



**Holcim**

**DECARBONISING THE BUILT ENVIRONMENT  
BY BUILDING BETTER WITH LESS?**

Case Study

**Oxford Initiative on Rethinking Purpose**

Saïd Business School

University of Oxford

**ORP Working Paper 2301**

# Holcim

Thea Jung (Cambridge University/ University of Oxford)  
Ryan Roberts (Holcim Ltd.)  
Maria Eugenia Ceballos-Hunziker (Holcim Ltd.)  
Judith C. Stroehle (University of St. Gallen/ University of Oxford)

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(i) aims at creating cutting-edge **research** to challenge conventional performance theory, measurement, and management. Research streams include purpose relevance at system and investor level, management decision-making and strategy, and cost-accounting and measurement; (ii) it **engages** with partners to develop frameworks for operationalising purpose and discuss and test ideas with a wide network of organisations and thought leaders; and (iii) conducts **outreach** activities to shape thought and practice via novel teaching and engagement programmes and regularly convening for knowledge exchange on how to rethink performance.

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## Contact Details

Oxford Rethinking Performance (ORP) Initiative  
Saïd Business School, Oxford University  
kimberley.payne@sbs.ox.ac.uk

## Overview: Purpose and structure of Case Study

### Purpose of case study

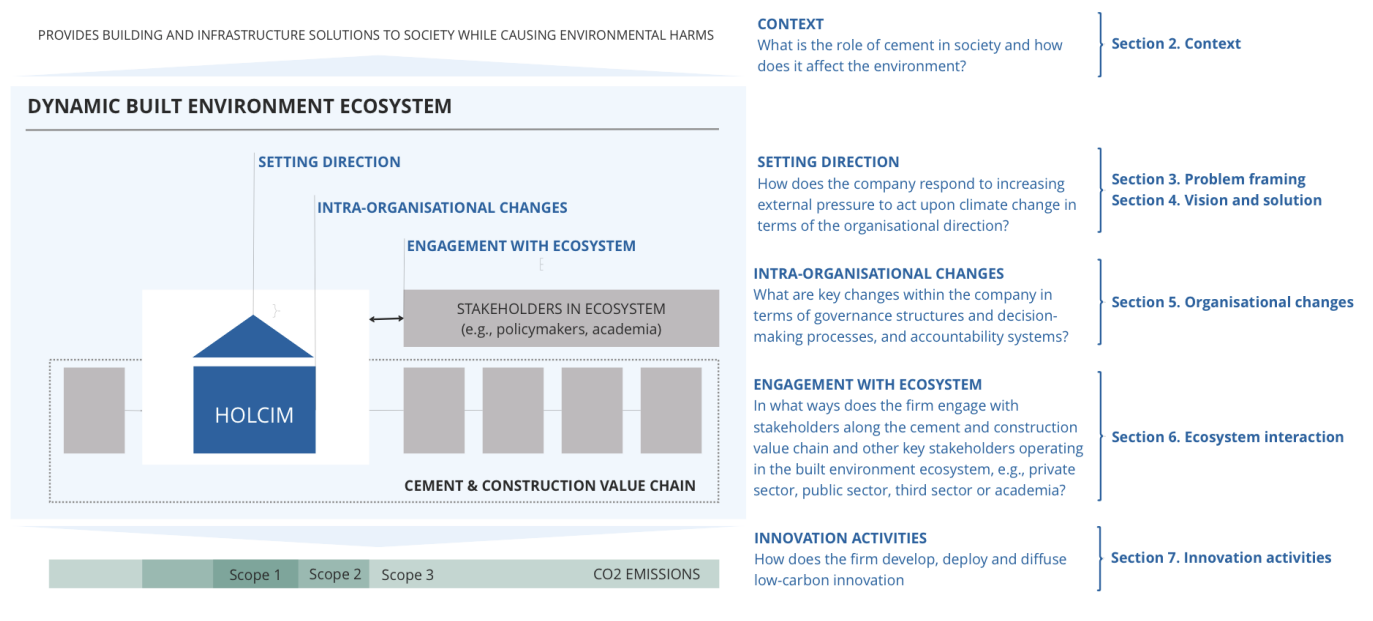
This case study explores how Holcim, as a leading company within the harder-to-abate sectors, responds to increasing external pressure to act upon climate change. We identify key actions the firm is undertaking to deal with the pressing challenge of climate change, both within and beyond their organizational boundaries. We pay particular attention to the role of Holcim within the wider ecosystem, given that developing novel and implementing existing mitigation solutions along the cement value chain often requires sustained and coordinated action from across private, public, and third sectors.

### Structure of case study

Section 1 introduces the case, situating Holcim as one of the largest, global cement manufacturers, while featuring one of the lowest CO2 emissions intensities within the cement sector. Section 2 provides background on the cement industry and its demand evolution, highlighting that concerted efforts are needed to accelerate decarbonisation of the cement industry and to bring the sector on track to net-zero by 2050. Section 3 explores the firm's systemic, reflexive view on climate change, associated problem framing, while Section 4 describes the firm's preferred solution scope and assumed agency. Section 5 and 6 discuss key actions the firm undertakes within and beyond organisational boundaries, while section 7 focuses on how the firm fosters the development, deployment, and diffusion of innovation activities. Section 8 discusses key insights and concludes with recommendations.

