



The Modern Architecture, Engineering & Construction (AEC) Firm

A whitepaper by Microsoft

Built for change

Yours is a high-risk business. The complexity and scale of build projects is being magnified. Your organization pivots on a few, unchanging elements: Materials, Labor, Supply Chain, and Schedules. Covid-19 accelerated the challenges of integrating these elements into an asset delivered on-time, on-budget, and without incident during, or after, build.

Why Does this Matter?

The infrastructure of our planet is changing. We are at a tipping point.

Our bridges, water systems, roads, and railways...our commercial and residential buildings, everywhere we go, drive, work, play and shop...it's all under construction – and if it's not, it likely needs to be modernized. Delivering those modernizations is becoming increasingly challenging.

The architecture, engineering, and construction (AEC) industry has persistently been challenged with labor shortages, supply chain delays and inefficiencies. Many companies rely on legacy software applications – a highly disparate ecosystem of applications tools used by multiple parties, & transient job sites. This complex ecosystem, if not carefully orchestrated, responsible for your planning, forecast, safety incident reporting, and supply chain management becomes a business liability. The current operational environment is not sustainable.

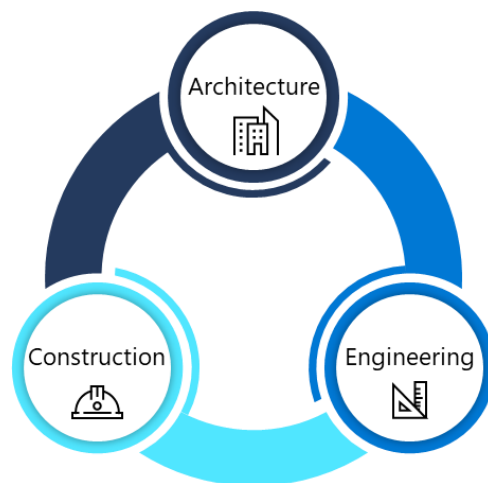
This industry needs transformation.

Architecture, Engineering and Construction is a highly complex economic sector with many players and various interest groups, all with their own requirements, dependencies and ways of working. This means that, rather than only affecting one trade, changes in Architecture, Engineering and Construction impact numerous parallel processes. This makes the introduction of new, digital structures more difficult. On the other hand, it also means that Architecture, Engineering and Construction would actually reap plenty of benefits from digitalisation. While Architecture, Engineering and Construction has lagged behind in terms of technology in many respects in recent years, the current pandemic is an opportunity to tackle digitalisation in the construction industry and switch to construction software, intelligent machines and sustainable production methods.¹

