travel	Combination of primary data sources where company operates its own fleet and a secondary data method, using some supplier data if available (information from travel providers on air/rail/ship emissions, use of company data for car/taxi travel).
6. Employee commuting	Use of either primary or secondary survey data, with national data on impacts from different travel modes.
7. Downstream transportation and distribution	Combination of primary data sources where company operates its own fleet and a secondary data method, using some supplier data if available.
8. Processing of sold products	Most likely approach is a secondary data method, probably modelling using LCA-based approaches.

### Purchase of goods

The assessment of Scope 3 emissions comprises all upstream (from cradle-to-gate) emissions from the manufacturing of products that the reporting company procured or obtained within the current reporting year. This pertains to both tangible goods and intangible services (e.g., telecommunications). The accounting of Scope 3 emissions usually includes the following activities:

- 1. The extraction of raw materials:** This entails emissions linked to the extraction of raw materials, such as aluminum, calcium, limestone, and iron that are utilized in the production of products acquired by the company which is reporting
- 2. Agricultural activities:** Emissions from raw fuel cultivation, such as emissions from agricultural practices involved in the production of raw materials, may be included in the accounting of Scope 3 emissions.
- 3. Land use and land-use change:** Emissions associated with changes in land use, such as deforestation or land conversion for the extraction of raw materials, may be considered as part of Scope 3 emissions.
- 4. Manufacturing, production, and processing:** Emissions from the manufacturing, production, and processing of raw materials into finished products, such as clinker production in the cement industry, may be accounted for in Scope 3 emissions.

The generation of electricity used in upstream activities, such as the extraction of raw materials. Emissions from the transportation of materials and products between suppliers, including the transportation of processing equipment.

It is important for companies to carefully assess and include all relevant emissions sources and activities in their accounting of Scope 3 emissions to ensure comprehensive and accurate reporting of their environmental impact along the value chain.

### **Capital goods**

All emissions generated during the extraction, manufacture, and transportation of capital goods bought or acquired by the reporting entity during the reporting year fall under the category of capital goods within the accounting of Scope 3 emissions. All emissions from the initial stages of a product's lifecycle (from "cradle to gate") are included here. Scope 3 emissions may include the use of capital goods such as kilns, vehicles, materials including pipes and cables, engines, and IT equipment.

Capital equipment emissions must be reported in the year of acquisition per the GHG Scope 3 Standard. This means that in the year of purchase or acquisition, businesses must calculate and report all greenhouse gas emissions from the extraction of raw materials to the manufacturing and distribution of finished products.

This allows for a comprehensive assessment of the emissions associated with the capital goods used in the company's operations, providing a more accurate and transparent representation of the environmental impact of these goods. Compliance with this reporting requirement enables companies to effectively monitor and manage their emissions associated with capital goods, and supports informed decision-making for sustainability and climate-related strategies.

### **Fuel and energy-related activities**

The category of fuel and electricity/heat within the accounting of Scope 3 emissions encompasses upstream emissions associated with the purchase of fuel and electricity/heat by the reporting company in the reporting year. This includes emissions from resource extraction, production, and transportation that occur upstream from the reporting company's operations. Examples of goods included in this category are fuel used in cement manufacturing (such as coal, heavy oil, and oil coke) and electricity and heat used in cement manufacturing.

Emissions from upstream processes, such as resource extraction, refining, and transportation, are included in the scope of accounting for fuel used in cement manufacturing. This guarantees a thorough evaluation of emissions throughout the whole fuel life cycle, from extraction to combustion in cement manufacture.

Similarly, when accounting for emissions from electricity and heat used in cement manufacture, the upstream stages of extraction of resources, production, and the energy used in the generation of electricity and heat are included. This facilitates a comprehensive evaluation of the emissions caused by the generation and distribution of the energy and heat consumed by the reporting company's operations.

By accounting for these upstream emissions associated with fuel and electricity/heat, companies can better understand and manage their indirect emissions from the use of these goods in their operations. This enables companies to identify opportunities for emissions reduction along the supply chain and supports informed decision-making for sustainable procurement and energy management strategies.



