



# REIMAGINING AEC

Industry Leaders Look to  
a Post-COVID-19 Future

Report by

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Thank you to the Autodesk customers who contributed their time, insights, and feedback during the symposium sessions that informed this report.

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## Executive Summary

In September, innovators and thought leaders from 10 countries around the world met virtually over a two-day period to take stock of the year's events and the impact on the global architecture, engineering and construction (AEC) industry in the immediate and longer term. They discussed a range of themes, from the macro forces affecting the industry and society, to the impact of the COVID-19 pandemic, to the strategies, tools and processes that will enable the industry to build resilience and transform to meet the demands of the future.

The pages that follow provide an overview of the two-day, multi-region session. Key topics include:

- The extent to which COVID-19 has accelerated digital transformation, and the risks and white space opportunities this provides to the AEC industry;
- Social, geographic, and demographic changes that affect our industry and the way we work;
- How the definition of the workplace is shifting, and what it means for project delivery, collaboration, and market opportunities;
- The future of innovation and design, as enabled by technology;
- The role of environmentalism, and how we can align it with business benefit;
- Strategies for improving project delivery in virtual environments;
- How Industrialized Construction (IC) and Design for Manufacture and Assembly (DfMA) might help us build a stronger, more efficient, more resilient industry;
- The role of data in AEC, and how we can use it to build stronger ecosystems; and
- What we think the world will look like in 10 years' time.

In the words of one industry leader:

*This is a time for innovation, if we rise to the challenge.*



## A Note from Autodesk

At Autodesk, we are consistently inspired by what our customers do with the products we make. That's why we hold events such as the AEC Futures Symposium: to learn and use what customers have learned to shape our long-term strategy.

As challenging as 2020 has been, it's encouraging to see that the circumstances in which we find ourselves have already driven innovation and change. We have adjusted to remote work. We have seen an exponential acceleration of cloud collaboration across the industry. The pandemic is accelerating the digitalization of the industry and transforming the way we work like never before.

Now it's time to reimagine how we design, the things we make, how we use technology, and how we plan our spaces. These changes must apply across the spectrum of the built environment, so we can return to the office and other shared environments safely.

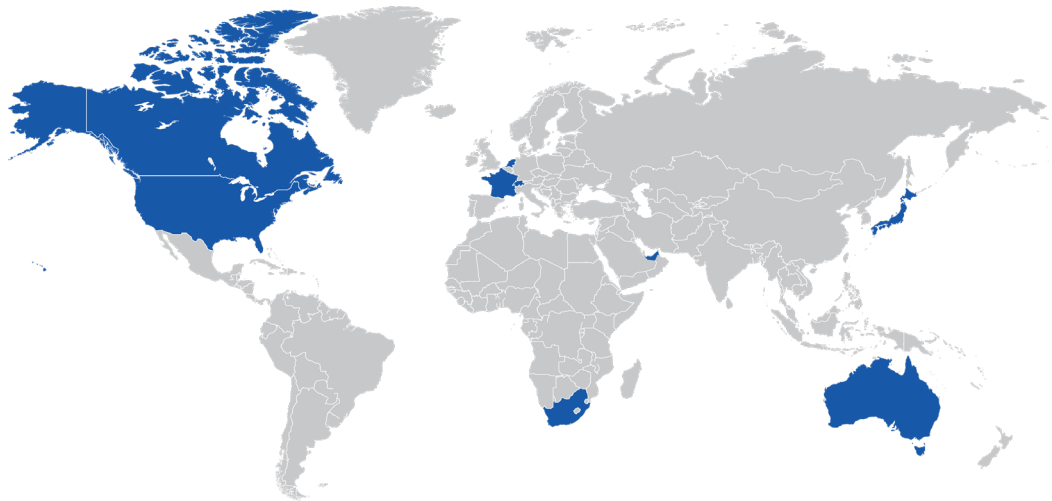
The pandemic has accelerated different ways of working, but the goal—to be resilient—is constant. We are at an inflection point; subjects such as the essential nature of our industry, the types of work we do and where and how we work are now on the table for us all to reimagine. We have an unparalleled opportunity to influence and drive these changes together.

Our thanks to all of you who participated in this year's symposium and shared your time and insights with us. And, for those of you who were not able to attend, we hope you find inspiration in this report and will partner with us not only to reimagine our industry, but to change it for the better.