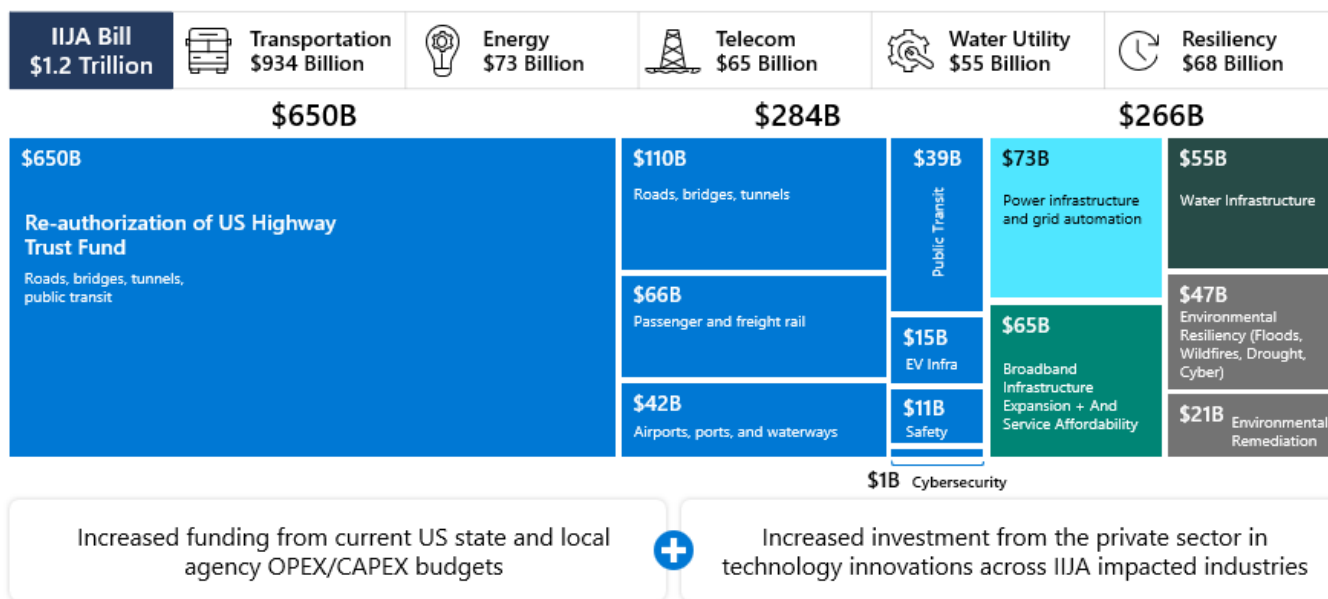


¹ "DIGITALISATION IN Architecture, Engineering and Construction: HOW CONSTRUCTION IS GOING DIGITAL" - <https://blog.bluebeam.com/au/digitalization-in-construction/>

The AEC industry is vital to the economic growth of our world. The US construction industry's growth rate is expected to jump by 3% over the coming year. Recent United States federal legislation is pumping over \$1T USD into infrastructure modernization and the time is NOW for the AEC industry to react, expand and meet the needs of the planet.



IIJA \$1.2T includes \$934B for transportation and \$266B of new investments in other core infrastructure



Today more than ever AEC companies need to rethink what's possible and become more resilient to our changing world.

The Business Reality

Owners are demanding faster project completion and burdening providers with more risk. AEC firms have responded with innovations in prefabrication, building information modeling (BIM), integrated project delivery (IPD) and design-build (D-B) practices. However, each innovation takes time to take root as "front office" professionals specify needs for translation into new operational processes that must then be embedded into "back-office" administrative systems – all subject to acceptance by prevailing firm culture. So, change takes at least as long as the slowest or least flexible participant in the chain.

How often have great ideas died slow deaths waiting for operations and administration to accommodate enabling process or transactional changes? How often has inflexible technology been the root cause? Far too often. This is why more AEC

firms are upgrading or replacing antiquated business systems to improve end-to-end process alignment, control and risk management across jobsite, and back office, activities.

Microsoft embraces the proposition that technologies should enable business process flexibility, support organizational change, and foster rapid adaptation to evolving operational and market needs. Indeed, this is a guiding principle fueling the Microsoft approach to modern business solutions and our vision for the Modern AEC Firm, designed and built for change.

Proactive and forward-looking technology can connect people to their work, bringing forward insights that enable better decisions and guiding processes that optimize results. Agile software empowers adaptation to changing economic and market conditions. It supports a firm that can anticipate rather than react to rapid change, and supports the optimal alignment of people, assets, systems, and data. The Microsoft Cloud delivers a connected platform to help firms stay current with leading edge practices and value-chain integration in the AEC industry.