### **Upstream distribution**

This category pertains to the emissions of greenhouse gases that are generated during the transportation and distribution of products acquired by the reporting company within a specified reporting period. These emissions arise from the activities of third-party carriers involved in transporting the company's products, as well as from the storage of these products in distribution centers, warehouses, and retail facilities. Various transportation and distribution activities such as air, rail, road, and marine transport can result in these emissions

The category comprises two main types of emissions:

1. Emissions from the delivery of products purchased by the company from tier 1 suppliers to its own facilities, using vehicles that are not owned or operated by the company. This includes multimodal shipping that involves multiple carriers in delivering a product, but it does not consider emissions from fuel and energy products.
2. Emissions from third-party distribution services procured by the company either directly or through an intermediary during the reporting year. This includes inbound logistics (transportation of goods into the reporting company's facilities), outbound logistics (transportation of goods sold to customers), and third-party distribution between the reporting company's facilities.

Transportation and distribution activities are significant indirect sources of emissions in a company's value chain. By measuring and accounting for these emissions, companies can identify opportunities to reduce their transportation and distribution-related emissions. This may involve optimizing transportation routes, enhancing transportation efficiency, and considering alternative transportation methods with lower emissions, such as low-emission vehicles or renewable energy sources in transportation. By considering these emissions, this category provides a comprehensive approach to assessing emissions associated with transportation and distribution across the value chain, enabling companies to manage their Scope 3 emissions and contribute to their sustainability efforts.

### **Business travel**

Emissions from business trips taken by personnel in airplanes, trains, buses, and passenger cars that are not company-owned or -operated are included here. Aeroplanes, trains, buses, and cars (such as those used for commercial purposes; this does not include regular commutes to and from work) all contribute to these pollutants. Businesses have the option of including hotel emissions for business travelers, while this is not required.

The Scope 1 and 2 emissions of transport like airlines should be factored into a company's Scope 3 emissions from business travel. Cement companies' business travel emissions are considered negligible compared to their overall Scope 1, 2, and 3 emissions.

Emissions from transportation in vehicles owned or controlled by the entity should be reported separately under "Scope 1" (fuel-consuming cars) and Scope 2 (electric vehicles). However, Scope 3 emissions should be accounted for when employees use third-party-owned or operated cars for business-related transportation.

By accounting for emissions from business travel in Scope 3, companies can gain insights into the environmental impact of their employees' travel activities and identify opportunities to reduce emissions, such as encouraging the use of low-emission modes of transportation, promoting virtual meetings as an alternative to business travel, and exploring options for more sustainable

transportation options. This category provides a comprehensive approach to account for emissions associated with business travel, contributing to a company's efforts to manage and reduce its overall greenhouse gas emissions

### **Employee commuting**

This classification pertains to the release of pollutants produced during the conveyance of workers from their residences to their places of employment. These pollutants may be generated through a variety of modes of transportation, including automobiles, buses, trains, airplanes, and other means of transportation like subways, bicycles, or walking. Businesses may opt to encompass the emissions generated from telecommuting (i.e., employees working remotely) within this classification.

It is important to acknowledge that a company that reports emissions should incorporate the Scope 1 and 2 emissions of employees and external transportation service providers in their Scope 3 emissions resulting from employee commuting. However, in comparison to other Scope 1, 2, and 3 emissions, the emissions from employee commuting for cement enterprises are not considered significant.

By accounting for emissions from employee commuting in Scope 3, companies can gain insights into the environmental impact of employee transportation to and from work and identify opportunities to reduce emissions, such as promoting public transportation, carpooling, or teleworking options, and encouraging the use of low-emission modes of transportation like biking or walking. This category provides a comprehensive approach to account for emissions associated with employee commuting, contributing to a company's efforts to manage and reduce its overall greenhouse gas emissions

### **Downstream distribution**

The category of downstream distribution pertains to emissions produced by the distribution of goods utilizing vehicles that are not owned or managed by the reporting company. Cement companies must include all downstream transport emissions in either their “Scope 1” or “Scope 3” reports. Any emissions that are not part of the “Scope 1” report must be included in the “Scope 3” report.

