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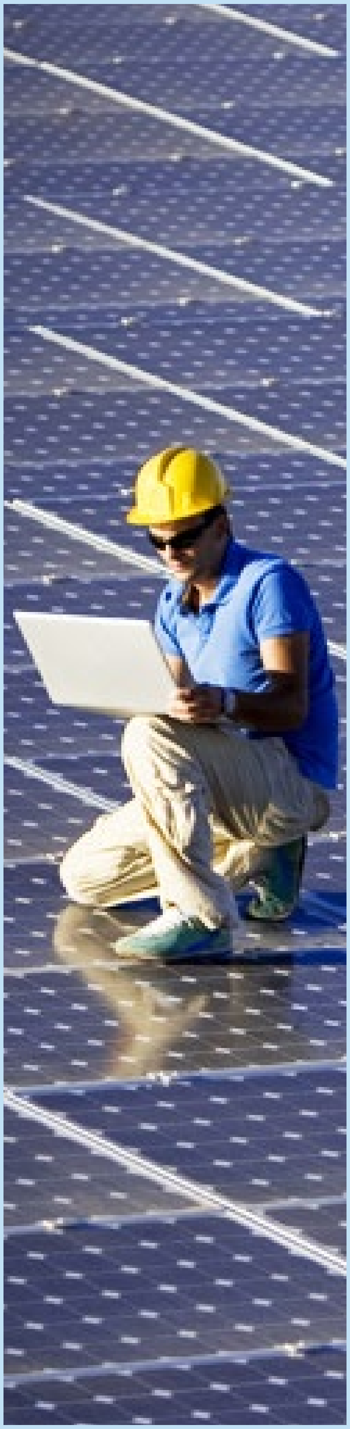

A BLUEPRINT FOR CARBON-LIGHT EPC OPERATIONS

Residential and commercial real estate as well as public infrastructure define the landscape of the global economy. However, this built-up infrastructure contributes to 38% of annual global greenhouse gas (GHG) emissions, according to the World Business Council for Sustainable Development (WBCSD).

It covers Scope 1, 2 and 3 emissions of the GHG Protocol – activities under direct and indirect control of enterprises as well as sources beyond their control. All in all, carbon is deeply embedded into the Engineering, Procurement and Construction (EPC) business.

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Carbon emissions of the EPC industry are classified into operational and embodied or capital emissions. Operational carbon is the carbon dioxide equivalent (CO2e) or GHG emissions offshoot of the energy consumed for lighting, heating, cooling, and other plug load requirements for operations and maintenance of buildings. Embodied emissions accrue during construction of a project.

Besides the carbon-intensive processes for extracting mineral ores and manufacturing building materials such as reinforced concrete, steel, cement, brick, and ceramic; disposal and end-of-life aspects of materials have a multiplier effect on embodied carbon.

Fossil fuels consumed by bulldozers, generators, dump trucks, and other equipment in a construction site also add to the carbon footprint.

Mitigating the carbon challenge

Mike Reynolds, the founder of an ecoconstruction company, has been building residential Earthships in Taos, New Mexico, since the 1970s.

An Earthship is a self-reliant ecosystem, established on the foundational principles of green buildings. The carbon-neutral structures use only natural and recycled materials.

Floor-to-ceiling solar windows regulate the room temperature, without grid power for heating or cooling. Notably, the demand for Earthships is growing exponentially worldwide.

The EPC industry can use the Earthships playbook to systematically reduce its carbon footprint. At the industry-level, low-carbon engineering standards need to be established for real estate assets, and certification and accreditation requirements for the carbon performance of materials should be upgraded. At an enterprise-level, decarbonization goals need to be factored into strategic and operational business plans.

The WBCSD report urges the EPC industry to adopt a lifecycle approach for effective decarbonization. It demands enterprises to assess embodied and operational carbon across the value chain. Visibility into the carbon intensity of systems and materials helps formulate policies and set realistic decarbonization targets. Further, quantitative inputs on whole life carbon performance of buildings guide strategies for offsetting emissions as well as investment decisions on adoption of low-carbon solutions.

Establishing a digital thread

Carbon reduction demands concerted action by constituents across the EPC value chain. Stakeholders in the ecosystem, including policy makers, government agencies, professional bodies, designers, architects, structural engineers, contractors, materials manufacturers, suppliers, logistics operators, environment consultants, academic institutions, technology companies, and user communities need to collaborate for carbon-light operations.

Strategic alignment of shared goals makes it easier to incorporate GHG considerations across the EPC project lifecycle – from design of industrial structures and residential buildings to use and decommissioning / repurposing.

