



The future of chemicals and advanced materials in buildings and construction:
Breaking away from the past



EXECUTIVE SUMMARY

A variety of chemicals and advanced materials (CAMs)—ranging from concrete admixtures to polymer composites—are increasingly being used in the buildings and construction industry. Many benefits including enhanced strength and integrity and overall systems cost reduction accrue to a construction or building project by using these CAMs. So, it is not surprising that the future growth rate for construction CAMs is expected to be in excess of 6 percent per annum, with the most incremental growth emanating from the Asia-Pacific region.¹ An uptick of construction and building activity driven by rapid urbanization and growing population is expected to be a major impetus behind this impressive growth.

A few major trends in the broader construction industry seem to be gradually shaping the future of construction CAMs. Taking advantage of these trends often requires companies to proactively lay out a different strategic path than envisioned earlier. First, they should be willing to adopt a “solutions-oriented” approach by not only packaging their products and services together, covering a broader repertoire, but also consider acquiring companies that might fill the “services” gap. Second, construction CAMs companies can aspire to be ecosystem shapers by collaborating in a more synchronized manner with their customers, which can help them understand their requirements at a deeper level—requirements that will most likely center around sustainability, overall systems cost reduction, and reduced project delivery time. Third, construction CAMs companies should continue to enhance their existing product portfolios through innovation and restructuring. They can acquire or tie-up with emerging construction technology companies, which are already attracting the attention of myriad VC funds. Finally, they should adopt digital technologies at a brisk pace to create unparalleled differentiation for themselves, and enhance construction efficiency, as well as mitigate the issue of skilled talent shortage for their customers.

Four key trends that are shaping the future of construction CAMs

1. **Technology advances and integration** in the broader construction industry will likely change the demand patterns for some key chemicals.
2. **Sustainability and the circular economy** may lead to greater incorporation of CAMs with a lower carbon footprint and less resource-intensity.
3. The need for **reducing overall project costs and speeding up project completion rate** is stimulating prefabrication or modular construction, as well as new product innovations like self-healing concrete and nanomaterials.
4. **Skilled labor shortage** has sometimes forced companies to use contractual labor, which often comes at inflated costs.

Construction chemicals and advanced materials: A brief introduction

The ancient history of concrete and other building and construction materials is replete with many stories. In these stories, we often get a glimpse of chemicals or materials that were used to make monuments or structures. For example, from the biblical story of Moses, we surmise that Egyptian pyramids were made with limestone-based mortars and mud bricks with straw—which acted as reinforcement and added strength to the building material.²

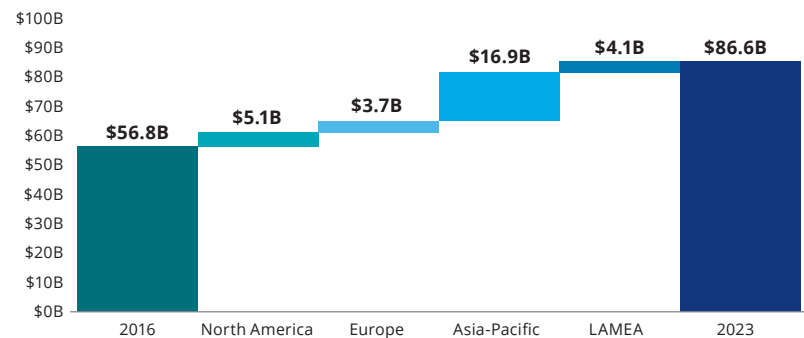
However, the diversity of construction chemicals and advanced materials (CAMs) has expanded by leaps and bounds since the making of the pyramids. Today, it not only includes concrete admixtures but also adhesives and sealants, coatings, insulation materials, and polymer composites. These CAMs—gifts of the petrochemical revolution—are designed to extend the otherwise “natural” life of the structure, give integrity, provide protection, and cut down material waste.

Concrete admixtures, for instance, which are increasingly used for producing super-strong concrete, are comprised of plasticizers/super-plasticizers, accelerators, air-entraining agents, bonding agents, retarders, shrinkage reducers, and so on. While adhesives and sealants help in joining dissimilar building components in a flexible, cost-effective, and durable manner, coatings enable lasting protection against weather and corrosion. Insulation materials like polymer foams help not only in thermal, acoustic, fire, and impact insulation but also enable lightweighting of building structures and components. Polymer composites come in many different forms, and given their high strength-to-stiffness ratio and low density, they offer durability, low weight, impact resistance, design flexibility, parts consolidation, toughness, and heat resistance³ (see SIDEBAR for more details).