For an accurate reporting of downstream distribution emissions, cement companies should take into account the Scope 1 and 2 emissions of transport companies, retailers, and, if applicable, customers. In case the company is involved in selling an intermediate product, emissions from the distribution of this product from the point of sale by the company to the end consumer or business customers should be reported if the eventual end use of the product is unknown. It is imperative for cement companies to identify and report on all emissions linked to downstream distribution activities.

By including emissions from downstream distribution in their Scope 3 reports, companies can determine the environmental impact of the distribution of their products throughout the value chain, even beyond their direct operational control. This helps companies to identify opportunities to reduce emissions by optimizing transportation routes, enhancing logistics efficiency, and collaborating with transportation and distribution partners to implement more sustainable practices. Reporting on these emissions in Scope 3 offers a comprehensive view of a company's carbon footprint and supports efforts towards more sustainable supply chain management practices.

### **Processing of sold products**

According to estimates, Scope 3 emissions in the downstream processes of the cement industry, which includes the mixing of concrete ingredients, are mainly attributed to electricity consumption at the mixing plant. However, such emissions are typically less than 2% of Scope 1 and 2 emissions associated with cement manufacturing. This suggests that although downstream processes may contribute to greenhouse gas emissions, they are generally a minor part of a cement company's overall emissions when compared to the emissions directly linked to the manufacturing operations (Scope 1 and 2).

It's important for cement companies to consider and disclose their Scope 3 emissions from downstream processes, including electricity consumption at mixing plants, as part of their overall sustainability and emissions reduction strategies. This can involve efforts to optimize energy efficiency, increase the use of renewable energy sources, and implement other mitigation measures to reduce Green House Gas emissions associated with the downstream processes of concrete production. By addressing Scope 3 emissions, cement companies can work towards a more comprehensive approach to managing their environmental impact throughout the entire value chain, from raw materials extraction to the end use of their products.

### **Analysis**

The report titled "Cement Sector Scope 3 Emissions Accounting and Reporting" is a comprehensive publication by the "World Business Council for Sustainable Development" (WBCSD) that focuses on the accounting and reporting of scope 3 emissions in the cement sector. The report, published in November 2016, provides an in-depth analysis of existing literature, methodologies, challenges, and opportunities related to scope 3 emissions, which are indirect emissions associated with the production and use of "purchased goods and services", as well as the transportation of materials and products in the cement value chain.

The report begins by highlighting the significant contribution of the cement sector to global greenhouse gas emissions, estimated to be approximately 5-7% of global CO<sub>2</sub> emissions. It emphasizes the need to address scope 3 emissions, as they often constitute a substantial portion of a company's total emissions and play a critical role in achieving climate change mitigation targets. The report also emphasizes the importance of collaboration among stakeholders along the cement value chain to effectively manage and reduce scope 3 emissions.

One of the strengths of the report is its thorough review of existing literature and methodologies for accounting and reporting scope 3 emissions in the cement sector. The report discusses various approaches, including the "cradle-to-gate" and "cradle-to-grave" methodologies, which consider emissions from the production and use of cement and concrete, as well as the end-of-life treatment of these materials. It also highlights the use of life cycle assessment (LCA) and environmental product declarations (EPDs) as tools to quantify emissions and assess the environmental impact of cement and concrete products.

The report acknowledges the challenges and limitations associated with accounting and reporting scope 3 emissions in the cement sector. These challenges include data availability, accuracy, and consistency, as well as the complexity of the cement value chain, which involves multiple actors and processes. The report also notes the need for standardized methodologies and reporting frameworks to ensure consistency and comparability of emissions data among different companies and regions.

This analysis provides a comprehensive overview of the complexities and challenges associated with scope 3 emissions accounting and reporting in the cement sector, which can serve as a valuable resource for companies, policymakers, and other stakeholders.

The report also emphasizes the importance of engaging with stakeholders along the cement value chain to effectively manage scope 3 emissions. It highlights the need for collaboration among cement producers, suppliers, customers, and other stakeholders to identify and implement emission reduction opportunities throughout the entire value chain. The report acknowledges that addressing scope 3 emissions requires a coordinated effort among all actors involved, and it provides examples of successful collaborative initiatives from the cement sector.