Figure 1 provides an overview of the case study contents, including key questions and sections.

Figure 1. Overview of Case Study Contents: Key questions and sections.



# 1. Introduction

Holcim Ltd. (Holcim) is one of the leading building material manufacturers in the world, supplying cement, aggregates, ready-mix concrete and integrated building solutions and products. The firm is among the top three building material producers by revenue (CHF 29.2 bn, in net sales)<sup>1</sup> and installed cement capacity (260.5 million metric tons per year).<sup>2</sup> Headquartered in Switzerland, the multinational company (MNC) operates in more than 50 countries around the world and employs circa 60.000 people.

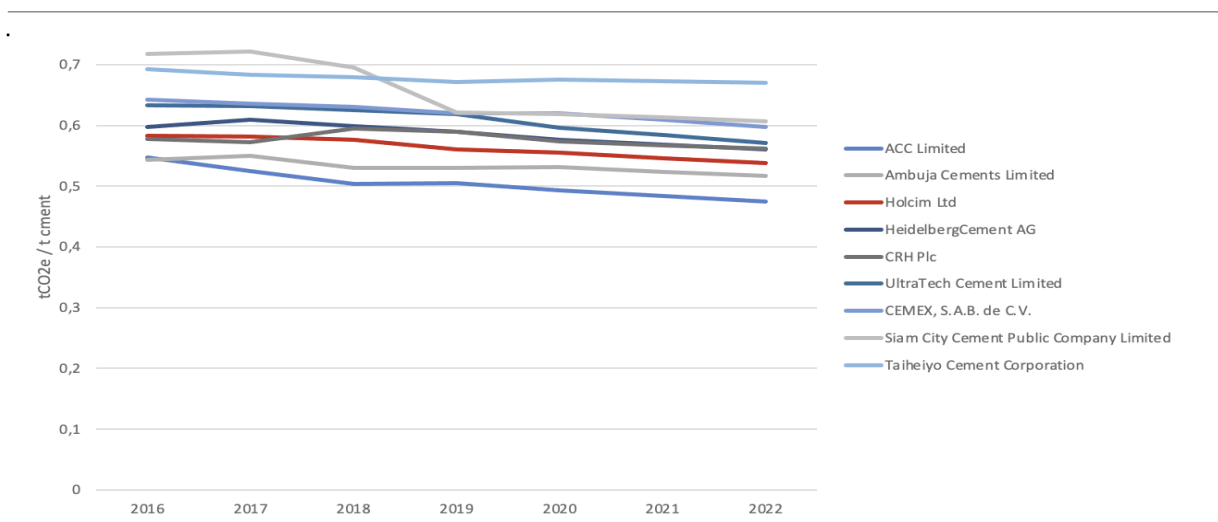
As of late, companies like Holcim that are operating in one of the so-called harder-to-abate, energy-intensive sectors, such as the cement industry, have come under increasing pressure to act upon the urgent challenge of climate change. The cement industry accounts for approximately 7% of global CO<sub>2</sub> emissions, and progress in decarbonizing the cement industry has been limited, to date, and comprehensive policy frameworks are often lacking.<sup>3</sup> Limiting global temperature rise to 1.5-2°C above pre-industrial levels requires rapid transformations of industrial systems (IPCC, 2018; 2022).

Within the cement industry, Holcim has one of the lowest CO<sub>2</sub> emissions intensities (see Figure 1), accounting for 0.55 tons of CO<sub>2</sub> per ton of cementitious product in 2021.

This is below the cement sector average of 0.60 tCO<sub>2</sub>/t, yet above the sectoral CO<sub>2</sub> emissions targets in 2021, namely 5.33 tCO<sub>2</sub>/t in 2021.<sup>4</sup> Over the past five years, Holcim has increasingly prioritized climate change mitigation within their corporate strategy, as reflected, e.g., in “Accelerating Green Growth – 2025”. The firm’s updated purpose is “to build progress for people and the planet”, with the aim of “decarbonizing building for a net-zero future, [...] while improving living standards for all”.<sup>4</sup> The firm seeks to provide low-carbon solutions which enable the construction industry across all regions to “build better with less”.<sup>5</sup>

Yet, Holcim faces a challenge: Decarbonizing the built environment requires concerted efforts from stakeholders across the whole value chain to transform prevailing unsustainable production, distribution, and consumption systems. While a range of mitigation levers have been identified, no single, one-size-fits-all solution exists to reduce CO<sub>2</sub> emissions along the value chain. Deploying, testing, and scaling existing technological innovations is often subject to country-specific conditions, such as natural resource endowment, institutional settings, low-carbon product demand or industrial structures. What then is and should be the role of Holcim in the net-zero transition of the cement value chain?

Figure 2. CO<sub>2</sub> emissions intensity of Holcim and other cement companies (2016-2022).



<sup>1</sup> Holcim, 2023a (<https://www.holcim.com/media/media-releases/full-year-2022-results>)

<sup>2</sup> Statista, 2022 (<https://www.statista.com/statistics/297845/cement-producers-capacity>)

<sup>3</sup> ETC, 2018; IEA, 2020.

