McKinsey & Company

Engineering, Construction & Building Materials Practice

The future cement industry: A cementitious 'golden age'?

If the cement industry can accelerate adoption of supplementary cementitious materials, it could fuel decarbonization efforts while unlocking a new horizon of value creation.

This article is a collaborative effort by Fabian Apel, Fabian Metzeler, Jose Luis Blanco, and Patrick Schulze, with Shailesh Lekhwani and Thomas Czigler, representing views from McKinsey's Engineering, Construction & Building Materials Practice.

November 2024

At first glance, the outlook for the global cement industry appears grim. Particularly in Europe, the industry has limited opportunities for growth, with flat or declining volumes and low valuation multiples. Companies are also having trouble attracting talent and facing significant costs to reach net-zero emissions. This is a challenging puzzle to solve—but it could be the start of a new "golden age" for the industry.

One major unlock—the greater adoption of supplementary cementitious materials (SCMs) and fillers—could completely reverse the industry's negative trajectories. SCMs are often low-carbon, lower-cost alternatives to clinker.[1] Existing and innovative SCMs could clear the way for decarbonization ambitions (notably in Europe) or alleviate supply in regions where clinker supply is constrained (for example, in the United States). McKinsey analysis suggests that greater SCM adoption could grow global SCM revenues to $40 billion to $60 billion by 2035 from $15 billion to $30 billion today.

Previous McKinsey research has described the range of levers that are likely to be relevant as the cement industry decarbonizes.[2] This article focuses on the true potential of SCMs, which we expect to play a preeminent role in the coming decade alongside other decarbonization levers—including an uptake in circularity and recycling, which share some structurally similar dynamics. If industry players seize the SCM opportunity, the cement industry could achieve growth, more attractive business structures (albeit with consolidation of some existing assets), and unprecedented returns for the remaining capital invested.

The state of the industry today—and what could turn things around

Players in the cement industry today are dealing with substantial challenges. Current projections show the industry is expected to plateau (in terms of volume) through 2050.[3] Several factors are responsible for this challenging value creation outlook:

1. *Shrinking demand.* Although there is increasing demand for construction (both globally and in specific local markets), this growth will be offset by the redesign of buildings and infrastructure to use less concrete, cement, and clinker to reduce CO_2 emissions or deal with constrained clinker supply. For example, under CEMBUREAU road map assumptions,[4] clinker demand in Europe is expected to shrink to 122 million metric tons in 2035 from 145 million metric tons in 2023.[5] In the United States, where many micromarkets are clinker-constrained, concrete players are looking for ways to mitigate high clinker costs through alternatives.

2. *Costs.* The cost of decarbonization will likely dampen demand further. Decarbonizing the cement industry (particularly clinker) is far from inexpensive today, and these costs are likely to significantly increase the cost of cement—in some cases, more than doubling it. In addition, many decarbonization options across the cement and concrete value chain, such as carbon capture, utilization, and storage (CCUS) and circularity,[6] are not yet technically mature, not yet economically viable, or both. Innovation and technical breakthroughs might change the cost equation, but given the pace and scale of existing pilots and early projects, this is likely to take time.

3. *Valuation.* Multiples have fallen, partly because of a lack of overall growth in the industry and uncertainty around decarbonization costs. For example, the four largest international "cement majors" were valued at eight to nine times EBITDA a decade ago, but in the past five years their valuations have fallen to six to seven times EBITDA (and four to five times EBITDA in Europe).[7]

[1] *GCCA policy document on blended cements and supplementary cementitious materials,* Global Cement and Concrete Association, October 2024.
[2] "Cementing your lead: The cement industry in the net-zero transition," McKinsey, October 6, 2023.
[3] McKinsey Cement Demand Model, consistent with *Concrete Future: The GCCA 2050 Cement and Concrete Industry Roadmap for Net Zero*, Global Cement and Concrete Association, October 2021.
[4] Including both the EU Emissions Trading System (ETS) scope and wider non-ETS-covered Europe.
[5] McKinsey Cement Demand Model, consistent with *From ambition to deployment—our 2050 roadmap*, CEMBUREAU, 2024.
[6] For more on these technologies, see "Cementing your lead," October 6, 2023.
[7] "EV/EBITDA (NTM) analysis for cement majors for 2013–24," McKinsey Value Intelligence.