Another strength of the report is the inclusion of several case studies from cement companies that have implemented strategies to address scope 3 emissions. These case studies provide practical examples of how companies have approached emissions accounting and reporting, engaged with stakeholders, and implemented emission reduction measures. The case studies also highlight the benefits and challenges associated with such initiatives, including the potential for cost savings, improved reputation, and increased competitiveness. These real-world examples offer valuable insights and lessons learned for other companies in the cement sector seeking to address scope 3 emissions.

Furthermore, the report emphasizes the role of innovation and technology in reducing scope 3 emissions in the cement sector. It highlights the use of alternative fuels, such as biomass and waste-derived fuels, as well as energy efficiency measures, such as waste heat recovery and process optimization, as potential emission reduction strategies. The report also discusses the potential of carbon capture and storage (CCS) technologies as a long-term solution for mitigating CO<sub>2</sub> emissions from cement production. This analysis highlights the importance of innovation and technology adoption in driving emission reduction efforts in the cement sector and encourages companies to explore and adopt sustainable technologies.

Additionally, the report discusses the role of policy and regulation in driving emission reduction efforts in the cement sector. It highlights the need for supportive policy frameworks, such as carbon pricing, emissions trading, and renewable energy incentives, to incentivize companies to invest in low-carbon technologies and practices. The report also acknowledges the importance of international cooperation and global agreements, such as the Paris Agreement, in setting ambitious emission reduction targets and creating a conducive environment for sustainable practices in the cement sector.

## **Relevance of Scope 3 emissions in the Cement Industry**

### **Assessment of upstream categories**

The most significant contributors to emissions for cement companies are generally Scope 3 emissions from Category 1 “Purchased goods and services”, Category 3 “Fuel and energy-related activities”, and Category 4 “Upstream transportation and distribution”. Although emissions from Category 2 “Capital goods” may not be crucial for many cement companies, it may still be relevant for certain company structures. Minimal emissions result from Category 5 “Waste generated in operations” due to modern production processes. Although emissions from Category 6 “Business travel” and Category 7 “Employee commuting” are typically negligible, companies may report them if they choose to do so. Although emissions from Category 8 “Upstream leased assets” are also generally insignificant, companies may still have to report them if they lease production plant

capacity from another company. Cement companies must evaluate the significance of each Scope 3 category based on their specific operations and conditions and report accordingly, in line with industry best practices and reporting guidelines. This approach can help cement companies gain better insights into their indirect emissions across the value chain and identify opportunities for emissions reductions and sustainability improvements.

### Assessment of downstream categories

The manufacturing of cement acts as an intermediary product that has various downstream applications. These applications can vary among cement companies depending on their production techniques and operations. Although Category 9 emissions “Downstream distribution” must be reported by most companies, it can be difficult for cement manufacturers to measure emissions in Category 10 “Processing of sold products”, Category 11 “Use of sold products”, and Category 12 “End-of-life treatment of sold products”. This is due to the diverse applications of cement products, making it challenging for producers to determine the precise usage and reliability of the collected data for reporting emissions in these categories. Category 13 “Downstream leased assets” is only relevant if a company's assets are leased to another company. However, Category 14 “Franchises” and Category 15 “Investments” are not pertinent to the cement industry and, thus, do not require reporting. In the case where a subsidiary cement producer is fully or partially owned by the reporting company, their Scope 1 and 2 emissions must be included in the reporting company's emissions instead of being reported separately under Category 15 .

### Further Reporting in Cement Industry

Further analysis on the activities of typical cement companies has led to the identification of the most relevant categories for inclusion in emissions reporting. The specific details of these categories can be found in the relevant sections of this report. It should be noted, however, that companies deviating from the typical structure of the cement sector may need to measure additional categories to comply with the Guidance. For example, while owning investments or operating franchises is not a typical practice for cement companies, those that do engage in these activities may need to consider these categories.