Digitization accelerates transformation by connecting stakeholders via a digital thread to improve carbon efficiency. It offers a single source of truth to implement advanced technology solutions and analytical tools for climate risk management.

Artificial Intelligence (AI) / Machine Learning (ML) systems consume data across the ecosystem to establish baseline targets. Data-first milestones help enterprises create actionable roadmaps for effective emission reduction.

AI / ML systems also provide a transparent mechanism for tracking carbon performance and identifying opportunities for improvement. Further, digital solutions enhance planning and enable course correction in decarbonization programs.

Reducing embodied carbon

Design and engineering play a primary role in lowering the whole life carbon footprint of EPC projects. Digitization enables enterprises to adopt 5D Building Information Modeling (BIM), use carbon calculators, and deploy mixed reality tools to visualize the impact of architectural concepts and choice of materials on embodied carbon. Further, digital solutions drive site efficiency by decarbonizing specific modules such as design, construction, and procurement. Visualization and simulation tools reduce over-specification as well as over-design while ensuring optimal use of natural lighting and ventilation. For instance, the impact of cavity wall insulation and double glazing on energy efficiency can be analyzed to optimize specifications for Heating, Ventilation and Air Conditioning (HVAC) systems.

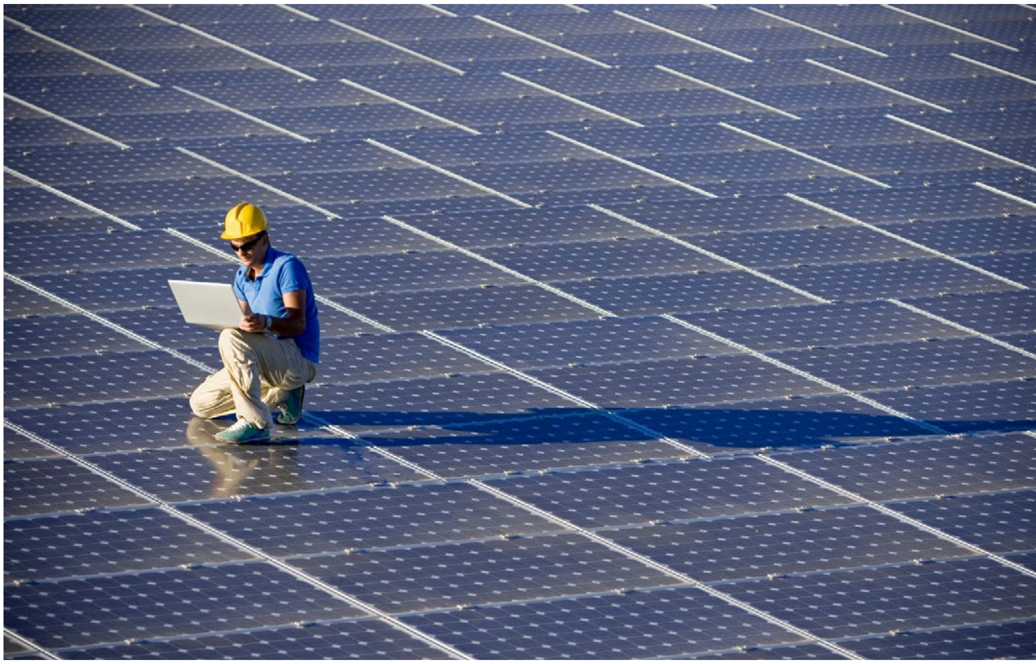
A digital ecosystem powers data-driven procurement and fabrication decisions to maximize carbon reduction. BIM tools allow teams to integrate the output of digital models for evaluating materials to meet specific project requirements. It enables informed decisions to replace carbon-intensive materials with alternative hybrid composites. Similarly, diesel-powered excavators, earth movers, cranes, and loaders can be replaced with an autonomous fleet powered by renewable energy.