In these challenging economic circumstances, cement and concrete players find it difficult to pursue decarbonization with gusto, especially if they do not yet have a sufficient base of customers willing to pay for low-carbon solutions in the near term.

Of the available decarbonization options, SCMs and fillers stand out because of their technological maturity, their current level of integration with existing standards, and their economic viability. In fact, according to our analysis, SCMs and fillers are expected to be the best solution for the industry in the next five to ten years. We do not suggest that SCMs and other cementitious solutions[8] are the only option for manufacturers; rather, SCMs are expected to be the decarbonization solution of choice in the coming years in regions where they are available, until alternative innovative technologies are ready and cost-effective.

SCMs and fillers can replace clinker (the most emissive component of cement) in cement mixes, lowering cement's emissions profile by 70 to 80 percent in some cases.[9] Traditional SCMs include fly ash, ground granulated blast-furnace slag (GGBFS), and silica fume, while innovative SCMs and fillers include calcined clay, increased limestone use, and recycled concrete. Some researchers and players are working on truly innovative SCMs with zero or even negative carbon footprints that would valorize basic oxygen furnace (BOF) and electric arc furnace (EAF) slag from steelmaking, as well as other waste streams.[10]

SCMs may also have a secondary benefit in markets where clinker supply is constrained, such as in some US markets. For example, they could enable the cement and concrete industry to produce more tons of cement (and concrete) per ton of clinker. This would relieve pain points from limited clinker supply and would be an alternative to the usually expensive capital expenditures needed for growth.

To varying degrees, SCMs and fillers are already approved in building standards, and they are widely available (albeit not in all micromarkets).[11] Unlike other decarbonization options, SCMs and fillers are also cost-efficient; in fact, they are already profitable today. In Europe, for example, EBIT margins for SCMs and fillers could exceed 50 percent by 2035, according to McKinsey analysis. Both for operational reasons and to optimize carbon emissions and costs, the industry already uses 24 percent SCMs in cement mixes; however, it is not yet employing this technology at its full potential.[12]

As a result, over the next few decades, we expect the use and mix of SCMs and fillers to shift. For example, according to McKinsey analysis, now and over the next five to ten years in Europe, players face domestic supply constraints for existing industrial SCMs—chiefly granulated blast-furnace slag (GBFS) and fly ash—as coal plants ramp down and steel production gradually shifts away from blast furnaces. Global imports into Europe may mitigate some of these constraints. The widening gap is likely to be filled by natural SCMs and fillers (notably pozzolans, calcined clay, and limestone fillers), which show potential to benefit from this shift. Beyond the next decade, innovative SCMs and fillers (and alternative binders) may play a more significant role as research, development, and innovation pay off (Exhibit 1).