The identified categories in this Guidance are classified as “required”, “optional on the basis of relevance”, “optional on the basis of intermediate product status” in the Green House Gases Scope 3 Standard, or usually not relevant to cement companies

Table 4: Scope 3 categories relevant to cement companies

	Blending plant operators	Grinding plant operators	Vertically integrated manufacturers
1 Purchased goods and services	→	→	→
2 Capital goods	↙	↘	↙
3 Fuel and energy-related activities	→	→	→
4 Upstream transportation and distribution	→	→	→
5 Waste generated in operations	—	—	—
6 Business travel	↙	↘	↙
7 Employee commuting	↙	↘	↙
8 Upstream leased assets	—	—	—
9 Downstream transportation and distribution	→	→	→
10 Processing of sold products	↙	↘	↙
11 Use of sold products	↔	↔	↔
12 End-of-life treatment of sold products	↔	↔	↔
13 Downstream leased assets	—	—	—
14 Franchises	—	—	—
15 Investments	—	—	—

Key

- required
- ↙ optional on basis of relevance
- ↔ optional on basis of intermediate product status
- not relevant to cement companies

## Conclusion

In conclusion, the Cement Sustainability Initiative's (CSI) Cement Sector Scope 3 GHG Accounting and Reporting Guidance is a comprehensive and valuable resource for cement manufacturers and stakeholders in the industry. The guidance provides a structured and standardized approach for measuring, reporting, and reducing greenhouse gas (GHG) emissions associated with the entire life cycle of cement, including both direct and indirect emissions.

The report emphasizes the importance of accounting for Scope 3 emissions, which are emissions that occur outside of a company's direct operations but are associated with its value chain, including the extraction of raw materials, transportation, and use of cement in construction. It highlights the need for robust and transparent reporting of Scope 3 emissions, as they represent a significant portion of the cement industry's total emissions and play a critical role in addressing climate change.

The guidance also promotes collaboration and engagement with stakeholders along the value chain, including suppliers, customers, and investors, to collectively reduce emissions and drive sustainable solutions. It encourages the adoption of best practices, innovation, and technology solutions to improve energy efficiency, reduce emissions, and transition towards low-carbon and circular economy approaches.”

Furthermore, the report emphasizes the importance of setting science-based targets and aligning them with the goals of the Paris Agreement to limit global warming to well below 2 degrees Celsius. It also underscores the need for continuous improvement through monitoring, measuring, and reporting of emissions, and regular review of targets and progress towards achieving them.

In conclusion, the Cement Sector Scope 3 GHG Accounting and Reporting Guidance provides a robust framework for the cement industry to account for and reduce its Scope 3 emissions, align with global climate goals, and drive sustainability across the value chain. By following the guidance, cement manufacturers can contribute to mitigating climate change, reducing environmental impacts, and building a more sustainable future for the cement sector and beyond.

## Limitations

However, despite the strengths of the report, there are some limitations that should be acknowledged. Firstly, the report was published in 2016, and the landscape of the cement sector and the global sustainability agenda may have evolved since then. It would be valuable to have an updated version of the report to reflect the latest developments in emissions accounting and reporting in the cement sector.

Secondly, while the report provides a comprehensive overview of existing literature, methodologies, and case studies, it could benefit from more quantitative data and analysis to support its findings and recommendations. Concrete data on emissions reduction potential, costs, and benefits of different strategies would provide a more robust basis for decision-making by companies and policymakers.

Moreover, the report could further explore social and economic aspects related to scope 3 emissions, such as the social impacts of cement production and use, economic implications for different stakeholders, and potential strategies for addressing social and economic challenges. This would provide a more holistic understanding of the complexities associated with scope 3 emissions in the cement sector.

Furthermore, the report could delve deeper into the specific challenges and opportunities associated with scope 3 emissions in different regions and countries, as the cement sector is diverse in terms of

production methods, technologies, and regulatory frameworks across different geographies. Understanding the context-specific challenges and opportunities would enable tailored strategies and policies that are better suited to the unique characteristics of different regions.

