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A Brief History of Technology for the Built Environment

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Learning Objectives

- Outline the broad history of leveraging technology to improve design, construction, and operations/maintenance of buildings and infrastructure.
- Identify inflection points in built environment tech during the 1960s, 1980s, and 2000s.
- Recognize major trends that shaped the advancement and the direction of AEC in the recent past, including CAD, BIM, and more.
- Define key themes expected to continue in the near-future of built environment technology.

Description

As we look at the remarkable pace and impact of the digital transformation of the built environment, it's sometimes hard to fathom just how much has happened in the last several years. Seemingly overnight, a whole new construct tech ecosystem has developed.

After years of stagnation, we're now in a virtuous circle. Technology advances including hardware and software. Ever-increasing demands from owner/operators, tenants, architects, engineers, contractors for new solutions. Entrepreneurs are responding to that demand by bringing innovation and technologies. And financial support of those entrepreneurs from incumbents as well as new players from the private equity markets.

To put what's happening today and what might happen tomorrow in context, it makes sense to go back in history, with a focus on the last 25 years when Autodesk started its AEC division.

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Speakers

Jeff Herriman

Jeff joined Ascentage in 2019 to provide business strategy and corporate development support to players in the emerging construction technology space.

Jeff has over 30 years of international experience in starting, developing, buying/selling, and turning around companies and senior management teams as a strategist, deal-maker, and "company doctor."

He was responsible for strategy, mergers & acquisitions, and information technology at Turner Construction in the early 2000s and had the same roles with W.S.Atkins engineering until 2017. In both cases, he was responsible for incubating new technology enabled ventures and partnering with software, hardware, and solution providers from startups to Autodesk and SAP.

Jeff has completed over 50 transactions on buy- and sell-side in the US, Europe, Middle East, Africa, and Asia. Over the years, he has built a strong network of relationships with private equity, investment banking, legal, and accounting firms.

Earlier in his career, Jeff was a strategy consultant and part of a start-up management team. He holds an MBA from Harvard Business School. He is also a Managing Director of Madison Park Group, a member of FINRA and SIPC.

Follow Jeff Herriman on LinkedIn.

Jesse Devitte

As Building Ventures Co-founder and General Partner, Jesse leverages his hands-on operating experience and industry contacts to source and nurture innovative companies applying technology to design, build, and improve our built world.

Jesse co-leads the Investment Committee and currently manages the firm's involvement at the board level with Aeroseal, enVerid, Extracker, Hypar, Join.Build, and Skillit. He also works closely with the teams at Blokable, Built Robotics, Canoa, Dandelion, Measurabl, and 75F. Previously, Jesse represented the firm's investment in Assemble Systems (acquired by Autodesk) and Borealis Ventures' investments in Honest Buildings (Acquired by Procore), Newforma (acquired by Battery Ventures), Envista Software (acquired by Accela), FieldLens

(acquired by WeWork), Handmark (acquired by Sprint), IrisMaps (acquired by OmniEarth), Scribe Software (acquired by The Mustang Group), SketchFab (acquired by Epic Games), SketchUp (acquired by Google), SpaceClaim (acquired by ANSYS), TinkerCad (acquired by Autodesk), and VICO Software (acquired by Trimble).

Prior to co-founding Borealis Ventures, Jesse served as an executive in two public application software companies. He helped grow Softdesk from a New Hampshire startup to a successful venture-funded public company as an executive and board director concluding in the sale of the business to Autodesk. While at Autodesk, Jesse served on the Autodesk executive staff as the Vice President & General Manager of the AEC Market Group. He is a founding member of the Urban Land Institute's Technology and Real Estate Council, and he serves on the Freddie Mac Housing Technology Council.

Jesse graduated with distinction from the Indiana University School of Public and Environmental Affairs and completed his military service as a member of the White House Communications Agency.