From cement to cementitious: A vision for the industry

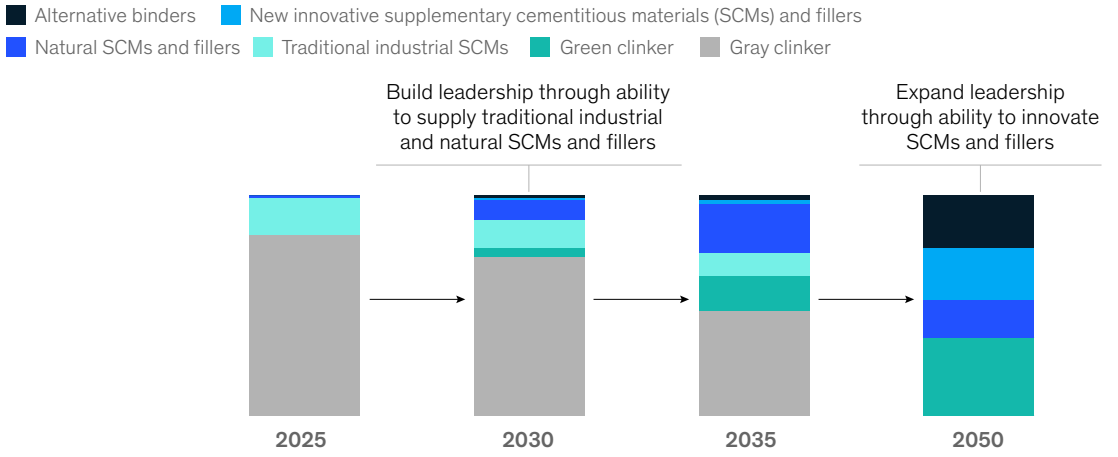
As the world decarbonizes, cementitious solutions—SCMs and fillers—are expected to be the most effective path forward for the cement industry. Players with established footprints can adopt a start-up mindset to build new SCM businesses to take advantage of this massive value-creation opportunity. The player landscape is also expected to change, with mining and steel players and new start-ups likely to play a bigger role as today's localized markets expand to cover larger regions.

[8] "Cementitious" materials refers to both SCMs and fillers that can or could replace clinker in cement and concrete products.
[9] "Frequently asked questions about ACT," Ecocem, accessed November 14, 2024; Isabelle Dumé, "We can reduce CO_2 emissions from cement by a factor of 10," Polytechnique Insights, January 6, 2022.
[10] John L. Provis, Laura Stefanini, and Brant Walkley, "Basic oxygen furnace (BOF) slag as an additive in sodium carbonate-activated slag cements," Materials and Structures, 2024, Volume 57, Number 153; Sofiane Amziane et al., "Utilization of air granulated basic oxygen furnace slag as a binder in belite calcium sulfoaluminate cement: A sustainable alternative," Journal of Cleaner Production, January 10, 2024, Volume 436.
[11] "ASTM C618-22: Standard specification for coal fly ash and raw or calcined natural pozzolan for use in concrete," ASTM, updated March 14, 2023; "ASTM C1157-02: Standard performance specification for hydraulic cement," ASTM, updated August 16, 2017; "DIN EN 206: Concrete - Specification, performance, production and conformity (includes Amendment :2021)," European Standards, June 2021; "UNE EN 197-6:2023: Cement - Part 6: Cement with recycled building materials," European Standards, September 20, 2023.
[12] "GNR 2.0 – GCCA in Numbers," Global Cement and Concrete Association, accessed November 13, 2024.

Exhibit 1

Supplementary cementitious materials are expected to play a key role in helping manufacturers meet decarbonization needs.

Expected virgin material mix over time (illustrative, % of total supply)



	Significant increase	Slight increase	Remains equal	Slight decrease	Significant decrease
Alternative binders New innovative SCMs and fillers	Innovative SCMs and binders not yet at scale or approved		Innovative SCMs or binder slowly starting to scale		Innovative SCMs and binders gaining share due to superior CO_2 and cost performance
Natural SCMs and fillers	Rise of natural SCMs as key means to decarbonize		Natural SCMs growing fast (and reaching peak)		Natural SCMs becoming less competitive
Traditional industrial SCMs	Traditional industrial SCMs still available (and in high demand)		Traditional industrial SCMs phasing out		Traditional industrial SCMs phased out
Green clinker	Green clinker pilots rolling out		Green clinker going beyond pilots		At-scale green clinker from mature CCUS[1] technology
Gray clinker	First plants with weak position phasing out		Accelerated "closing" of pure gray clinker assets		(Virtually) no gray clinker assets left

[1]Carbon capture, utilization, and storage.