# About the Participants

## Locations Represented

- Australia
- Canada
- Dubai
- France
- Japan
- Netherlands
- Singapore
- South Africa
- Switzerland
- USA



## Participant Titles

Director External Ventures	AEC Thought Leadership	Co-Founder	Education Manager	Engineer
Construction Technology Manager	AEC Sales Readiness Manager	Director, Product Management		
Industry Program Manager	Director Of Architecture	AV Technology Support Specialist	Director	
Industry Marketing Manager, Thought Leadership	Engagement Manager, Global Technology Centers	Executive Director And Founder	Experience Design Manager	
Director Strategic Foresight Office Of The President	Digital Advisory Lead	Director Of Engineering	Head Of Industrialized Construction Strategy & Evangelism	
Director, AEC Industry Futures	Director, Building Design Strategy	Director, Practice Group, Strategic Foresight	General Manager - Digital	
Global Manager - Design Technology	Group Product Manager- Aec/Smart Cities/3d	Head Of Digital Practice	Industry Marketing Manager, Infrastructure	
IS Leader - APAC / Technology And Technical Applications Leader	Managing Director	Managing Partner	Owner	Head Of Innovation

## The AEC Industry Today

### Macro Forces Affecting the Industry

COVID-19 has had disparate impacts on industries and firms. Some have been able to operate as before, others at reduced levels, and still others have been dramatically upended.

Construction sites, warehouses, and other workplaces are socially distanced. Some offices remain closed, while others function at reduced capacity. Fulfillment centers operate nonstop to keep up with accelerated demand for ecommerce. Homes are crowded with families and others competing for connectivity, and a quiet place to work, while transportation agencies struggle to deliver essential services in the face of eroding ridership numbers.



Some companies and industries are at risk, while others dramatically reimaged their processes, technologies, and business models to meet rapidly changing needs. Facilities that previously manufactured commercial products pivoted to PPE production. Landmark retail locations around the world are being reborn as fulfillment centers for ecommerce.<sup>1</sup>

All of this creates uncertainty in the AEC ecosystem. At the same time, the competitive landscape is undergoing a significant shift. As technologies mature, industries converge, revealing a spectrum of opportunities for reinvention and optimization, as well as risks driven by consolidation, a changing market landscape, and overhead and capitalization costs.

“The sentiment that was expressed at the symposium,” reported Hilmar Koch, Director, Practice Group, Strategic Foresight at Autodesk, “is that we have really been jostled into a new state of thinking about both physical infrastructure such as transportation and virtual infrastructure such as communication and digital systems, and the purposes they serve for us. While some systems such as transportation are being disrupted as a result of shifts from urbanization to suburbanization, over time they may have a different role to play in terms of how we live together and how communities form.”

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<sup>1</sup>Fung, Esther and Herrera, Sebastian. [“Amazon and Mall Operator Look at Turning Sears, J.C. Penney Stores Into Fulfillment Centers.”](#) The Wall Street Journal. August 9, 2020.

“The most exciting thing that I’m seeing post-COVID is related to more distributed forms of agency and the potential for new forms of urban life to emerge in cities,” said Lindsey Wikstrom, Senior Research Scientist, Autodesk. “This might also tie into the way that we create resilient and equitable experiences, and our ability to measure places qualitatively.”

But one thing that 2020 has exposed is the fragility of the AEC industry in response to changes in the economy. “What we’re really talking about,” said Paul Murphy, Technology and Technical Applications leader for GHD, “is bringing an adaptive systems thinking view to community infrastructure and finding ways to go from monolithic, long-term investment and planning cycles into shorter timelines of agile and adaptable planning and delivery cycles.”

“This is similar in many respects to the changes in the software development world. Over the course of the last 10-15 years, software has moved from fixed products delivered using waterfall approaches to more modular, agile methods of delivery. And I wonder whether there’s a commonality: to look at ways in which we can adopt more nimble approaches with dynamic modular frameworks.”

*“What we’re really talking about is bringing an adaptive systems thinking view to community infrastructure and finding ways to go from monolithic, long-term investment and planning cycles into shorter timelines of agile and adaptable planning and delivery cycles.”*

**Paul Murphy**

Technology and Technical Applications leader for GHD

## The Impact of COVID-19

While COVID-19 clearly accelerated a number of trends already in motion, the impact to specific industries has been highly variable. The challenge now is to assess which elements of our “new normal” are permanent, which are temporary, and which may be episodic. Following are some of the key questions and imperatives:

- **Convergence of manufacturing and construction and the role of design.** Before COVID-19, companies were slower to adopt new technologies. Since the beginning of 2020, however, we have seen accelerating use of cloud-based technologies and increased momentum toward breaking down information silos to support integrated project delivery. At the same time, the downturn has increased competition significantly, driving firms to seek competitive advantages.
- **The construction labor workforce.** Although COVID-19 has tended to affect the construction labor workforce less intensely than other groups, it is still critical to find ways to motivate people to learn new skills to enable us to build the resilience to confront different types of challenges and opportunities.
- **Asset management.** There is a clear need to adapt existing buildings and support technology adoption and workflows not only in the face of COVID-19, but to build more industry resilience overall.
- **Mechanical, Electrical, and Plumbing (MEP) and Heating, Ventilation and Air Conditioning (HVAC) Imperatives.** Sanitation requirements are driving the imperative for changes to MEP and HVAC systems to address COVID-19 safety.
- **Impact of social distancing on design.** While requirements for social distancing are currently prompting changes to design standards, it remains uncertain how permanent these changes will be.<sup>2</sup> At the same time, there is ample precedent for changes to architectural and design aesthetics in the wake of public health emergencies.<sup>3</sup>