<sup>4</sup> TPI, 2022.

<sup>5</sup> Holcim, 2023b (<https://www.holcim.com/what-we-do>)

## 2. Context: The complex, industrial ecosystem of the built environment

Concrete is the second-most consumed material in the world after water, with a total of 14 billion metric tons produced in 2021.<sup>6</sup> Made from limestone, sand, water and aggregates, it is the binding element in the formation of concrete, the most widely used construction material.<sup>7</sup> Given the material's strength, water-resistance, abundance and affordability, concrete is considered essential for meeting the United Nations Sustainable Development Goals (UN SDGs) affordable housing (SDG 6), and establishing the basis for key infrastructures of transport and (clean) energy systems (SDG 9), e.g., bridges, buildings, dikes, dams or wind turbine foundations.<sup>8</sup> Moreover, in many countries, cement manufacturing and adjacent sectors along the concrete and construction value chain are considered crucial for creating jobs and economic growth (SDG 8).<sup>9</sup>

Concrete production has increased almost 30-fold since 1950, given continuous population growth, urbanization, and economic growth.<sup>10</sup> As these trends continue, demand for concrete is expected to increase up to 16 billion metric by 2050. 60% of the built environment estimated to be required to accommodate for building and infrastructural needs of the global, urban population by 2050, still needs to be constructed.

Yet, besides being considered as "fundamental" material for society and economy, it has also been labelled the "most destructive material on earth".<sup>11</sup> This is due to significant environmental harms linked to the activities along the cement value chain from quarrying raw materials to transforming

limestone into clinker and concrete, up to the demolition of building stock: Environmental harms include resource degradation, biodiversity loss, landfill, noise and greenhouse gas emissions, such as CO<sub>2</sub> emissions.

In this case study, we focus on CO<sub>2</sub> emissions of the global cement industry, which, in 2022, accounts for about 7% of all global anthropogenic carbon dioxide emissions per year.<sup>12</sup> Cement-related, direct CO<sub>2</sub> emissions include energy-related (circa 40%) and process-related CO<sub>2</sub> emissions (circa 50%); indirect CO<sub>2</sub> emissions include transport- and electricity-related CO<sub>2</sub> emissions (circa 10%).

To date, progress in decarbonising the cement industry has been slow, and the industry is not on track to achieve net zero by 2050. During 2015-2021, direct CO<sub>2</sub> intensity of cement production increased by about 1.5% per year, while 3% annual declines are required up to 2030 to get on track with the IEA 2050 Net Zero Emissions Scenario.<sup>13</sup>

No single, one-size-fits-all solution exists to decarbonise the built environment. Yet, a range of existing and near-horizon mitigation levers have been identified to reduce cement and concrete CO<sub>2</sub> emissions. These include increased usage of alternative fuels, energy efficiency and material efficiency efforts, such as using right-sized prefabricated components, cementitious material substitution, as well as carbon capture utilisation and storage.<sup>14</sup>

<sup>6</sup> GCCA (2022), [www.gccassociation.com](http://www.gccassociation.com).

<sup>7</sup> Naqi and Jang, 2019; Oss and Padovani, 2003

<sup>8</sup> ME, 2019; Scrivener et al (2018)

<sup>9</sup> EC, 2018.

<sup>10</sup> Gilfillian et al., 2019, UNFCCC, 2019

<sup>11</sup> Watts (2019),

<https://www.theguardian.com/cities/2019/feb/25/concrete-the-most-destructive-material-on-earth#:~:text=Concrete%20causes%20up%20to%208,our%20relationship%20to%20the%20planet.>

<sup>12</sup> Global cement production is the third largest source of anthropogenic CO<sub>2</sub> emissions due to decomposition of carbonates, after (i) oxidation of fuels, and (ii) deforestation and other land use changes. Anthropogenic CO<sub>2</sub> emissions, accounting for the major share of GHG emissions

have been recognized as a key contributor to increases in the average global temperature by more than 1°C since the pre-industrial era (IPCC, 2018). Cement is one of the harder-to-abate energy-intensive industries (EIs), which also include manufacturing of other industrial materials, such as iron and steel, pulp and paper, or aluminium, and which jointly account for about 69.0% of total direct CO<sub>2</sub> emissions from industry (IEA, 2020). Cement is the largest source of direct CO<sub>2</sub> emissions from industry, which is predominantly due to large volumes produced by the cement industry.

<sup>13</sup> IEA, 2023. (<https://www.iea.org/reports/cement>)

<sup>14</sup> IPCC, 2022.

### 3. Systemic view and iterative approach to problem (re)definition

#### Taking a systemic view for broad problem framing

Holcim adopts a “systemic view” on the challenge of climate change in terms of articulating a *broad* problem framing that “looks beyond [our] own boundaries” (C. de Meeûs): Instead of solely focusing on decarbonizing cement operations (Scope 1 emissions), the firm’s problem framing encompasses the whole value chain (Scope 1-3 emissions), as e.g., Scope 3 emissions are “still bigger than Milan’s CO<sub>2</sub> emissions” (M. Anderson). The firm’s broad problem framing thus focuses on how to shift towards carbon-neutral construction and contribute to “accelerat[ing] our world’s shift to net-zero” (Holcim, 2022: 4), while providing affordable, resilient building solutions around the world that are “better for all stakeholders” (R. Roberts).