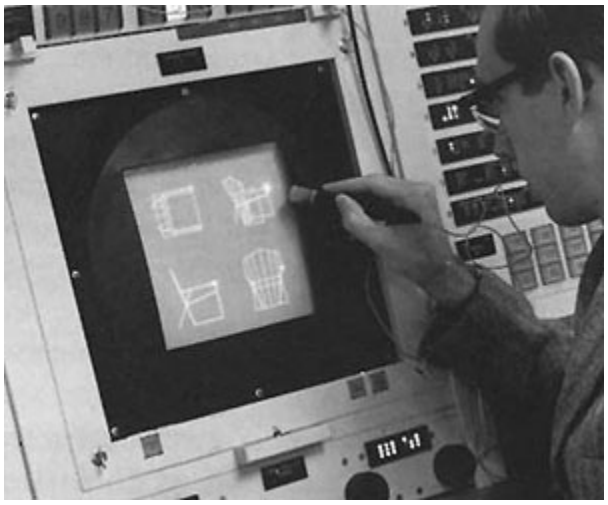
Follow Jesse Devitte on LinkedIn or Twitter, and keep up to date with Building Ventures.

History of Built Environment Technology

We're narrowing the scope of the history of built environment technology to specifically explore the digital age and the uneven growth that our industry has experienced over the last 25 years—so that we can identify what needs to happen next. But to understand that history, we need to go all the way back to the 1960s.

1960s: Direct Interface on Mainframe Computer

In 1963, Ivan Sutherland developed the computer-aided design technology that came to be known as Sketchpad as a part of his PhD dissertation at MIT. This is a significant starting point in AEC history, as this technology marked the first use of a graphic user interface.



A still from Ivan Sutherland's 1963 demonstration.

While Sketchpad and Sutherland's technology has been incredibly influential for built environment design, it also presented challenges that remain prevalent in the industry today: an individual working on a direct interface to a mainframe computer in a single, offsite location just wasn't going to meet the needs of the built environment. This continues to be a larger theme in the 2000s, as well as the future of built environment technology.

1980s: Applications on Workstations

The path from mainframes through workstations eventually led to the IBM PC and MS DOS in 1981 and, soon after, the creation of AutoCAD in 1982. (That's right—AutoCAD will be 40 years old in December 2022!) AutoCAD software enabled the creation of both 2D and 3D drawings, replacing manual drafting and modeling. By 1986, AutoCAD was the most widely used CAD application globally.

A photo of the original AutoCad floppy disc. How's that for a history lesson.
Source: Autodesk.Blog

In the 1990s, we saw a number of firms begin to develop applications that extended the usefulness of AutoCAD, including Softdesk (acquired by Autdesk in 1997) and CharlesRiver Software, which became Revit (acquired by Autodesk in 2002). During this time, other important pieces of the AEC techstack were also emerging. NavisWorks, for example, came out of Lightworks in 1997, and offered the ability to combine and review 3D models in real time.

2000s: BIM, Collaboration and the Cloud

As with other major industries, the early 2000s were marked in AEC by the dot com era. In this space, the biggest promise was collaboration. Unfortunately, the boom didn't last long for the industry, and many construction-related startups in particular suffered from the October 2002 crash. Among the names some of you remember from that era of construction collaboration are BluelineOnline, eBricks, Cephren, Bidcom, and the Autodesk spinout Buzzsaw.

Another key trend in the early 2000s was the onset of BIM, or building information modeling. For years, many in the industry speculated that in the same way that CAD migrated to computer-aided manufacturing (CAM) and eventually product lifecycle management (PLM) on the industrial side for aircraft, cars, and eventually all manufactured goods, we'd see similar progress in the design, construction, operations, and maintenance for buildings, as well as roads and rail, bridges and tunnels, water and utilities. While BIM became a common topic, this technology has been still largely in progress rather than definitive of the 2000s.

Progress in Built Environment Tech

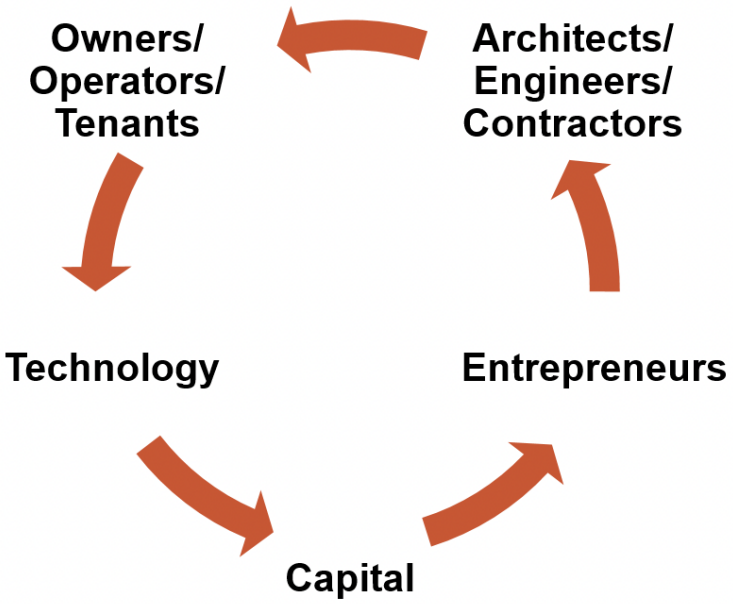
There is an important trend that comes through when you view each of these inflection points in sequence: designing, planning, constructing, and operating buildings and infrastructure requires collective efforts of many people in multiple locations with many different skill sets. This inherent dependency on different groups of people, often in discrete and separate locations, requires very specific solutions and accounts in part for the disjointed progress that we've seen.