*“Looking back 12 months, almost nobody thought the whole world could be changed within a couple of weeks by a microscopic virus. But the current situation makes you think about what else could happen that would have such a strong impact on life on this planet.”*

**Symposium Participant**

<sup>2</sup>For more on this topic, see Etlinger, Susan. [“Designing for Social Distancing: Balancing Safety and Human Connection”](#). September 9, 2020.

<sup>3</sup>Chayka, Kyle. [“How the Coronavirus Will Reshape Architecture.”](#) The New Yorker. June 17, 2020.

## Strategies for the Future

### Rethinking Assumptions

Irrespective of COVID, the AEC industry faces an unprecedented opportunity to reflect on and plan for the future of our work. At the same time, said one participant, “it seems early to tell what will stick and not stick. Our opportunity to influence this by where we choose to focus research and technology development is pretty interesting...maybe real change is not only possible but guidable.”

This means questioning fundamental assumptions about the way we live, work, and build. For example:

- **Do structures need to be permanent?** Should we rethink the assumption of permanence in built environments, reflecting the tension between mutability and permanence of the built environment at multiple scales?
- **Can infrastructure fund itself?** Can we reimagine infrastructure to be self-supporting, and how could that free resources for other creative uses?
- **How can data and collaboration support resilience?** Having a common data environment (CDE) can drive insights that help design teams tackle challenging social problems.
- **What would it look like to focus less on profit and more on prosperity?** How could we articulate the value of prosperity in a compelling and consistent way? What metrics might we need?

*“Don’t waste a crisis—reinvent!”*

**Symposium Participant**

## Reimagining the Workplace

While the term “workplace” means different things to different people—from a construction site to a factory to a fulfillment center to an office—there is no question that the definition is shifting.<sup>4</sup> Following are some of the key insights:

- **Distributed work will become a permanent feature of the workforce.** This will accelerate use of digital technologies and change the use of office space. On one hand, a mixed presence office has the potential to be a completely different work experience. On the other: Do we even need to have offices?
- **At the same time, we need to better understand the nature of distributed work.** Specifically, we need to consider the steps to fully enable a distributed workforce, which involves a number of technology, people, and industry factors, as well as a different kind of leadership and social contract.<sup>5</sup>
- **Distributed work may also yield new client opportunities.** Given the likely permanence of some form of distributed work, companies note that some clients who previously required local presence are now more open to remote professional services, which has the potential not only to diversify the internal talent base, but revenue opportunities as well.
- **At the same time, in-person interaction is still critical for innovation.** Working from home provides work-life balance, but to foster trust and innovation, people still need to be in physical proximity.
- **People movement modeling is interesting.** Integrating generative spatial design with people movement modeling can open up a lot of options for designing built environments.<sup>6</sup>
- **Supply chains are transforming.** There will be a re-consideration of local vs. global supply chain as supply chains become stable again. Will this be a permanent shift, or a periodic rebalancing?



<sup>4</sup> For more on this, see: Etlinger, Susan. [“Strategies for Growth in the Reimagined Workplace.”](#) October 22, 2020.

<sup>5</sup> Ibid.

<sup>6</sup> For more on this, see this webinar by Autodesk and Movement Strategies: [“Designing for Social Distancing: New Parameters in a Time of Change.”](#) July 7, 2020; and Etlinger. [“Designing for Social Distancing: Balancing Safety and Human Connection.”](#)

## People, Culture, and Collaboration

Collaboration is the common thread that unites discussion about the future of organizational culture. Collaboration among people in different locations is becoming the norm, while shared delivery goals, breaking down organizational siloes, and supporting this work with a common data environment are also powerful ways to align teams.

But not everyone agrees about the impact or even the practicality of collaboration within and across organizations. Some question whether distributed work environments are conducive to creative collaboration, while others question whether people are fundamentally capable of collaborating at all. And, of course, geography, culture, industry and other factors all have a role to play in determining the right approach to organizational design.