A growing market for construction CAMs, but which segments hold the most promise?

According to various research reports, the global construction CAMs market is expected to grow from \$57 billion in 2016 to \$87 billion by 2023, clocking a CAGR of more than 6 percent. The highest contribution to the incremental growth from 2016 to 2023 will likely come from the Asia-Pacific region, specifically China, India, and South-East Asia (Thailand, Vietnam, Malaysia, etc.; see figure 1).

Figure 1. Global market size and growth of construction chemicals and advanced materials

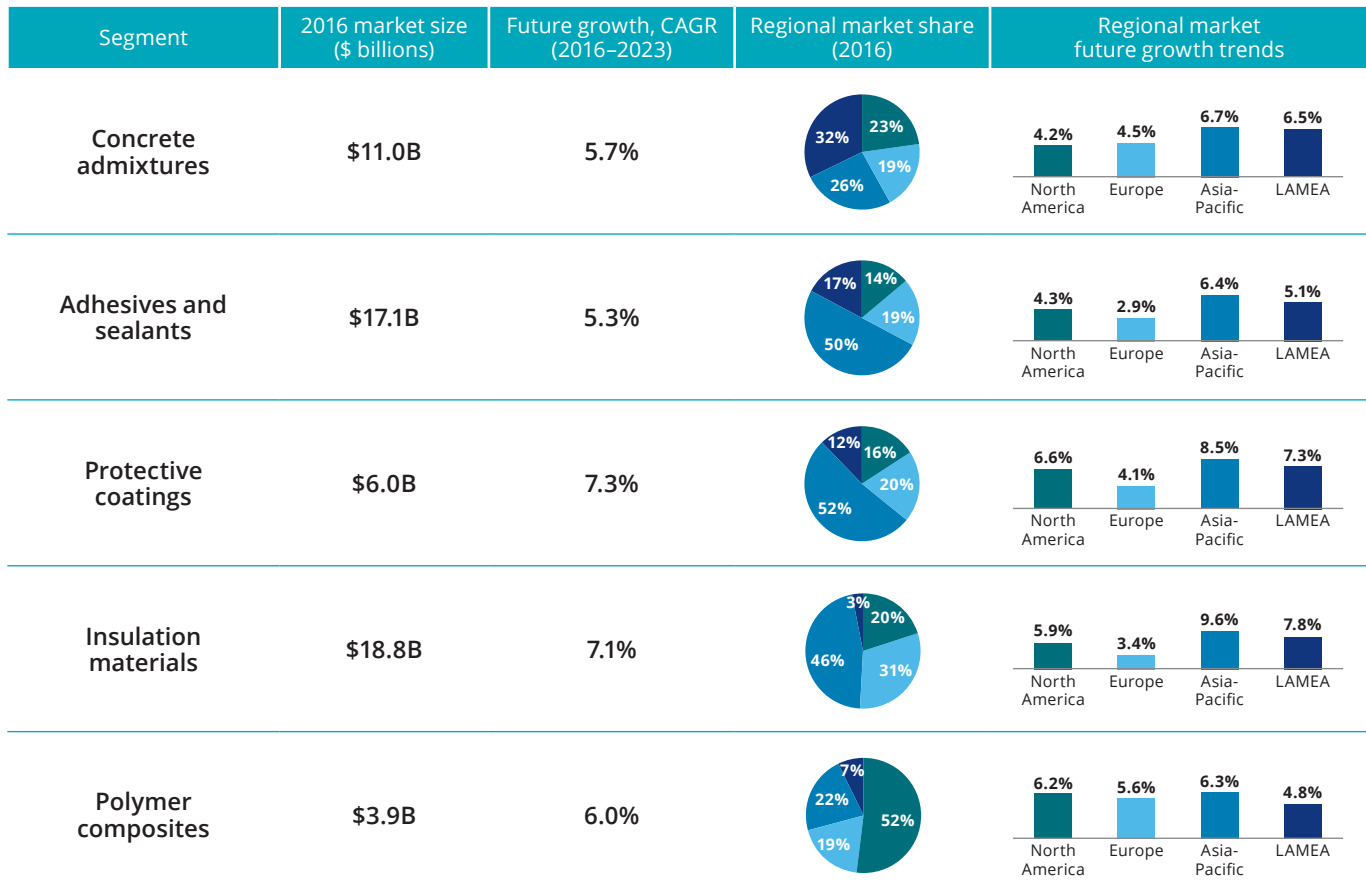


Note: Construction CAMs include concrete admixtures, adhesives and sealants, protective coatings, insulation materials, and polymer composites.