McKinsey & Company

A few factors are expected to be at play in the future cementitious industry: healthy regional demand growth, increasing material prices, a consolidating supplier landscape, and a shift toward new solutions and business models.

— *Healthy regional demand growth.* As noted above, our analysis indicates increasing demand for construction by 2050, particularly for infrastructure needed in the energy transition, such as roads, airports, and ports funded by infrastructure investments expected in the European Union and the United States.[13] Demand is also expected from industries critical to the energy transition and further digitalization—such as microchips, batteries, and energy materials—as they "homeshore" or "friendshore" infrastructure and factories. Because of their improved sustainability and cost, SCMs could allow the industry to meet this increased construction demand without radically lowering cement volumes.

— *Increasing material prices.* Prices for cement and concrete products are expected to increase because of rising carbon costs, limited availability of labor and traditional SCMs (depending on the location), and consolidated markets. These pressures are likely to allow prices to keep up with input-cost inflation. In Europe, carbon will become the biggest cost driver. If free allowances are withdrawn as planned and the carbon border adjustment mechanism (CBAM) is implemented effectively, players further along on their decarbonization journeys could have a major competitive advantage.

— *Consolidating supplier landscape and asset networks.* Despite fragmentation on a global scale, local markets are relatively consolidated, with only three to four competitors (typically a mixture of global players and local leaders) on average. We expect local markets to expand and become increasingly regional as decarbonization pressures mount and suppliers find synergies through economies of scale. With higher prices and margins from low-carbon cement, companies may be better able to afford higher transport costs, allowing them to expand their footprints (particularly if players can engage in emerging markets for green certificates). Supplier and asset network consolidation will also likely be driven by talent scarcity and the cost of decarbonization. For example, investing in CCUS technology for a plant could cost as much as €1 billion, making only a handful of big and well-located plants suited to carbon capture.[14] As a result, consolidation will likely also drive better overall capacity utilization and therefore efficiency of fixed assets.

— *Shift toward solutions and new business models.* The industry is expected to shift toward new solutions and business models thanks to more complex construction needs around labor, carbon, and water. These more sophisticated solutions will be less commoditized than today's cement and concrete products. We also expect increased automation and partnerships (for example, setting up an operations excellence team for more than one player to ensure that expertise can be leveraged).

These factors will shape player considerations moving forward as the cement industry becomes a cementitious industry, built around SCMs, to facilitate more cement per metric ton of clinker. This will support both the global transition to net-zero and cement growth where clinker is constrained.

Regional deep dives

Although the changes we expect to see are global in scope, the drivers underlying them vary by region. For example, Europe and North America are

[13] "Record U.S. infrastructure spending is colliding with higher construction costs and other hurdles," S&P Global, May 14, 2024.
[14] "First major shipment delivered for the Brevik carbon capture project," ProjectCargoJournal.com, May 20, 2022; "About the project," Brevik CCS, accessed November 13, 2024.

expected to drive demand for SCMs (particularly to 2035), but for different reasons.

Below, we explore some of the regional projections and implications of the growing market for SCMs and fillers.

Europe

In Europe, demand, prices, and margins for cementitious materials are expected to be slightly positive as a result of growing infrastructure demand in Eastern Europe and Türkiye, as well as regional retrofit activity to achieve greater energy efficiency. In one scenario, prices for cement are likely to rise above €200 per metric ton (by 2035) in many European markets, and EBITDA margins for sustainable materials (such as low-carbon clinker and certain SCMs) could range above 30 percent in certain markets.[15]