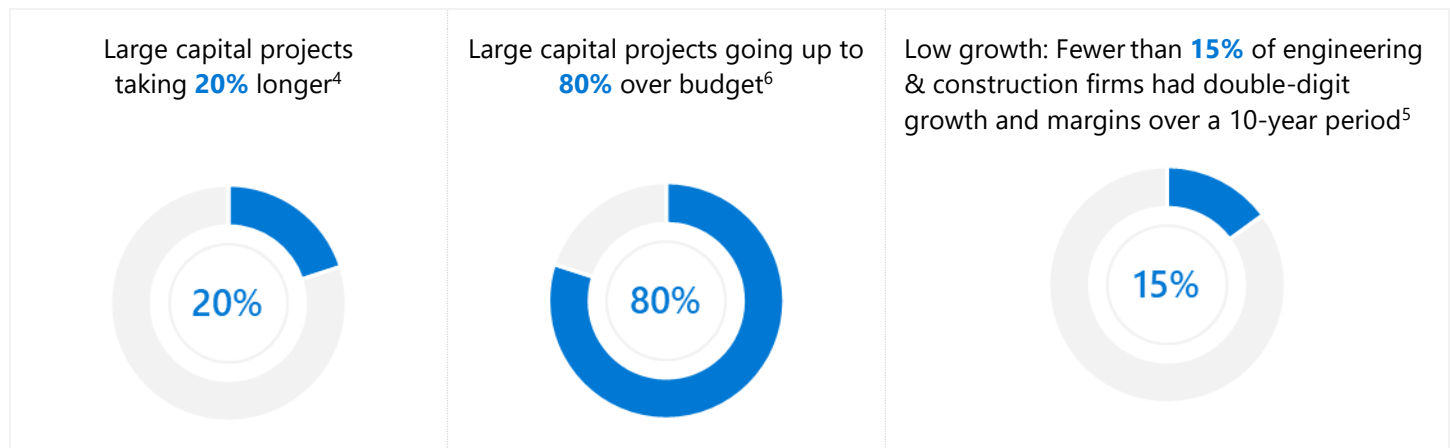
Industry Challenges & Strategic Concerns

Despite being critical to the modernizing United States (and global) economy, there are still numerous unrealized opportunities to intelligently apply technology to drive industry priorities. Relative to other industries, construction, specifically, lacks digital maturity².

Digital investments cannot, by themselves, solve all AEC industry challenges. They, however, are the better alternative to the prior position where digitization was secondary, and not a priority, to survival³

The industry is seeking solutions to challenges that are the difference between competing or complacency.

The case for innovation and change



² "Digitization Will Raise Construction to the Modern Day" – <https://www.ie.edu/insights/articles/digitization-will-raise-construction-to-the-modern-day/>

³ "Digitalizing S E Asia's multibillion-dollar construction and real estate sectors" – <https://www.digiconasia.net/features/digitalization-in-the-construction-and-real-estate-industry>

⁴ "The Construction Industry is Ripe for Disruption" – McKinsey Infographic - <https://www.mckinsey.com/~media/mckinsey/business%20functions/operations/our%20insights/imagining%20constructions%20digital%20future/the-construction-industry-is-ripe-for-disruption-infographic.pdf>

⁵ "Imagining construction's digital future" – <https://www.mckinsey.com/capabilities/operations/our-insights/imagining-constructions-digital-future-infographic>

Current State of Industry

AEC Industry Ecosystem

				
Siloed Data Sources and Legacy systems	Tight Margins and On-time Delivery	Shortage of Skilled Labor and Cultural barriers	Supply Chain, Regulated and Risk averse	Insufficient Digital Skills and Business Model

Highly Fragmented nature of industry – makes it challenging to capture growth potential

We believe Microsoft can be the transformation platform partner for this digital imperative and the Federal infusion of Infrastructure Investment and Jobs Act (IIJA) funds is poised to be the catalyst. Even if your firm does not deliver or support Federally-funded, or infrastructure-related projects, you are likely looking at new ways to integrate technology into the flow of your business operations to address pressing, and sustained industry challenges.

Technology is just one source of disruption. Leaders must consider all socioeconomic factors and challenges to take full advantage of old technologies⁶

⁶ Digitalizing the construction industry: A case study in complex disruption – <https://www2.deloitte.com/us/en/insights/topics/digital-transformation/digitizing-the-construction-industry.html>

The Modern AEC Firm

Industry leaders are innovating and re-envisioning industry operations in the back-office and on the job site.