Based on the adopted systemic view, Holcim recognizes interdependencies between actors along the cement and construction value chain:

*“One actor’s Scope 1 emissions are another actor’s Scope 3 emissions.” (M. Anderson)*

On the one hand, the firm is aware that besides cement producers, various other stakeholders along the value chain, including suppliers, civil engineers, construction companies and architects, are involved in co-producing prevailing, unsustainable systems of production, distribution, and consumption. On the other hand, no “no single organisation can tackle [the problem] alone” (Holcim, 2022: 68), as climate change is a problem of many. In turn, to tackle the challenge of climate change “unprecedented collaboration” (ibid.) is needed: Decarbonising the whole built environment requires concerted and sustained efforts from actors across sectors.

In sum, to deal with the two-fold complexity of climate change and a dynamic, complex industrial ecosystem within which the firm is operating in, Holcim adopts a ‘systemic’ view on the problem. While the ‘system’ of interest is defined by the firm, our case shows that via such approach the firm recognises interdependencies both in constituting prevailing and in co-creating shifts towards novel practices and systems of production, distribution, and consumption.

#### Taking an iterative approach to problem (re)definition

Confronted with uncertainty and dynamic complexity associated with climate change and the industrial ecosystem, the firm adopts a process-based approach to redefining the problem and solution, as novel information might emerge, or ecosystem dynamics evolve. Neither the problem, nor the solution are conceived to be “black and white” (C. de Meeûs), emphasising the need to recognise problem definition and solution diagnosis to deal with climate change “as a process around a very complex topic” (ibid.).

Holcim adopts an iterative approach, with the sustainability team recurrently asking,

*“(i) what is the problem, (ii) what is our agency, (iii) what can we do first.” (R. Roberts)*

Throughout the last decade, the firm has iteratively adjusted their problem and solution scope, as well as their vision and strategy in response to novel information or ecosystem dynamics. For instance, as external pressure increased, impact measurement practices improved, and sectoral benchmarks were established, the firm updated their CO<sub>2</sub> emissions reduction targets to encompass not only Scope 1, but Scope 1-3 emissions; as well as upgrading the targets to be more ambitious in terms of aligning first with the 2-Degrees-Scenario and subsequently with the 1.5°C-Degree Scenario. The firm deals with uncertainties and potential contestation, by relying on science-based validation by external entities and tying into established accountability systems to increase transparency and legitimacy of the corporate net-zero strategy and targets.

Overall, in the context of a dynamically evolving complex industrial ecosystem, the firm’s iterative approach seems highly fruitful: This includes recurrently updating assumptions on what might be the key problem to focus on, what might be potential, preferred, and feasible solutions as well as in what ways the challenge might be governable, and what the potential role, and limits thereof, of the actor may be, given its agency, positioning and resources within the ecosystem.

## 4. Aspired vision and proposed solution: Building better with less cement

### Aspired vision and redefining its role in ecosystem

Mirroring the broad problem framing, the firm aspires to

*“be [...] the indisputable global leader in innovative and sustainable building solutions.”*  
(E. Bermejo)

This differs from the firm’s prior vision articulated in the 2017 strategy “Building for Growth – 2022” with the “vision [...] to be a global blue-chip company in the attractive and growing building materials market” (LH, 2018: 1), reflecting the firm’s directional shift towards increasingly prioritising climate change mitigation.

Holcim seeks to redefine their role within the ecosystem, assuming it has a “critical role to play to help decrease that carbon footprint” (Holcim, 2022: 68) of the built environment. Aspiring to be recognised as “most innovative company” and “disruptor” with impact in the overall built environment fits with the firm’s broad problem framing (E. Bermejo).

To redefine and sustain the aspired role, the firm proactively engages in branding, marketing, and signalling activities to distance itself from negative images of the ‘heavy polluting’ cement industry and ‘greenwashing’ private sector. Hereby, the firm seeks to increase their credibility, transparency, and legitimacy by relying on third-party organisations to, partly scientifically, validate the firm’s strategy, targets, impact measurement practices and progress.

### Solution scope: Indispensability of cement

Holcim’s proposed solution is to “build more with less, yet more valuable cement” (E. Bermejo). Seeking to be part of and contribute to the net-zero transition, the firm highlights the indispensability of cement, and recognises the need to decarbonise cement, which differs from earlier assumptions that developing less carbon intensive cement and concrete would not be required due to path dependencies: “everything is dependent on cement” (E. Bermejo). To date, no suitable alternative material substitute exists that feature required construction material characteristics, such as durability, strength, affordability, abundance, as well as less carbon intensive. The firm acknowledges existing alternatives, less CO<sub>2</sub> intensive construction materials, such as wood, yet pledges for a whole-lifecycle and long-term view when

evaluating the performance of buildings: “It does not make sense to impose thresholds in terms of material use - it always depends on the local context. The focus should therefore be on the building’s lifecycle performance and not a single material” (C. de Meeûs).