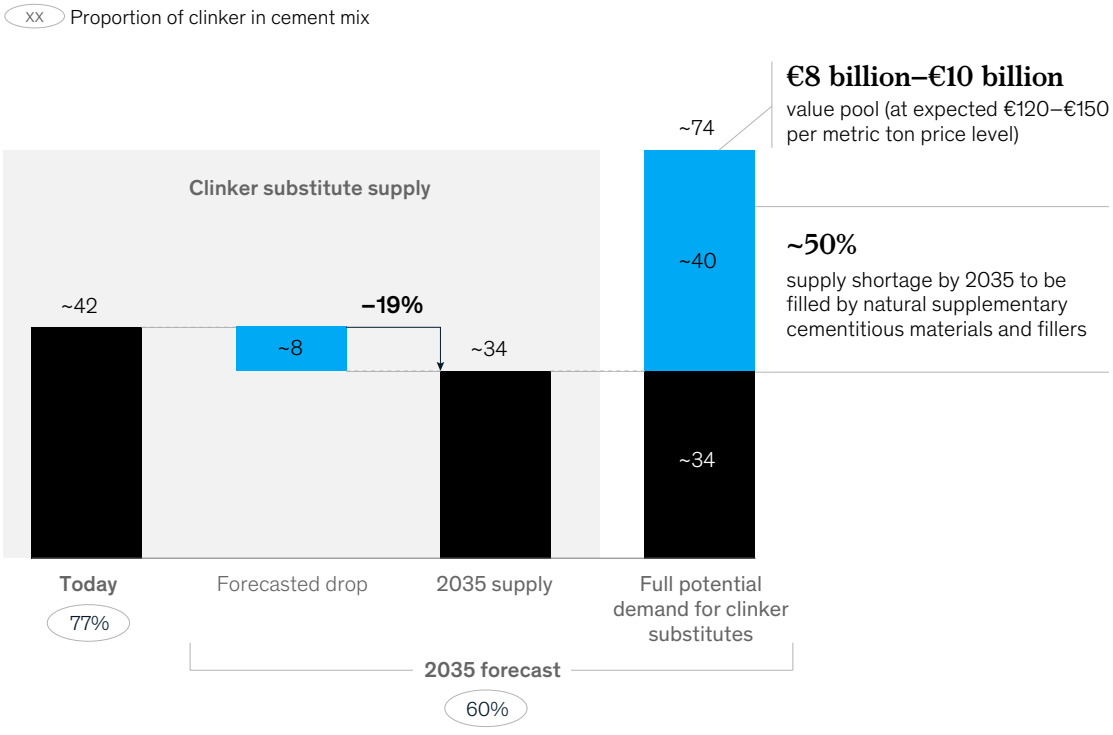
SCMs and fillers in the region represent an emerging value pool that could reach €8 billion to €10 billion in 2035 (Exhibit 2). This is likely to grow further as new SCMs and fillers are developed, particularly if clinker can be substituted beyond the approximately 60 percent clinker share currently foreseen in industry road maps.[16]

[15] This scenario was modeled in McKinsey's SCM Outlook Model based on rising emissions trading scheme (ETS) prices, retirement of free allowances, and an effective CBAM.
[16] "CEMBUREAU's Net Zero Roadmap," CEMBUREAU, May 21, 2024.

Exhibit 2

By 2035, clinker substitutes could be a €8 billion to €10 billion value pool in Europe alone.

Supply and potential demand for clinker substitutes, million metric tons per annum



Source: Expert interviews; *International Cement Review*; McKinsey Cement Demand Outlook Model

McKinsey & Company

Demand growth in North America is projected to be robust, driven by strong GDP growth, increased infrastructure and housing demand, and infrastructure initiatives.

European players with large emissions footprints will need to adapt as demand shifts toward sustainable materials, driven by regulation (and, to some extent, customers). Increasing carbon taxes and the resulting decarbonization could lead companies to restructure their current asset footprints, such as shutting down difficult-to-decarbonize assets or converting them into SCM assets where possible given the availability of raw materials. At the same time, by 2035 we expect a few net-zero mega-clinker plants to emerge in locations with limestone access, green energy, and CO_2 sink and storage capacity, leveraging scaled CCUS technology.