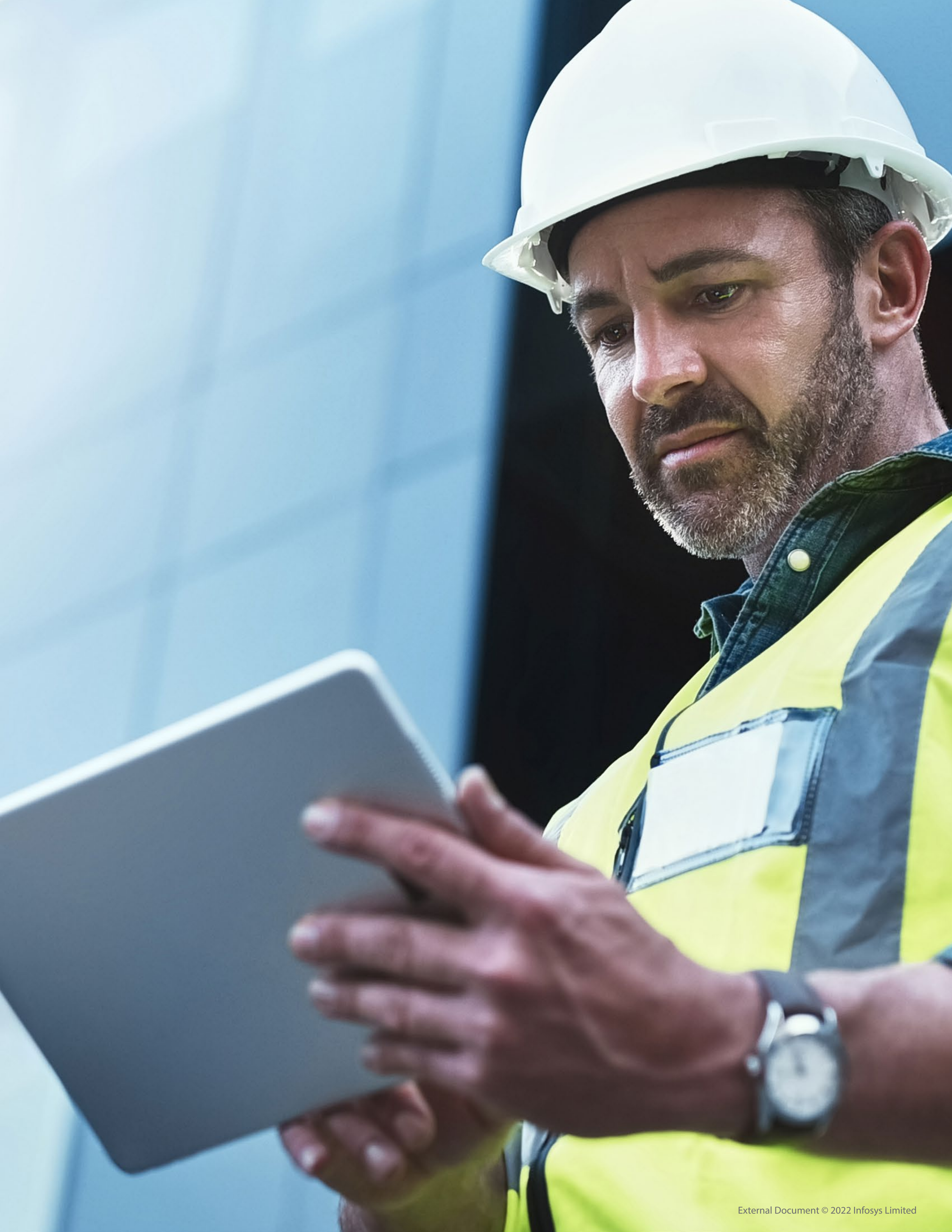
A digital supply chain allows EPC enterprises to explore options for sustainable materials. Digitization provides the flexibility to restructure the supply chain leveraging the principles of the circular economy – reduce, reuse and recycle. Supply chain carbon mapping is useful to measure and reduce CO2e emissions across procurement and logistics. These maps calculate the carbon footprint by accounting for the location of bulk materials, distance from source to destination, and mode of transportation.

At the same time, Non-Destructive Testing (NDE) techniques test the resilience of reused and recycled building materials. It enables engineers at construction and fabrication centers to assess risks accurately and take informed sourcing decisions.

The ability to validate the suitability of locally sourced and lower-intensity materials expands options to reduce net embodied carbon.

For instance, prefabricated / precast units may be used to minimize the cost of structures under construction. Similarly, recycled steel rods can be used in a concrete beam instead of virgin steel rods produced at a fossil-fuel based production plant. Significantly, a digital thread enables seamless communication and collaboration among constituents to minimize capital carbon in greenfield projects.





Minimizing operational carbon

While operational GHG emissions of buildings is the outcome of design decisions made in the build phase, effective demand-side management can rationalize operational energy requirements.

The EPC industry can foster a carbon-light culture by focusing on renewable energy supplies and energy efficiency across domestic, commercial and industrial buildings. Digital tools can be embedded in the operational environment for continuous assessment and effective control of carbon emissions.