Sources: Allied Market Research, Grand View Research, and Technavio

However, the segment-wise market size and growth prospects differ. So, if “insulation materials” and “adhesives and sealants” are the largest in terms of market size today, “protective coatings” and “insulation materials” are expected to show the highest growth rates going forward. In addition, there are subsegments within these segments that are showing higher-than-average growth prospects. For example, within “adhesives & sealants,” hot-melt adhesives are in high demand due to their ease of use and storage, and environment-friendliness. In “protective coatings,” water-borne, solvent-borne, and solvent-less coatings are increasingly being preferred in both residential and nonresidential applications. Among “insulation materials,” polyurethane and extruded polystyrene (XPS) foams are already popular and making further inroads into residential construction.⁴ (See figure 2.)

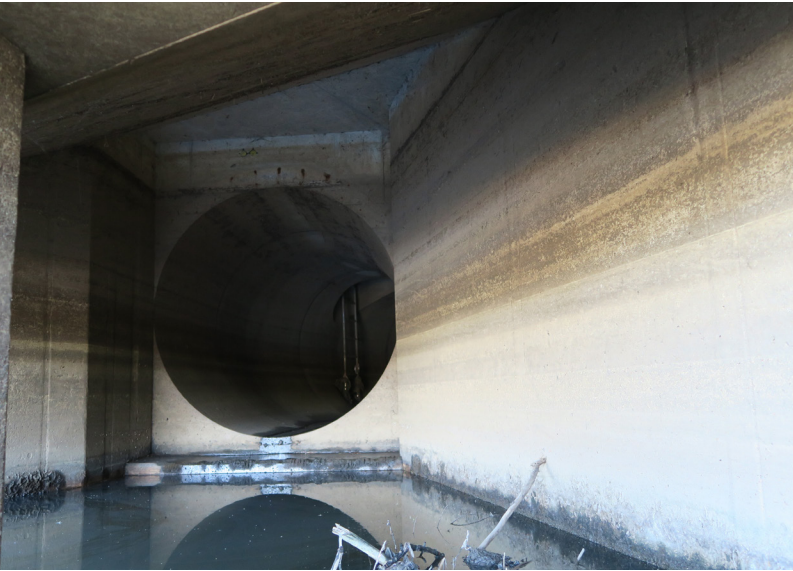
Figure 2. Market trends for segments within global construction CAMs



Sources: Allied Market Research, Grand View Research, and Technavio

A few segments seem to have great potential going forward only if some challenges are removed. For example, in the case of polymer composites, if their costs can be reduced, fabrication efficiency improved, and their different types standardized, they could find more applications in the construction and buildings space.

Construction CAMs, today, account for only a tiny fraction of the overall construction industry. For instance, they directly accounted for only 1.1 percent of the \$829 billion US construction industry, or \$9 billion in 2016.⁵ Despite their small contribution, the role played by construction CAMs in reducing overall systems costs while maintaining the same or increased performance is considered very significant.



The fate of construction CAMs remains inevitably tied to the trajectory of the overall construction industry. In recent times, the global construction industry has been buoyed by rising infrastructure spend and increasing housing starts, especially in emerging economies. Evidence comes from the revenue growth figures of top global construction companies, which have risen by 6 percent in 2017, and from the rise in sales of new single-family homes in the US, which have grown by more than 9 percent (2017).⁶ These figures, in turn, are typically driven by the megatrends of rapid urbanization and growing population.

Many changes are underway in the broader construction industry that can have major implications for construction CAMs. How these changes can shape the future of construction CAMs, we will discuss in the next section.

Four trends in buildings and construction that are shaping the future of CAMs

Several emerging and existing trends within the broader construction industry have the potential to disrupt the future of construction CAMs. It is thus imperative for companies to not only be aware of how these trends could impact their product demand but also take steps to turn potential challenges into opportunities.