North America

Demand growth in North America is projected to be robust, driven by strong GDP growth, increased infrastructure and housing demand (particularly in the southern United States), and government-backed infrastructure initiatives.[17] Additionally, reshoring and friendshoring are expected to bolster private sector infrastructure investments. This balance of supply and demand is expected to support a healthy pricing environment, particularly given the relatively consolidated nature of the North American cement market.

As North America seeks to meet this high demand, it is expected to encounter material and labor shortages. These will be key drivers for adoption, since SCMs and fillers can replace clinker in a clinker-constrained market. Already, all available GGBFS in the United States (approximately three million to five million metric tons, both local and imported) is used, as well as 15 million metric tons of fly ash.[18] To meet growing demand, North America is expected to rely on traditional industrial SCMs (GGBFS, fly ash, limestone) longer than the European Union, because traditional manufacturing is not expected to be converted as quickly.

The US concrete industry, known for its fragmentation and emphasis on flexibility, is less likely to see the same level of vertical integration expected in Europe. In addition, state and federal regulations in the United States are beginning to take shape, including climate disclosure rules, legislation such as the Infrastructure Investment and Jobs Act, standards for lower-carbon materials in government projects, and state-driven carbon taxes and green premiums, such as California's Buy Clean California Act and New York's Local Law 97.

Rest of the world

Other markets across the world will see their own shifts in cementitious markets, driven partly by local dynamics and partly by global trade flows. Below, we outline considerations across key regions.

[17] Evie Gardner, "Cement 2024 – stagflation," World Cement, January 11, 2024.
[18] "Minerals Yearbook 2021 (Volume I. -- Metals and Minerals)," National Minerals Information Center, US Geological Survey, 2023; *2022 coal combustion product (CCP) production & use survey report*, American Coal Ash Association, 2022.

— *India.* The Indian market is expected to grow around 7 to 9 percent by 2030, driven by demand from large cities.[19] There is an abundance of GBFS around local steel plants and of fly ash around coal-fired power plants. These volumes are expected to keep increasing at more than 5 percent per annum.[20] However, Indian manufacturers may not turn to new SCMs immediately, because clinker use is already low. Steel plants near coasts are likely to move first on SCMs, especially if they have existing export relationships in Europe, the United States, and other markets in which SCMs (GBFS in particular) are in short supply .

— *China.* China has an oversupplied market; downturns in the real estate sector and in infrastructure investment led to a demand decline of 4.5 percent in 2023.[21] We expect these trends to continue in the long run, with a projected market decline of 2 to 3 percent per annum (in volume terms). Despite this, China remains the world's largest cement manufacturer and thus faces significant pressure to decarbonize. Government initiatives have encouraged decarbonization, and major cement companies have recently started to introduce products with low clinker ratios and optimized concrete, creating space for SCM growth. Accordingly, companies have invested in creating two million metric tons of SCM processing capacity in cement-producing provinces such as Hebei, Shandong, and Jiangsu. The country's steel and coal production means GBFS and fly ash could become important export products, although this could be highly variable. For example, GBFS exports fluctuated between 60 metric kilotons in 2020 and ten million metric tons in 2023.[22]

— *Rest of Asia and Australasia.* Many Asian countries are already significant exporters of clinker or cement, such as Japan, Korea, Vietnam, and Indonesia. Countries with overcapacity in cement will likely continue to be exporters and are unlikely to meaningfully switch to SCMs without regulatory pressure. Of course, the shift to SCMs in other regions—notably Europe and possibly North America—may reduce global demand for clinker and cement trade. Instead, some countries could begin exporting GBFS and fly ash. Meanwhile, Australia and New Zealand are facing similar dynamics to European markets because of carbon pricing. In these markets, traditional industrial SCMs are likely to be in short supply, leading players to focus on importing SCMs and producing clays and pozzolans locally.