*“I’m excited about the distributed workforce, encouraged along by the pandemic. We’ve always collaborated globally; to have it even more distributed is exciting to me.”*

**James Brogan**  
Principal/CIO at KPF

For example, while the pandemic has been a catalyst for increased collaboration, and it can be a powerful driver of change, factors such as performance incentives and hierarchical structures can undermine a desire to collaborate. “At the end of the day, culture trumps intent,” said Chris Luebke, former Director for Global Foresight + Research + Innovation at Arup. “I don’t agree that we’ll only see a steady flattening of organizations; most of us need clear lines of responsibility and accountability. Hierarchy is one way to express this, and this is welcome in some cultures and challenges others. Time will tell which will triumph.”

Others frame the issue in terms not only of common goals but of common language. One participant noted that “the comment ‘the two groups don’t speak the same language’ sticks.” As a result, aligning organizations to value and reinforce collaboration, while promoting better translation and communication among groups, could become powerful tools to develop organizational resilience. But beyond the ability to collaborate in a static environment, true resilience requires the ability to work together in shifting and often unpredictable circumstances.

## THOUGHT EXPERIMENT #1

## What is the future of innovation and design?

Any discussion of innovation must focus both on internal (organizational) and external (market) factors. From an internal standpoint, the key issue is how to overcome resistance to change within the industry, as well as how to leverage the types of innovation we are already seeing in areas such as Industrialized Construction (IC) and Design for Manufacture and Assembly (DfMA). From an external standpoint, the question is more about how to weather market and potential competitive threats. Following are some of the highlights.

*“We have been pushed into a new atmosphere of questioning and re-evaluating everything, and that change is required, because our context is not static.”*

Symposium Participant

## Innovation Means Rethinking Our Assumptions

One participant commented that “the industry talks about disruption and innovation, but we seem to be stuck in a place where innovation means using different technology but asking for the same output.” At the same time, said another, “I’m excited by the amount of innovation we’re seeing from startups and early-stage companies. In some sense, a lot of this bodes well as there are so many people trying new ways of doing things. On the other hand, I worry that this is really going to reduce demand for architectural services.”

Whether innovation comes from within or without, the discussion focused on several themes:

- **Competition.** How changes in the competitive landscape such as vertical integration and new entrants into the market can spark innovation.
- **New Approaches.** Opportunities for approaches such as DfMA to optimize processes and outputs, expanding the possibilities for innovation.
- **New Technologies.** Intelligent technologies such as generative design, not only to increase speed and quality of outcomes but also to reveal new ways of solving problems.
- **Legal Agreements.** The potential to explore new ways to protect against liability related to model use, while removing obstacles to progress.
- **Crowdsourcing Input.** New ways of collecting input by crowdsourcing people’s preferences on questions about anything from project and budget priorities to fixtures and fittings, thus building support by including communities in the design process.

No matter which of these possibilities the industry may adopt, this is a time for the industry to come together, ask probing questions, and consider a range of potential futures.

## THOUGHT EXPERIMENT #2

## How might the industry gain global alignment around sustainability?

Environmentalism and sustainability emerge in nearly every conversation about the future of the industry. What do we mean by environmentalism in AEC? What are the key priorities in different regions, and how do we foster alignment while respecting the economies, political environments, workforces, and social structures of these disparate regions and cultures?

One useful way to focus the discussion is to start from existing institutional frameworks and approaches. The central aim of [The Paris Agreement](#), for example, is “to strengthen the global response to the threat of climate change,” while the [United Nations’ Sustainable Development Goals](#) focus on 17 global issues such as clean water and sanitation (SDG #6); affordable and clean energy (SDG #7) and sustainable cities and communities (SDG #11).

From a more programmatic standpoint, the European Union approved a stimulus package in July 2020 intended to “reach the EU’s objectives of climate neutrality and digital transformation, to offer social and employment support as well as to reinforce the EU’s role as a global player,” while China’s President Xi Jinping “pledged that China would become carbon neutral by 2060.”<sup>7</sup>

Further, while designing with environmentalism as a core mandate will grow in importance, there is also concern that this issue will continue to be politicized and that, at least in the United States, its influence on the AEC industry will depend on political leadership and perceptions of economic risk and value.

In emerging economies, some felt, there will be tension between environmentalism and economic development, regardless of whether or not that is a false choice. “I am hopeful,” one participant commented, that “as world citizens, we will make environmentalism a top priority and rally around it.”

*“I see environmentalism and resilience as interrelated. The world is changing, and our building and infrastructure are going to respond by being stronger and more sustainable.”*

**Symposium Participant**

<sup>7</sup> [“Covid-19: the EU plan for the economic recovery”](#). European Parliament. Updated July 29, 2020. [“China carbon neutrality in 2060: a possible game changer for climate”](#). European Union External Action. October 23, 2020.

## Project Delivery

While incremental digital transformation has certainly prompted changes in the industry over the past several years, the sheer speed and suddenness of the shift to distributed work as a result of the COVID-19 pandemic has affected AEC project delivery in a multitude of ways.