At least until recently.

Reversing the Trend

During this long period up until about 10 years ago, comparatively little effort or funding has gone into improving, expanding, or testing AEC-related technologies. We've covered the progress made by Autodesk and a few others, but these pioneers were the exception rather than the rule.

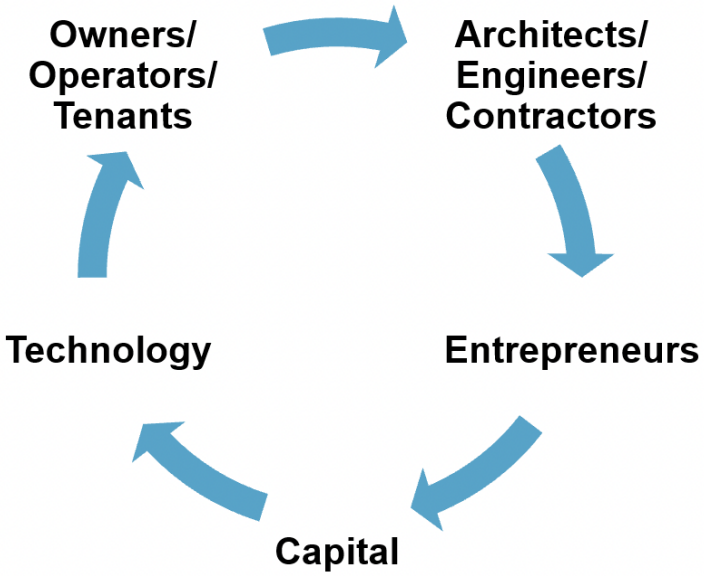
The industry was in a vicious circle. Technology that wasn't fit for purpose meant low adoption, and very little investment. With no money, very few entrepreneurs innovated in this space. Without a larger culture of innovation, widespread resistance to adopting new technologies settled. Architects and engineers, for example, sought to adopt technology when and where it was offered, and when they were able to find a way to charge back the costs to their clients, who therefore had very low expectations. These influences combined to create a terrible circle that committed us to stagnation.



The Vicious Circle

In more recent years, we've seen a dramatic shift to a virtuous circle that drives change and technology adoption. In each case, external factors are at play.

- **Technology** – Software and hardware solutions have, luckily enough, become better suited to the built environment and easier to adopt and test, most significantly with multi-tenant cloud computing and smart mobile devices.
- **Owner/Operators/Tenants** – With the impact of climate change, owners, operators and tenants, and even home-owners demand more from their buildings and infrastructure than just "shade and shelter."
- **AEC** – Designers, builders and those responsible for repairs and maintenance are looking for better tools to do their jobs more efficiently and effectively, which has been exacerbated by skilled worker shortages impacting these firms.
- **Entrepreneurs** – Because of this significant opportunity, hundreds of entrepreneurs, many with experience in the AEC sector and many without, have been entering the growing construct tech ecosystems.
- **Capital** – Last but not least money, which has belatedly "discovered" the opportunities in this sector as part of a much broader trend toward investments in industrial digitization.