1. **Technology advances and integration:** Use of advanced software like BIM (Building Information Modeling) and more prevalent use of drones, simulations, Augmented Reality, 3D printing, and so on could mean that construction efficiency will improve while minimizing waste. In one way, this could lead to lower demand (than anticipated earlier) for construction CAMs (because of lower waste generation), but on the other hand, this could open new opportunities for chemicals companies. For example, because of increasing use of 3D printing in constructing residential dwellings, 3D printing-compatible chemicals and materials are expected to be in high demand and experience higher growth. In fact, bold projections are already made for 3D printing in the construction market. According to one source, it is projected to grow from a mere \$40 million in 2016 to a staggering \$40 billion by 2027, a CAGR of 87 percent.⁷ Heeding this prediction, a few chemical companies have recently acquired companies in the 3D printing space and kickstarted joint development efforts with some 3D printing startups.⁸

These new technologies and their integration could also address the growing issue of flat or declining productivity of construction labor and low digital maturity of the global construction industry. It might be no surprise, then, that construction startups based on technologies like cloud-based collaboration software and hardware are attracting the most funding.⁹

2. **Sustainability and the circular economy:**

The buildings and construction industry remains the centerpiece of the global warming puzzle since more than a third of global final energy-use (36 percent) and energy-related CO₂ emissions (~40 percent) are directly attributed to the sector.¹⁰ Based on the recently concluded Paris agreement, the energy intensity of buildings needs to improve by 30 percent from current levels by 2030.¹¹ The achievement of this target seems far-fetched, as more than two-thirds of new buildings and construction will be in many emerging economies without strong mandatory building codes.

Nevertheless, many national governments are making green building standards more stringent as the target year approaches. These evolving regulations are exerting more pressure on construction companies to use materials and chemicals that have a lower carbon footprint and are less resource-intensive. For example, chemical admixtures, which are added during the concrete-making process, not only reduce overall water usage but also take less time to set. Electric poles made up of polymer composites are lightweight, possess lower carbon footprint, and have a longer shelf-life than metal poles. Many other polymer composite applications are already underway in the building and civil engineering sector that are not only new and complex applications (from a design perspective) but also provide a way to retrofit and refurbish older infrastructure without bringing it down. Whether it is an aging pipeline infrastructure, an abandoned factory, or the roof of a commercial building, the trend of adaptive reuse and repair is picking up as a ready alternative to costly replacement, and construction CAMs remain the best bet to meet this growing trend.¹²

The mounting wave of smart cities, which is much broader in scope and scale than green buildings, is also expected to enhance the demand for new chemicals and materials. For example, for enabling an energy-efficient infrastructure within a smart city, chemicals companies can innovate across different chemicals and requirement types like high-reflectance coatings, high-performance insulation foams, and phase change materials.¹³

3. **Trends in project completion timelines and overall**

costs: Due to rising material costs and lower availability of skilled labor, the construction industry has suffered from low productivity and extended deadlines.¹⁴ There is often an imminent need to not only speed up the time needed to construct a building or infrastructure but also bring down the overall project costs. In fact, costs and speed of project completion are the two most important factors that contractors and construction companies look forward to—even surpassing the need to “go green.”¹⁵

Clearly, prefabrication or modular construction is a rising trend for all of these reasons, and more so indicated by the increasing number of tech startups in the “offsite construction” space.¹⁶ Prefabricated units can be made offsite, reduce waste generation, recycle material, and thus expedite the overall construction process.¹⁷ Apart from this, technologies like 3D printing can also help in reducing overall project costs and streamline processes.¹⁸ Innovation at the product level can also help reduce the transportation time and eventually the costs of construction. For example, a global chemicals conglomerate started shipping latex powders instead of heavy liquids, which can be readily made into formulations or mixed with water at a manufacturing facility or construction site for further use, thus reducing transportation times and costs.¹⁹

New, advanced material innovations like self-healing concrete and nanomaterials like Graphene might also lead to overall lower life cycle costs, though there is a high initial cost associated.²⁰ These novel materials enable instant repair of a concrete structure, thus eliminating the need for its repair, rehabilitation, or complete replacement for relatively longer periods of time.