*“Project delivery is equal parts planned activities and a bunch of gotchas—change of conditions, change of scope, change of people, change of economic factors—stuff that is hard to see coming that you may not have thought about until it’s sitting in your lap. And I think there’s a real opportunity to address that by using better project performance data.”*

**Cory Dippold**

Mott MacDonald

At the same time, the combination of increased collaboration and new digital processes (especially those hastily invented under duress) also have the potential to reduce efficiency in the short term. Some of the most promising strategies to adjust to virtual work, align teams and leverage technology to deliver projects more effectively and efficiently included:

- **Stakeholder Integration.** Encouraging stakeholder integration to ensure alignment and reduce confusion, as well as sharing risks and lowering liability boundaries to support project success.
- **Common protocols and language.** A set of protocols and a common language to describe the process from conception through operation to set phase-appropriate expectations, help ease pain around model uses, facilitate decisions and approvals, drive data continuity throughout the project and ensure that every stakeholder gets what they need.
- **Technology and Tools.** Processes such as Business Information Modeling (BIM) that align modes of digitization and embed fabrication knowledge, as well as early use of models and protocols for sharing them. Additionally, making technology a safe space for record-keeping supports procurement, as it removes the silos between construction and ownership.

- **Common Data Platform.** A trusted common data platform and format, and a single source of truth, are critical to enable people across the value chain to share information and deliverables in a common language—an area where a lot of inefficiencies exist today.
- **Continuous Reshaping.** The ability to collect data over the lifetime of the building and learn more about its operation and waste processes.
- **Knowledge Transfer.** Recognition that there will be some degree of variability—one size doesn't fit all. Embedding and sharing knowledge from design to delivery; for example, embedding knowledge from fabricators throughout all specialties so that teams can deliver buildings in more effective ways.
- **Retooling and Reskilling.** One of the key issues the construction and manufacturing industry faces today is the gap between existing skills in the labor workforce and those needed to thrive in the age of intelligent automation. This gap will only widen without a commitment to aligning employer and labor needs by retooling and reskilling where necessary and possible. The good news is that the ways that employees upskill and reskill are evolving a great deal, driven by advances in assistive learning and learning-by-doing technologies.<sup>8</sup>



<sup>8</sup>For an in-depth analysis of methods to enable worker success, see Speicher, Joe and Neuhaus, Tracy. [“Supporting worker success in the age of automation”](#). June 2019.

## New Approaches: DfMa and Industrialized Construction

DfMA is a set of design principles that enables and optimizes prefabrication and the productization of traditional construction processes. Products and components are designed specifically for manufacturing and to make manufacturing processes easier and more cost-effective. Industrialized construction (IC) promotes the advancement of construction processes by employing mechanization and automation. Taken together, DfMA and IC aim to bring consistent, productized processes to design and construction.

*“The industry absolutely needs to embrace industrialized methods like DfMa and prefabrication but keep the sense of designing for human value.”*

**Symposium Participant**

How will these approaches shift such a large, fragmented industry from top to bottom?

### Perceived Risks

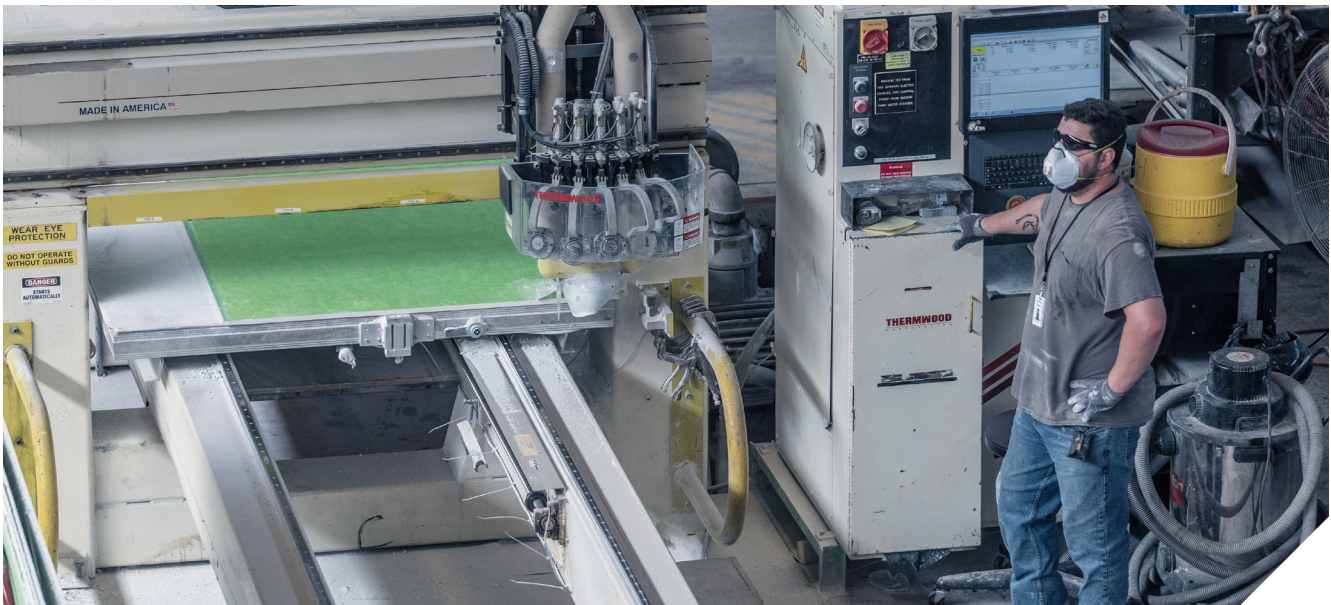
Like any significant industry shift, there are a number of risks to consider. One is the ambitiousness and investment required, and the industry expertise and leadership needed to make IC and DfMA a reality. There is also a risk that, taken too literally, IC and DfMA could limit collaboration and innovation and transform design, manufacturing and construction into procurement-led disciplines.