The firm’s solution scope entails

- (i) transforming the image of cement from “conservative” and “traditional” to “innovative” (E. Bermejo), as product that features various additional attributes such as workability or carbon neutrality; and
- (ii) transforming the current business model by reallocating the relative shares of business segments within the firm’s portfolio: Instead of being predominantly a “commodity provider” (M. Anderson), the firm seeks to increasingly offer integrated building solutions, expanding the share of the business segment ‘Solutions and Products’ to one third of total net sales to external customers by 2030. Integrated, built environment solutions include cooling roofing products or energy efficient refurbishments.

### Potential and limits to agency

While Holcim seeks to take on responsibility and contribute to shifting towards a low-carbon built environment, the firm is also aware of limits to its own agency. This is particularly due to differences in stakeholders along the value chain when it comes to normative stances towards climate change, awareness of opportunities for mitigating climate change, and prioritisation of climate action. Moreover, the firm acknowledges that addressing the problem, attaining the firm’s vision of a low-carbon built environment, and reducing Holcim’s Scope 1-3 emissions requires engagement from stakeholders along the value chain, from adjacent sectors, and from academic and public sector domains. For instance, introducing comprehensive policy packages are considered essential to enable the company and sector to “stay competitive and sustainable”.

*“Achieving carbon neutrality requires the involvement of entire value chains. A company alone cannot achieve it - it is a societal endeavour.”* (C. de Meeûs)

Given the firm’s awareness of its limited agency in transforming the whole complex industrial ecosystem, a range of actions within (section 5) and beyond (section 6) organisational boundaries are undertaken which we describe in the following.

## 5. Intra-organisational shifts oriented to purpose to build better with less

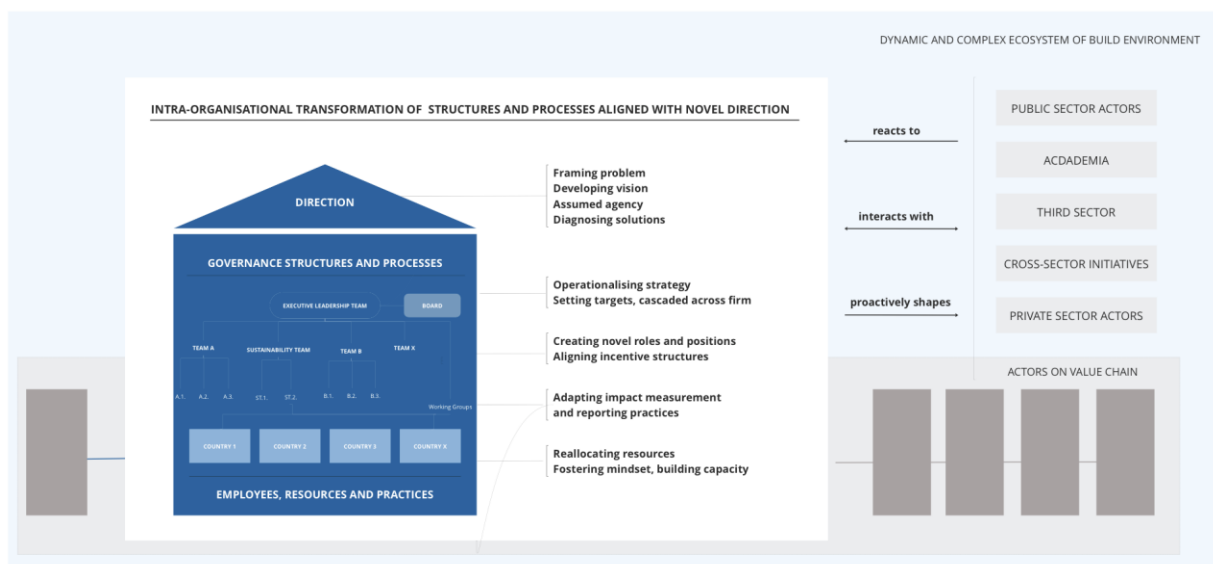
### Operationalizing and endorsing corporate strategy top-down

Over the past five years, Holcim has increasingly prioritized climate change mitigation within their corporate strategy, as reflected, e.g., in the most recent one “Accelerating Green Growth – 2025”. The firm’s updated purpose is “to build progress for people and the planet”, with the aim of “decarbonizing building for a net-zero future, [...] while improving living standards for all”.<sup>4</sup> The firm seeks to provide low-carbon solutions which enable the construction industry across all regions to “build better with less”.<sup>15</sup> The corporate strategy is endorsed “top down” via “bold” leadership to ensure a cohesive approach within the organization and across all teams: “We basically decide where the tanker goes”, by developing a “corporate narrative” that everyone “needs to be aware of and that we spin” (C. de Meeûs).

### Setting targets in alignment with direction

The firm has adapted both short- and long-term targets for Scope 1, 2, and 3 emissions, which are validated and legitimised via external, science-based organizations, such as the [Science-Based-Targets Initiative](#). In contrast to earlier targets, these are based on different time horizons, increase the firm’s ambition in terms of being aligned with a 2-Degree-Scenario and then with the recently upgraded sectoral 1.5°C decarbonization guidance.<sup>16</sup> Corporate targets are externally validated to increase transparency, legitimacy, and credibility, and cascaded across country-level offices with potential room for manoeuvre if a country office seeks to set more ambitious targets.