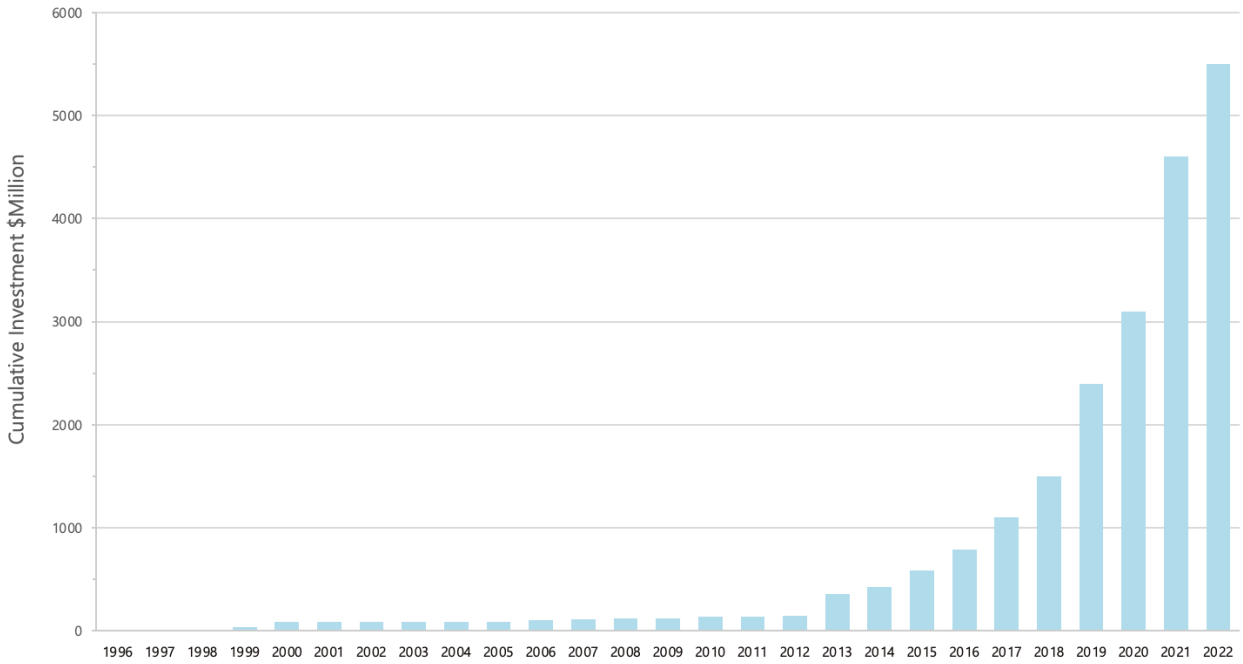


The Virtuous Circle

This shift has led to a "new normal," a transition for the industry that's marked by investment, innovation, and growth.

New Normal: Venture Capital, Entrepreneurs, & Growth

The shift from the vicious to the virtuous circle, along with the advancements in key technologies like cloud-based applications, artificial intelligence, and machine learning, has led to exponential growth over the last 5-10 years. This has also opened the industry to outside entrepreneurs and venture capital to rapidly and substantially increase progress in our built environment technology.



This graph represents cumulative venture funding over the last twenty-five years.
Sources: Capital IQ, Pitchbook, company websites, press releases.

Over the last 25 years, more than $5.5 billion has come into AEC from venture capital firms and private equity, with the majority of these funds coming into the industry just in the last 10 years. As we look toward the future of built environment technology, it's these new firms, plus the strategic incumbents like Autodesk, that will help fuel the next stage of growth for the industry.

Looking to Built Tech in the Future

In this brief history, we've outlined the key inflection points that catalyzed the creation of built environment technology. We've also followed themes in the external pressure that shapes these inflection points, as well as the market dynamics that influence the technology. This historical background is important for understanding the current state of our industry, and it's also crucial for knowing what to expect in the future.

These are the major themes we'll see driving the industry forward in the next 25 years:

- **Artificial Intelligence** – With increasing ability to generate and collect data, and the increasing price/performance of sensors, we'll see continued focus on AI to leverage the information embedded in the design, engineering, construction, and operation of the built environment.

- **Automation** – Robotics and automation will continue to grow in proficiency and availability, specifically in construction where the most dangerous and repetitive tasks can be de-risked. This also includes the accelerating trend toward offsite and modular construction.

- **Asset Management** – We will continue to experience the proliferation of digital twin technologies that encompass a design and construction-centric model of an asset, as well as an operation and repair-centric model. Talked about since the 1980s, the ultimate achievement will see a common data 'thread' from conceptual design all the way through to operations.

Additional Resources

Recommended Reading

The Autodesk File

Ed. by John Walker

https://www.fourmilab.ch/autofile/

Recommended Watching

Ivan Sutherland Sketchpad Demo 1963

https://www.youtube.com/watch?v=6orsmFndx_o