### Perceived Opportunities

These approaches hold tremendous potential to improve efficiency, support speed of construction and accelerate schedules for designing and building. It is also important to distinguish between standardization of process versus output. Processes may become more predictable and controlled, but within a given discipline there may be a range of possible product variations. Said one participant, “We can still create a cost effective, environmentally sound, beautifully designed product with better outcomes, while having a controlled process.”

Approaches such as IC and DfMA also present significant opportunities to scale and integrate methods across different types of communities and to innovate from a process perspective: as we change what we build, we have a chance to reimagine how we build it as well.

Industrialized construction also has the potential to promote sustainable processes and practices. Said one participant, “Industrialization (with customization) will standardize progressive models of building and infrastructure that can be more sustainable and environmentally responsible, as opposed to leaving localized and siloed methods unchecked.” “At this point,” said another, “I don’t think there’s a choice. If we want to address the challenges brought about by climate change and hyper-urbanization, we must fundamentally transform construction, so that we can significantly lower our carbon impact.”



### Open Questions

Some of the most pressing issues in the industry focus on how to foster an open, broad range of ways to use industrialized construction to support diverse firms and modes of practice, rather than relying on consolidated, vertically integrated companies. There are workforce impacts to consider; specifically, what process and culture changes might be needed for the construction labor workforce, and, of course, the impact on jobs. There is also the question of customer attitudes about these approaches, given that this industry has historically resisted change.

### How Applicable is IC for Developing Economies?

IC and DfMA also raise larger questions about the role of economics and demographics in the built environment and how they may apply to emerging economies in which resources and priorities may differ. Most importantly, while industrialization is necessary to achieve economies of scale required to solve global issues, it can’t leave behind disadvantaged communities who may not be able to benefit from massive industrialization technology.

## The Big Idea: IC is Convergence Realized

The most prominent example of convergence is Industrialized Construction, which demonstrates the merging and transformation of technology, industries, business models, process, products and ultimately value delivered. The AEC-O ecosystem is accelerating delivery and increasing certainty through adoption of product mindset using Design for Manufacturing (DfMA), resulting in optimized prefabrication. These advances enable robust design exploration that optimize the manufacturing and assembly process, aesthetics, utility and value over time.

“The industry needs to move to solutions that provide predefined elements for commodity building components,” said Amy Marks, Head of Strategy and Evangelism for Industrialized Construction at Autodesk. “This will free designers and engineers to focus on value creation aspects such as user experience, functionality and aesthetics.”

### Thinking Ahead

Says Amy Marks, “We are moving to an expanded construction ecosystem that includes new ways of working, new business models, new capabilities, and new players. In order to accelerate to meet global demand and increasing complexity, the AEC-O ecosystem will adopt standardization for common or repeatable building elements, ultimately in order to apply machine learning, AI, generative design, resulting in a more automated process that also informs an integrated, functional digital twin.

“Contrary to popular belief, IC expands what is possible by allowing generative design and AI to explore all the ways these elements can be combined to create productive, efficient, novel and better outcomes.” These changes will happen when the industry moves to digitization of functional, real product and project data connecting the broader ecosystem—connecting design, make and operate.

Finally, she said, “It doesn’t matter what we call it, as it’s always a debate on language (IC, modern methods of construction, etc) –we won’t change until we look inward. Changing our behavior to get results from project data, processes, and design will allow us to make the biggest difference .”

*“We won’t change until we look inward. Changing our behavior to get results from project data, processes, and design will allow us to make the biggest difference.”*

**Amy Marks**  
Autodesk

## The Role of Data



The discussion on data centered on two main topics: its value as a vehicle for alignment and insight, and the human impact of data collection and use. Both themes speak to the tension that all industries face—to become more resilient and innovative while preserving the trust of stakeholders. Following are the key issues related to data and technology.