Digital platforms for energy-as-a-service enable consumers to set realistic targets and control usage in real time, and select zero carbon sources.

IoT-driven infrastructure management solutions measure and report energy consumption while identifying opportunities to conserve energy.

AI-based load (demand)-supply optimization solutions and econometric models map the carbon footprint and building-level energy profile with energy efficiency standards.

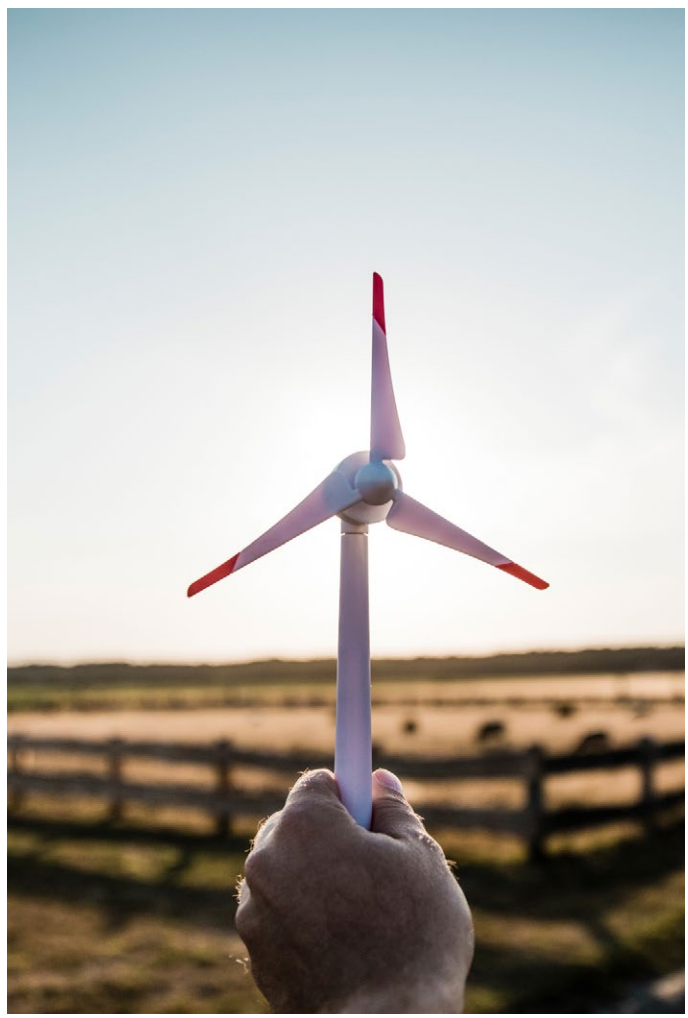
Insights from benchmarking serve as inputs for programs to influence consumer behavior, replace carbon-intensive equipment, and implement predictive asset maintenance.

Further, field compliance audits provide visibility into load factors and performance, which enables targeted interventions to better manage demand dynamics. An attitudinal change is required for decarbonization of the EPC industry.

Digital tools aid training and knowledge management. e-learning modules enable enterprises to share best practices and collaborate with partners for developing innovative design practices and remediation strategies.

Simultaneously, skill development programs for employees need to focus on technologies, frameworks and tools for net-zero build and operating environments. Professional education should equip engineers with the ability to assess carbon performance at the design phase and commission projects that are planned for optimal resource utilization.

The EPC industry needs to enhance digitization to decarbonize operations and help nation states achieve goals of the UN Climate Change Conference of the Parties (COP26) agreement.



About the Authors

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Mitrankur (Mit) Majumdar is a strategic business leader with 25 years of experience in Technology consulting. He specializes in bringing business transformation through Technology, Process and People intervention. Currently at Infosys, Mit plays an important role in positioning Infosys as a global systems integrator across information services, publishing, professional services, education, EPC and travel and hospitality practices. Prior to that Mit was instrumental in incubating and developing market share for our telecom, wireless, cable and satellite industry segments. He was also responsible for growing the cable portfolio as a significantly large practice within Infosys.

Mit holds a bachelor of engineering degree in electronics and telecommunication and an MBA from McCombs Schools of Business, University of Texas. Mit has also completed a 1-year Global Leadership course from Stanford. He is on the advisory board of Business School of Texas A&M, Commerce, Texas. He is also a Board Advisor for University of Illinois, Chicago – College of Engineering. He is also on the advisory board of GEDC (Global Engineering Deans Council).

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