In conclusion, the "Cement Sector Scope 3 Emissions Accounting and Reporting" report by the WBCSD provides a comprehensive analysis of the challenges and opportunities associated with accounting and reporting of scope 3 emissions in the cement sector. The report highlights the importance of collaboration, innovation, policy support, and engagement with stakeholders to effectively manage and reduce scope 3 emissions. It provides valuable insights from existing literature, methodologies, and case studies, and encourages companies and policymakers to take concrete actions to address scope 3 emissions in the cement sector. However, the report could benefit from more quantitative data, deeper analysis of social and economic aspects, and context-specific considerations to provide a more comprehensive and up-to-date understanding of the complex issue of scope 3 emissions in the cement sector.

### **Future scope of study**

The "Cement Sector Scope 3 Emissions Accounting and Reporting" report by the WBCSD provides a valuable foundation for understanding the challenges and opportunities associated with scope 3 emissions in the cement sector. Building on this report, there are several potential areas for future research and study to further advance our understanding of this important topic.

- 1. Quantitative analysis of scope 3 emissions:** The report provides an overview of existing methodologies for accounting and reporting scope 3 emissions in the cement sector, but there is a need for more quantitative analysis to estimate the magnitude of scope 3 emissions and their drivers. Future research could focus on developing robust models and tools to quantify scope 3 emissions from cement production, distribution, and use, and assess the relative contribution of different activities and processes to overall emissions. This would help companies and policymakers prioritize their mitigation efforts and identify the most effective strategies for reducing scope 3 emissions.
- 2. Comparative analysis of regional and country-specific challenges:** The cement sector is characterized by regional and country-specific variations in production methods, technologies, and regulatory frameworks. Future research could conduct a comparative analysis of scope 3 emissions in different regions and countries, taking into account their unique characteristics and challenges. This could provide insights into the contextual factors that influence scope 3 emissions in different regions, and identify region-specific strategies and policies for emissions reduction.
- 3. Social and economic aspects of scope 3 emissions:** The report briefly touches upon the social and economic aspects of scope 3 emissions, but there is a need for further research in this area. Future studies could investigate the social impacts of cement production and use, such as health effects on local communities, livelihoods of workers, and human rights issues. Additionally, economic implications for different stakeholders, such as costs and benefits of emissions reduction strategies, economic incentives for adopting low-carbon technologies, and potential business models for circular economy approaches, could be explored in more depth. This would provide a more holistic understanding of the broader sustainability implications of scope 3 emissions in the cement sector.

4. **Innovations and technologies for emissions reduction:** The report highlights the need for innovation and technology development to achieve emissions reduction in the cement sector. Future research could focus on identifying and evaluating innovative technologies and practices that have the potential to significantly reduce scope 3 emissions. This could include emerging technologies, such as carbon capture, utilization, and storage (CCUS), alternative fuels and raw materials, and process optimization techniques. The feasibility, scalability, and cost-effectiveness of these technologies could be assessed, along with their potential barriers to adoption, and opportunities for policy support and industry collaboration.
5. **Stakeholder engagement and collaboration:** The report emphasizes the importance of stakeholder engagement and collaboration in addressing scope 3 emissions in the cement sector. Future research could investigate different stakeholder perspectives and interests, and the dynamics of stakeholder engagement processes in the context of scope 3 emissions. This could include understanding the roles and responsibilities of different stakeholders, barriers and facilitators of stakeholder engagement, and strategies for effective collaboration among stakeholders. Lessons learned from successful stakeholder engagement initiatives in the cement sector and other relevant industries could provide valuable insights for future efforts.
6. **Policy and regulatory frameworks:** The report acknowledges the role of policy and regulation in driving emissions reduction efforts in the cement sector. Future research could further explore the effectiveness of different policy and regulatory frameworks in incentivizing emissions reduction and promoting sustainable practices in the cement sector. This could include analyzing the impacts of carbon pricing, emissions trading, renewable energy incentives, and other policy instruments on scope 3 emissions, as well as identifying best practices and lessons learned from policy implementation in different countries and regions.

In conclusion, the "Cement Sector Scope 3 Emissions Accounting and Reporting" report by the WBCSD provides a solid foundation for understanding the challenges and opportunities

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