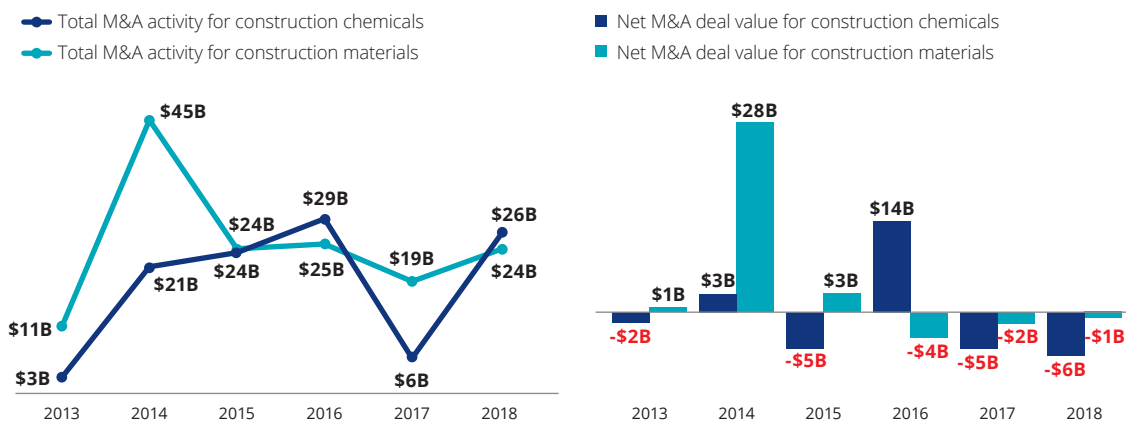
4. **Skilled labor shortage:** Labor costs typically account for 40 percent of total construction project costs—indicating that the construction industry is still labor-intensive, though regional variations exist.²¹ The construction industry has been dealing with a skilled labor shortage issue for a long time, and contractors and construction companies are sometimes forced to recruit contractual labor that often comes with inflated costs. Many construction companies and contractors are now relying on nontraditional approaches to solve this recurring issue.²²

Chemicals and advanced materials companies can also offer their part of the solution. For instance, many contractors are looking for products that are easy to install on-site and don't require the use of special equipment or extensive training—thus reducing the need for skilled labor. On the other hand, technologies like 3D printing can reduce the need for more semi-skilled workers in construction. Hence, though the talent shortage issue will most likely remain in the short to medium term, in the long term, because of innovations in materials and technology, the issue can be addressed to a large extent.

A more consolidated industry soon?

After getting a major dip in both number and value in 2017, M&A and divestiture activity in the construction CAMs industry has picked up pace in 2018. Most large players are looking at optimizing their portfolios, doing more cross-border M&A, and extending their customer base. Some M&A transactions also shed light on the fact that a few are trying to own “solutions” that cover an entire range of products and services—from laying down a building foundation to renovating a crumbling roof.

Figure 3. M&A trends in construction chemicals and materials



Note 1: Only transactions (completed + pending) greater than or equal to \$100 million are taken into consideration here.

Note 2: Transactions here include “chemicals” and “construction materials” as the target industries, and only those companies in the “chemicals” industry are considered that have significant direct exposure to the construction and buildings sector.

Note 3: The first chart on the left shows the total M&A activity that is pure mergers & acquisitions + divestitures (or spinoffs); the net M&A value in the second chart on the right equates to pure M&A deals’ value—value of divestitures (or spinoffs).