— *The Middle East and Africa.* The Middle East and Africa (MEA) region represents two extremes for the cement and concrete industry. Nations such as Saudi Arabia and the United Arab Emirates are leading ambitious net-zero projects, while developing countries in the region are grappling with basic infrastructure needs and thus may have a less pronounced focus on decarbonization. There is already some use of traditional SCMs such as GGBFS and fly ash in the region, though their availability is inconsistent because of a reliance on imports and challenging climatic conditions. On the other hand, the region has natural reserves of pozzolans, especially in countries such as Kenya and Ethiopia, which could allow the region to expand its use of low-carbon materials, driven by infrastructure demand and sustainability pressures.

Bringing it together: A blueprint for the industry's future

The global cement industry could turn around its sluggish growth and declining multiples over the next ten years. However, as in every journey, not everyone will succeed. Four mindset shifts could make the difference between winning and losing:

1. *Proactively reshaping clinker asset footprints toward sustainability.* Players can assess the long-term competitiveness of each asset and then adjust their footprints. This could mean converting or closing small or badly positioned assets over

[19] Jagdeep Verma, *Indian cement: An overview, Global Cement Magazine*, October 2023.
[20] *Report on fly ash generation at coal / lignite based thermal power stations and its utilization in the country for the 1st half of the year 2022 – 2023 (April 2022 to September 2022),* Central Electricity Authority New Delhi, March 2023; *Indian minerals yearbook 2022 (Part- II: Metals & alloys), 61st edition: Iron, steel & scrap and slag*, Government of India, Ministry of Mines, April 1, 2024.
[21] "A tough time for China," International Cement Review, July 2024.
[22] UN Comtrade Database, UN Statistics Division, accessed November 13, 2024.

time, installing CCUS on existing assets, building new cementitious assets, or considering greenfield net-zero mega-clinker plants.

2. *Endorsing SCMs and fillers to capture growth.* In addition to their importance for decarbonizing existing cement assets, SCMs and fillers will represent a highly profitable new growth segment with relatively low capital expenditures. This could be beneficial, both in markets where cement players are already active (to compensate for reduced clinker sales) and in new geographies (as additional business). To take advantage of the cementitious opportunity, established players may explore building agile, fast new start-up businesses centered on SCMs.

3. *Building solution capabilities.* As SCM and filler businesses grow and evolve, regulatory positioning will be critical, as will strategic SCM sourcing and enhanced SCM portfolios (including acquisition, innovation, and technology partnerships). Companies can look into SCM "enablers," such as additives that allow for a higher share of SCMs (limestone fillers, chemicals, and other additions). To reduce reliance on clinker, technology providers can improve circularity by enabling and scaling the use of construction and demolition waste (CDW). Players can also create tailored solutions for customer needs.

4. *Creating partnerships and platforms.* Partnerships can allow players to secure unique access to SCMs and fillers, share the risk of CCUS projects (between technology providers and cement companies, for example) or share infrastructure such as pipelines. Partnerships can also expand financial firepower beyond public funding and balance sheet commitments from larger cement players, which are the core revenue streams for the industry today. Finally, partnerships can multiply participation in growth initiatives and joint innovation.

Looking forward, the global cement industry could achieve greater growth from novel solutions, higher margins, and greater global integration. However, to succeed in the coming cementitious landscape, players will need to play offense and act fast. As the new blueprint of the cement industry takes shape between 2025 and 2035, those that are first to the table stand to reap the greatest rewards.

Fabian Apel is a partner in McKinsey's London office, **Fabian Metzeler** is a partner in the Dusseldorf office, **Jose Luis Blanco** is a senior partner in the New York office, **Patrick Schulze** is a partner in the Berlin office, **Shailesh Lekhwani** is an alumnus of the Houston office , and **Thomas Czigler** is an expert in the Frankfurt office.

The authors wish to thank Eleftherios Charalambous and Qiao Xie for their contributions to this article.