Figure 3. Overview of key intra-organisational changes to align with novel direction.



<sup>15</sup> Holcim, 2023b (<https://www.holcim.com/what-we-do>)

<sup>16</sup> SBTi, 2022: 5.



### **Adjusting governance structures, aligning incentive structures**

The firm has established a range of positions, explicitly tasked with the responsibility to implement measures within and beyond the company to drive climate change mitigation within the built environment. This includes the appointment of a Chief Sustainability Officer as well as committees and an interdisciplinary sustainability team, that operates across departments to promote the novel sustainability-oriented direction. Moreover, the firm adapted intra-organisational incentive structures for both senior management and other employees. Incentives include specific targets for CO<sub>2</sub> emissions intensity reduction or the amount of recycled waste and have been updated to align with the revised CO<sub>2</sub> emissions targets to be in line with the firm's long-term net-zero ambition. By adapting the firm's internal incentive structure, the firm aims to become "competitively sustainable" (E. Hunziker-Ceballos), ensuring that decision-makers do not have to choose between profit and sustainability.

### **Adapting impact measurement practices**

The firm continuously improves their impact measurement and reporting practices. "[I]s the data right, and where do these carbon emissions actually occur? That is the starting point" (R. Roberts). This includes the development of [integrated profit and loss statements](#), ensuring compliance with established reporting guidelines (e.g., GRI or SASB), and hiring external third-party organisations to [certify and validate impact measurement and reporting practices](#). By tying into external accountability systems, the firm aims to increase external credibility and transparency on the firm's carbon performance. In addition, the firm strengthens internal and external skills to increase the accuracy and consistency of Scope 1-3 emissions data collection across involved stakeholders, e.g., by supporting 'suppliers-in-transition', or integrating lifecycle emissions calculation software along the value chain (E. Hunziker-Ceballos).

### **Reallocating resources, developing novel products and capacity building**

To cater to the vision of providing innovative and sustainable building solutions, the firm reallocates their business portfolio. Between 2020-2022, Holcim has reallocated their resources, expanding the business segment of solutions and products from 8% to 19% of total net sales to external consumers (Holcim, 2023). Moreover, the firm invests in novel product development, aiming to provide innovative building solutions, for instance, via the low-carbon cement range of EcoPact (see Section 7). In addition, the firm established the sustainability academy with customised skills development for employees, depending on their position, responsibility, and perception of the topic. For instance, to attain a business model transformation in line with the vision of building more with less, the sales team requires to shift their mindset in terms of "thinking in margins and volumes to [thinking in] value" (E. Bermejo).

In turn, living up to the CO<sub>2</sub> emissions reporting guidelines, responsible employees need to be trained on how to leverage novel software and tools, to increase accuracy and consistency of data collection practices across the globe. Finally, adopting a decentralised approach, the sustainability team trains key brokers across country offices and departments to promote sustainability-oriented practices both within the firm (E. Hunziker-Ceballos), and to prepare local teams to engage with external actors while adhering to the overall corporate narrative. By establishing working groups on key themes and products, the firm aims to foster knowledge exchange across countries and increase joint, evolutionary learning from best practices for developing, deploying, and scaling different low-carbon innovations.

## 6. Interacting with key stakeholders to transform the built environment

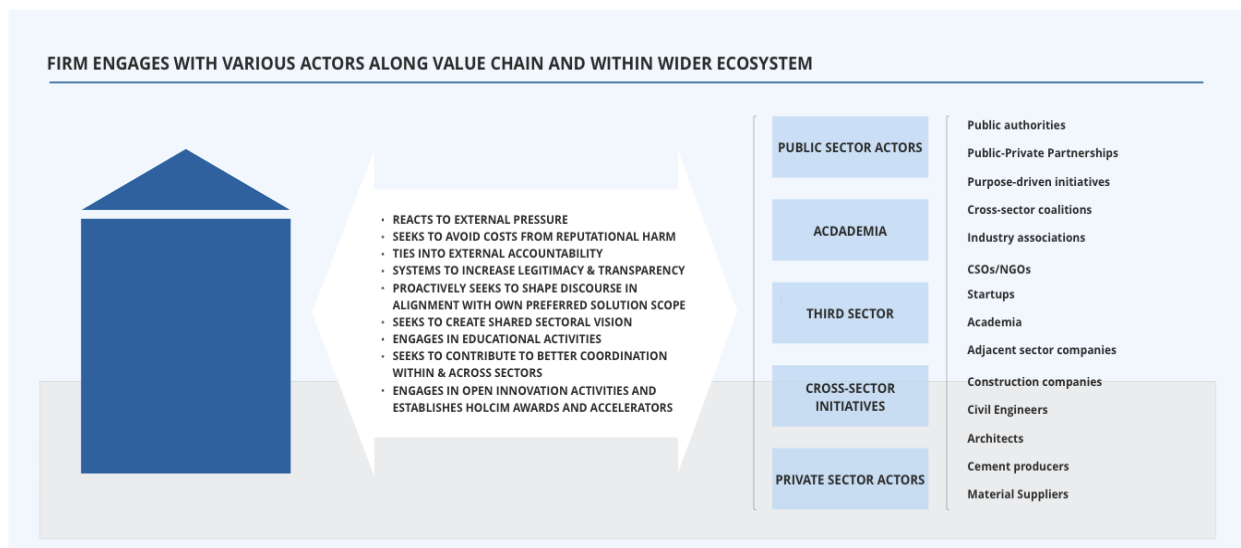
### Tying into external accountability systems