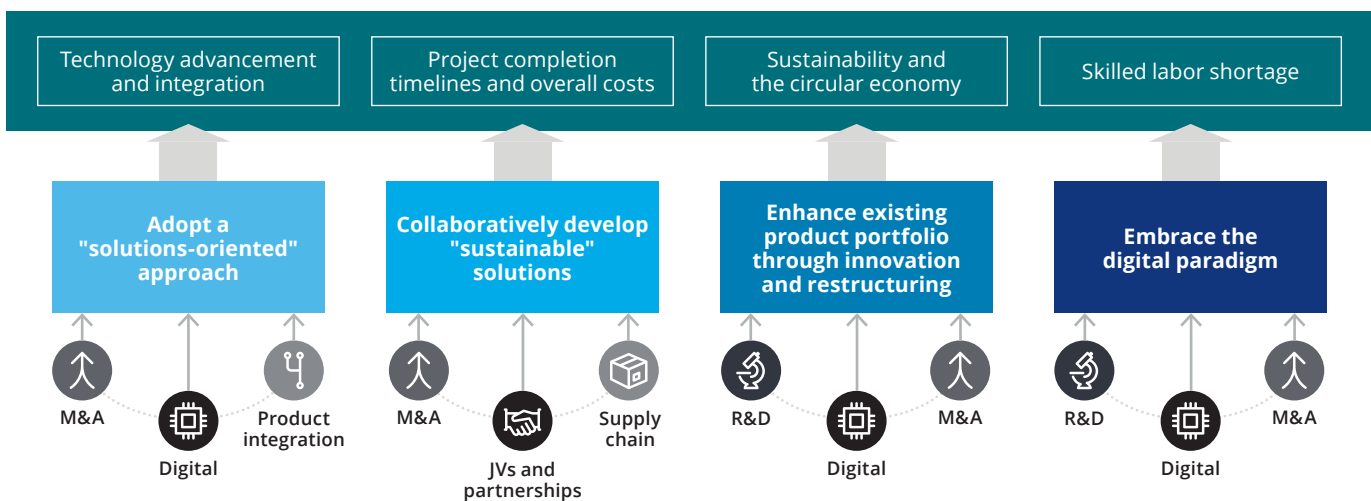
Source: Thomson SDC platinum database

However, the number of divestitures has been on the uptrend, and the overall value of such divestitures is higher than pure mergers or acquisitions in the last two years. Clearly, a few companies may be looking to exit the industry. One such case is that of a global diversified chemicals conglomerate, which is looking at either selling off its construction chemicals unit to potential bidders or finding a suitable JV partner.²³ Also, of late, many PE funds are increasingly showing interest, not only buying and selling pure-play construction CAMs companies, but also funding construction tech startups.

How should construction CAMs companies respond, given the above trends?

- a. **Adopt a “solutions-oriented” approach:** Chemicals companies can provide new offerings that integrate their products with a service. Services that integrate well with products can include technical assistance as well as digital services that enable a customer to find the right product match. For example, a diversified chemicals company not only provides digital tools (to find the right product) to its customers, but also an online order portal.²⁴ Owning such solutions can help companies capture a greater share of the growing pie, especially in the emerging technology space. For instance, out of the \$40 billion market projected for 3D printing in construction (by 2027), 90 percent is attributed to applications and services, while only less than 1 percent is directly attributed to materials.²⁵
- b. **Collaboratively develop “sustainable” solutions:** Companies can promote and position their solutions (products + services) to decrypt the most pressing issues of the industry—with sustainability capturing the top-of-the-mind share for most businesses. A “sustainable” solution can be innovative, but it can be costly too. Therefore, apart from delivering “sustainability” benefits to the customer, such solutions should also strive to reduce overall systems costs (including installation cost) and expedite project completion. Understanding and acting on these requirements will likely need proactive collaboration between construction CAMs companies, contractors, and construction tech companies. Such collaboration would also synchronize and streamline a finalized plan for execution across materials, systems, processes, and operations.
- c. **Enhance existing product portfolio through innovation and restructuring:** The construction CAMs industry seems on the path to consolidation, with many mergers and acquisitions (M&A) simultaneously happening. Companies should be on the lookout for how these M&A activities are shaping up and whether there are opportunities for them to boost their existing product portfolio. Construction CAMs companies can also explore acquiring or tying-up with emerging tech companies to develop new products that complement their existing portfolio. These technology JVs can be in the space of emerging building technologies like 3D printing and prefabrication, or they can also be in construction management software and technical tools. The good news is that the existing construction tech startup space has very few pure-play construction companies funding them, which leaves ample opportunity for construction CAMs companies to jump in.
- d. **Embrace the digital paradigm:** Such an approach could include machine learning, big data, sensors, networks, and simulation tools that can help convince the customer of a reduction in total systems costs without compromising overall performance or quality, through real-time monitoring. For example, a product simulation tool can readily assess what can be the potential reduction in overall costs for a component if the customer incorporates a certain product from the construction CAMs company. Investing in digital technologies can also create unparalleled differentiation, enhance construction efficiency, and mitigate the issue of skilled talent shortage.

Figure 4. Strategic responses of construction CAMs companies to major trends



A NEW HOPE FOR THE FUTURE

Some \$69 trillion worth of infrastructure investment could be needed between 2017 and 2035, a majority of which (~60 percent) will likely happen in emerging economies.²⁶ In Asia-Pacific, for example, a substantial portion of investment is expected to be directed toward middle-class residential housing, and huge infrastructure initiatives funded by the government (e.g., China's Belt and Road initiative). Because of this, growth in construction CAMs will likely outpace global GDP growth and the overall construction market.

But for construction CAMs companies to successfully ride this wave, they should shed their old skin and adopt "newer" ways of doing business. Companies that embrace innovative technologies (including digital), focus more on collaborating with their customers, and strive toward making their organizations highly agile by restructuring their product portfolios may stand a higher chance to ride on the crest even when the seas become rough.

Authors

Duane Dickson

US Oil, Gas & Chemicals sector leader
Principal & vice chairman
Deloitte Consulting LLP
+1 203 979 2300
rdickson@deloitte.com

Michelle Meisels

Engineering & Construction leader
Principal
Deloitte Consulting LLP
+1 213 688 3293
mmeisels@deloitte.com

Aijaz Hussain

Senior Manager and Chemicals research leader
Deloitte Services LP
+1 469 395 3759
aihussain@deloitte.com

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