- **The need for data and a trusted common data platform** so people across the value chain can share high-quality information and deliverables in a common language—an area where there are currently a number of inefficiencies.
- **The value of high-quality data across the delivery process.** The opportunity to capture and act on human input processes and ensure that key data (design, requirements, goals, legal) about the project are maintained and transmitted at every stage of the design process easily and with minimal loss.
- **Interoperability.** Standardizing formats of deliverables and interoperability among architects, contractors and other stakeholders to solve major industry problems.
- **Designing for resilience.** The industry must focus more on the resilience of both product and process, with the understanding that flexible and adaptable buildings will survive and thrive—one of many new challenges in the industry.
- **Accruing the value of data over time.** This entails templating building processes and smoothing project delivery, but also collecting data over the lifetime of the building to learn about its operation and waste processes.

- **The potential of blockchain.** Whether blockchain contracts could be a viable and valuable way to maintain a trusted system of record.
- **Privacy and Permissions.** What permissions will people be willing to grant with regard to tracking? How will organizations and governments navigate this complex web of decisions? This is a particularly salient issue, even given existing privacy regulations such as the [General Data Protection Regulation](#) (GDPR) and the [California Consumer Privacy Act](#) (CCPA). As the AEC industry begins to place more importance on data and intelligent technologies, it must anticipate questions about the extent to which organizations and governments mine data about and track and monetize the behaviors of customers, consumers and everyday people. These issues—and their implications—are meticulously documented in Shoshanna Zuboff’s book [The Age of Surveillance Capitalism](#).

*“In AEC, we are at the very beginning of that level of maturity in using data to harvest AEC capital project delivery, or even the operational aspects of our physical world to guide behavior and outcomes. This is very much in the mind of most large companies and governments moving forward, with digital twins etc. being seen as an enabler, but what the implications are to our society and how we can expect different stakeholders emerging (and some being less prioritized) is of interest to me.”*

**Survey Respondent**

## THOUGHT EXPERIMENT #3

## What if cities had APIs?

As with many of the provocations, this one sparked debate at both ends of the spectrum. To answer “yes” implies that we will see smart cities that connect to a common data platform that powers a series of apps and digital twin networks that enable utilities and services to connect with each other.



The question becomes the extent of the interconnection. Does water become an app in the home? Does heat? Does a traffic light? The scale we envision carries a range of implications. Following are some of the highlights:

- **Short term implications.** Like most disruptive shifts, we may need to go through a stage of negative impact before there is a positive impact in the future.
- **Stakeholder Alignment.** Technology may be the (relatively) easy part; the harder part will be aligning different stakeholders with different agendas and developing the processes to support this wide range of needs.
- **Governance.** This includes legal and governance processes that are specific to the city but also recognizes that other cities and countries will have their own thresholds for what adopting an API means. Specifics include provenance of the API and the data, decisions about terms of use, authorized use cases, model oversight, and other factors.
- **Trust and Security.** Ensuring that data—particularly personal data—is secure, well managed and protected from denials of service, viruses and other threats. Clarity on what data is proprietary, what is open source and how these decisions are made and enforced.
- **Privacy and Equity.** Requirement for checks and balances to ensure that APIs and cities are equitable and balance information sharing and privacy protection. Protection from manipulation of such systems by autocratic governments.

## Strategic Foresight Exercise: The Headlines of the Future

The practice of strategic foresight helps us understand how emerging issues unfolding today could affect our business tomorrow. At Autodesk, we leverage foresight tools and methods to better navigate uncertainty, to more proactively capitalize on change, and to explore possible futures with the goals of realizing preferable futures.

During the symposium, we asked attendees to develop fictitious headlines for an AEC publication in the year 2030.

We then selected the 8 headlines which seemed to provide the richest canvas of possible futures in that time horizon. After the symposium a small, diverse team of Autodesk thinkers co-created two tableaus to illustrate pathways to novel states of the ecosystem and looked at potential impacts on our customers and on the company. These flash fictions and the discussions that emerge help us to learn about and assess potential futures of the AEC domain.

Flash fictions are just one of the many tools we use to understand the paths forward.