Holcim engages with a range of third-party entities to obtain external validation and increase transparency, credibility and legitimacy of the firm’s strategy and business operations. One key underpinning mechanism is the firm’s aim to avoid political and economic costs from reputational harm, e.g., emerging from prevailing negative images of the heavy polluting cement industry or greenwashing across the private sector. External branding and signalling activities include public pledges, science-based validation of short- and long-term Scope 1-3 emissions reduction targets, leveraging of sustainability rankings, guidelines, and benchmarks to monitor and showcase the firm’s performance in reducing CO2 emissions. Moreover, Holcim strategically engages with various purpose-driven initiatives to signal the firm’s commitment to and exchange with peers on net-zero transitions in the built environment and beyond, such as the [First Mover Coalition](#).

### Firm contributes to intra- and intersectoral coordination mechanisms in ecosystem

Acknowledging the need for concerted efforts within the cement sector and the whole built environment ecosystem, Holcim engages with various stakeholders: First, with industrial peers and association, the firm joins forces to co-create a shared sectoral vision and decarbonisation roadmaps, on global or regional levels. For instance, Holcim’s CSO led the working group for the global net-zero roadmap for the cement and concrete industry. Moreover, the firm collaborates with other organisations to develop shared impact measurement practices within the sector (e.g., WBCSD, IEA), and emerges as founding member for several novel entities or networks that, e.g., aim to foster best practice exchange. Finally, individual employees or the affiliated Holcim Foundation operate as brokers between, e.g., academia and industry, or the public and private sector to enable exchange among various stakeholders. Through above mentioned channels the firm interacts with a range of actors to work towards the firm’s vision of decarbonising the built environment.

Figure 4. Overview of interactions of firm with actors in wider built environment ecosystem.



### **Proactive discursive and educational activities**

The firm seeks to proactively shape the discourse within the ecosystem in alignment with the firm's preferred solution scope, namely, to build more and better with less cement. As cement producer, the firm clearly highlights the indispensability of cement, and the decarbonisation thereof, as existing low-carbon solutions, such as wood, are not suitable for all contexts.

Holcim engages with peers to develop joint positions on key issues, such as regulatory frameworks, promoting a constructive, not defensive approach. Moreover, the firm engages in educational and marketing campaigns about existing low-carbon solutions, to inform clients about less carbon intensive solutions, such as EcoPact. Here, Holcim contributes to a "chain of education" (V. Elfmarkova) among relevant parties involved in a construction project. The firm seeks to further increase awareness on the gravity and scale of climate change among architects and civil engineers, highlighting their crucial role in enabling a transition toward a sustainable built environment. For instance, a targeted section in the firm's

showroom in Lyon showcases potential mitigation solutions where architects would emerge as key stakeholders in implementing these. Extending the problem scope to include Scope 1-3 emissions, the firm increasingly cooperates and supports in-transition suppliers to, e.g., develop roadmaps, educating them and promoting capacity development to align their practices with sustainability standards, and assuring Holcim to meet EPD requirements. Lastly, the firm engages bilaterally, via trade associations or other initiatives with regulatory authorities to ensure that the cement industry can "stay sustainable competitive" (E. Ceballos-Hunziker) in Europe and beyond. The firm highlights that an enabling policy framework is indispensable for the development, deployment, and diffusion of technological, low-carbon innovations. For instance, diffusing low-carbon cements is difficult unless the novel material is within building and material codes, or standards are adapted, which are often lengthy processes. Aligning regulatory frameworks are considered instrumental to induce coordinated shifts in practices across the value chain and "to get the ecosystem work in concord" (C. de Meeüs).

## 7. Distributed experimentation and open innovation

### Decentralised approach

A range of mitigation levers have been identified along the value chain, such as implementing energy efficiency measures, switching to alternative fuels, substituting cementitious materials, increasing material and design efficiency, or developing CCU/S. No single, one-size-fits-all solution portfolio exists across countries, since developing, deploying, and diffusing low-carbon innovations is subject to raw material availability, demand and industrial structures, locally established collaborations between industry, academy or other initiatives, country-specific development priorities or institutional settings, such as building codes or material standards.

Within Holcim, technological innovations are considered essential for “chang[ing] the way we build tomorrow” (Holcim, 2022). Central and regional innovation labs exist and are now predominantly reoriented towards addressing climate change and sustainability issues. In 2022, “more than 80% of R&D projects aimed at finding sustainability-related solutions”, and circa “65% of [] patents have a positive impact on sustainability along the value chain” (E. Bermejo; Holcim, 2022: 51).

As mentioned in Section 5, the net-zero strategy is predominantly endorsed top-down. Yet, the deployability and scalability of developed innovation is predominantly tested on country-level and in local contexts: There is a “strong belief within the organization that real solutions are often only found at a local level” (L. Viscovich). The firm thus adopts a “collaborative” approach with local stakeholders (R. Roberts), as decisions on what kind of solutions are tested is often customer-led, and subject to locally contingent conditions. The country teams identify local demand, which is then connected back to the global strategy. In some countries, trade-offs may emerge due to competing economic, political and climate priorities: For instance, in one country, deploying 3D printing at scale had to be reconsidered due to adverse impacts on communities and employment structures. As illustrated, country-level teams thus have room for manoeuvre when selecting, deploying, and diffusing low-carbon solutions.

Finally, issue- or product-specific working groups exist on a corporate level to share best practices and lessons learned, thus accelerating joint, evolutionary learning.

### Open innovation and Holcim Awards

Aware of its own limited agency (see Section 4), Holcim engages in various open innovation activities. Today, about 80% of ideas for mitigating climate change and driving net-zero transitions in the built environment come from outside the firm – “[t]hat is not because we are stupid, but because the scale of the problem needs input from more than just internal stakeholders” (E. Bermejo).

The firm engages with a range of actors, fostering an open innovation ecosystem. Cooperative innovation activities include

- (i) engagement with more than 70 academic institutions around the globe to foster fundamental research and innovative ideas, develop prototypes and proof of concepts,
- (ii) more than 600 start-ups who leverage the firm’s expertise, network to, e.g., investors, or access to industrial sites to test prototypes,
- (iii) firms from adjacent sectors, e.g., to establish partnerships on renewable energy or industrial symbiosis,
- (iv) collective and collaborative entities, such as public private partnerships, or industry associations. Finally, the firm emphasises the need for public support for developing risky innovations at scale, such as CCU/S.

Lastly, the company has established different innovation competitions, such as Holcim Accelerator or Holcim Awards. The latter is run by the Holcim Foundation for Sustainable Construction and incentivises the development of an innovative sustainable built environment, in alignment with the firm’s vision. Hereby, the firm can foster innovation activities on global and local level, leveraging a multi-scalar approach to developing, testing, and diffusing innovation.

## 8. Conclusions and key recommendations

In reviewing the activities of Holcim, our case study provides insights into how a multinational company, operating within the complex industrial ecosystem of the built environment, responds to increasing external pressure to act upon climate change and shift towards more sustainable production, distribution, and consumption practices. Below we highlight key learnings from the case study.

### ADOPTING A REFLEXIVE APPROACH & SYSTEMIC VIEW ON CLIMATE CHANGE

- Promotes awareness on how discrepancy in normative orientation of the firm and societal, political, or financial entities might result in reputational harms;
- Allows firm to identify key interdependencies with other actors in terms of contributing to climate change and working towards more sustainable provision of building solutions; interdependencies are reflected in impact measurement encompassing the whole value chain based on Scope 1, 2, and 3 emissions;
- Enables firm to recognise potential and limits to its own agency, and to identify in what ways concerted efforts are required to attain firm's vision of decarbonising the whole built environment; and how firm relies on other entities' actions to in attaining objective of becoming leader in providing sustainable and innovative building solutions;
- Leads multinational company to acknowledge differences in development, deployment and scaling of technological innovation across countries due to locally specific conditions.

### EMBRACE AND ENFORCE INTRA-ORGANISATIONAL CHANGE TO ALIGN WITH FIRMS ECOSYSTEM PURPOSE

- Operationalising vision by developing strategy with cohesive narrative across company;
- Setting science-based targets for Scope 1, 2, and 3 emissions reduction, both short-and long-term, aligned with 1.5°C scenario and sectoral benchmarking;
- Re-arrange governance structures within company and establish novel positions and teams with responsibility of implementing sustainability-oriented strategy;
- Aligning incentive structures with novel direction and update accountability mechanisms via enhanced impact measurement and reporting practices;
- Reallocate resources, business portfolio and innovation activities' focus with novel corporate direction; Foster mindset and cultural shift among employees, build capacity to address climate change.

### ENGAGING IN AN ITERATIVE, ADAPTIVE GOVERNANCE APPROACH TO DEAL WITH CONTINUOUSLY EVOLVING ECOSYSTEM DYNAMICS

- Continuous monitoring of own performance and ecosystem dynamics in relation to potential opportunities or risks associated with climate change mitigation;
- Recurrently reflect upon underlying assumptions on problem scope and scale, potential of solutions, and own agency, due to newly emerging information or adapted impact measurement practices;
- Foster ongoing knowledge exchange with academic institutions, policymakers, investors, etc. to anticipate potential changes in, e.g., scientific, institutional, financial, technological spheres.

### ENGAGING WITH STAKEHOLDERS IS CRUCIAL TO TRANSFORM THE BUILT ENVIRONMENT

- Engaging in open innovation activities with, e.g., academia, public sector entities, startups, etc. to co-develop and trial low-carbon technological innovations;
- Contribute to co-creating shared sectoral vision with firms, associations, and cross-sectoral initiatives to foster concerted efforts towards redefined direction;
- Contribute to coordination mechanisms within sector and along value chain to foster knowledge exchange and best practice exchange, e.g., on impact measurement practices;;
- Rely on third-party organisations and science-based entities to increase transparency, e.g., by verifying impact measurement practices.
- Engaging with public sector entities and policy makers to develop a policy framework that facilitates the shift to decarbonised production and consumption.