### Headlines

*Reuse of old building stock and reimagining spaces is transforming communities the world over.*

*The manufactured home you actually want. Delivered and installed on site in less than a week.*

*Believe it or not, people used to work together in offices: a history lesson about how COVID changed the world 3 pandemics ago!*

*Major hotel chain transforms building to commercial space using 100% of pre-existing components and materials*

*Construction industry shifts from delivering projects to products, cutting costs tenfold*

*The first autonomous and self-reconfigurable hospital delivered*

*Is the architect the new travel agent? Industry faces stiff competition from automation and remote competition overseas.*

*First ever net-zero skyscraper designed and built in Kampala, by local consortium*

## FLASH FICTION #1

## Freakonomics Podcast November 13th, 2030: Is the architect the new travel agent?

*If you have recently tried to find an architect, chances are high you were out of luck. One of the oldest of professions, it has been essentially evicted from voice search. We set out to find out why. The reasons we found surprised us too.*

Nearly 10 years ago, post-Covid pandemic, an abundance of empty commercial and residential real estate led cities all over the country to scramble zoning standards into a single plane of mixed-use. Planning departments digitized permitting and instituted rock-solid building standards platforms through public-private partnerships. The manufacturing sector responded quickly by churning out kits of parts to modify building interiors for just about any possible need. This laid the groundwork for the hungriest of developers to swoop in. With citizens moored in cities since the collapse of air travel, and with no one being able to reach long-haul destinations, the demand for variety in cities skyrocketed.



Highly specific data on the behavior change of citizens was available. The opportunity was immense.

But there was one catch: who could map the needs of people against their hobbies and their work, and optimize neighborhoods for self-actualization? This was not the kind of work where retrospective data offered any clues. Instead, generative algorithms had to be programmed for experience and lifestyle outcomes. And there was only one type of profession that had right stuff for the task.

Yes, architects, people who had always been as much psychologist as engineers, had the answers ready. They were quickly picked up as employees of the development consortiums as lifestyle designers. They were the ones that designed bespoke and community lifestyles all across the country, and they even published “immersive experience trailers” for those who were looking for more variety in life.

So, today, if you want to find an architect, go to your nearest travel agency, speak to any lifestyle consultant, and the odds are decent that you found a person who was trained as one. Just don’t call them an interior designer. They won’t like it.

## FLASH FICTION #2

**CBS Virtual – February 3, 2030: The first autonomous and self-reconfigurable hospital delivered.**

*BOSTON – In a city renowned for medical advancements, the latest one is the size of a city block: a fully autonomous and self-reconfigurable hospital.*

Called MassGen Poly-Hospital, the facility is the brainchild of MedTwin Construction Group, a partnership of Massachusetts General Hospital and A5D Construction.

“When the construction industry shifted from delivering projects to delivering products after the first COVID pandemic in 2020, it opened up an opportunity for A5D,” said A5D Construction CEO Jim Canter. “We had been building hospitals for years. By shifting to DfMA, we were able to produce whole hospital rooms and surgery suites in our factory and ship them out in weeks.”

Planning for MassGen Poly-Hospital began in 2026, after the latest SARS-COV-2 mutation outpaced patient bed availability in Boston for the third winter in a row. With many patients requiring long-term in-patient care, Massachusetts General Hospital recognized a need for personalized hospital rooms that could accommodate families in quarantine.

Working with architects, A5D produced a catalogue of room types, intensive care unit types, and nurse station configurations that could be arranged to suit emergent needs.

Each unit is freestanding, capable of operating independent of the city’s energy grid. Electric and utility systems within the units can be connected to form a larger autonomous building. Even the hallways are self-contained units. When the hospital needs to be reformatted to address emergencies, robotic construction workers decouple the units, transport them to their new location, and reconnect utilities.



“MassGen Poly-Hospital is designed to the highest international patient room standards,” said Ericha Stanbourne, Chief Configuration Officer at MedTwin. “In addition, the Robotics Union has established strict operational safety standards.”

At a ribbon-cutting for the hospital in January, Boston Mayor Ehli Sanchez said, “This is the future of healthcare in the United States and across the world. That, and universal healthcare, which I am confident we will have someday soon.”

## Assessing 2020, Looking Ahead

As we reflect on the events of 2020 and their massive impact on our families, communities, industries and organizations, it's easy to overlook the tremendous progress we have made as an industry.

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In the space of a few days, we radically changed the way we work and live. We adopted or accelerated our use of a range of technologies. We found new ways to connect and socialize. We learned how to be resourceful in an uncertain and worrying set of circumstances, all while serving our customers, communities, and continuing to move forward.

At the same time, our individual and collective adaptability is not the same thing as organizational or industry resilience. While we have shown that the AEC industry can flex to meet the demands of a crisis—even a sustained one—we still need the people, process and technology foundations that will enable us not only to survive, but to thrive, reimagine and grow, continuously and at scale.

This means questioning status-quo assumptions, building skills, experimenting with new approaches and processes, staying in close contact with customers and employees, and imagining new ways of doing business, designing, and building. It may not be easy, but it will be rewarding. And, if we take the opportunity to use this sustained period of crisis to reinvent our industry, we will emerge stronger, healthier, and more resilient than ever before.



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