Changing Landscape and Digital Transformation

01

Workforce is collaborating like never before

Solving the ever-pressing need of collaboration and communication



02

New technologies are driving innovation

Data and Innovation are fueling new opportunities



03

Going beyond Building Information Management

Simpler and more efficient tools, processes and operation



04

Sustainability – Critical across the value chain

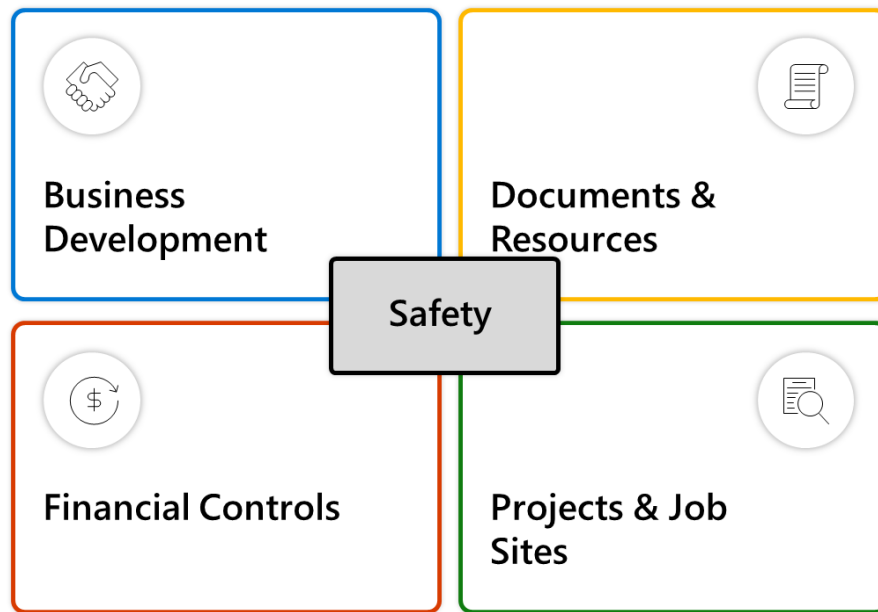
Construction industry impacts on our Planet



All players in the AEC industry will be impacted by digital pressure. This pressure creates an opportunity for transformation and modernization.⁷

The biggest areas of transformation opportunity exist around the way firms think about employee and contractor safety, their clients and revenue, how they collaborate across their multiple partners through document and resource sharing, implementing financial controls, and reimagining projects and job sites.

⁷ "DIGITALIZATION OF THE CONSTRUCTION INDUSTRY: THE REVOLUTION IS UNDERWAY" – https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2018/july/OliverWyman_Digitalization_in_the_construction_industry_web_final.PDF



Safety: Knowing who is working on your jobs, and keeping them safe, is paramount. AEC leaders have a responsibility to face a changing safety landscape: higher workforce transiency, reduced skill level (caused by accelerating retirements from skilled team members) and more complex delivery challenge every job site and project.

Embracing digital technologies, simplifying reporting, and digitizing processes creates real-time visibility into job site participants, employee location, safety incident reporting, and real-time communications and status.

Business Development: Not all revenue is good revenue; the right clients and projects yield better, more sustainable business results; and the best deals are those where you help the client shape the project and RFP. But ambitious sellers and dedicated problem solvers want to respond to every new opportunity and interesting client challenge, so it takes sophisticated cultural alchemy to channel all that individual initiative into productive activities.

To generate profitable growth, firm leaders need to establish clear priorities and risk controls, aligning opportunity management, review and escalation protocols. And once processes are in place, leaders need to equip marketers and seller-doers with the tools necessary to determine who-knows-whom and who-knows-what to assemble the right pursuit teams rapidly, influence project formulation, create outstanding execution plans, and deliver compelling proposals that distinguish the firm from the competition.

Documents & Resources: Project proposals, contracts, designs, transmittals, submittals, subcontractor certifications, change orders and so many more digital and hardcopy documents flow through AEC firms every day. Unfortunately, jurisdiction-specific forms, non-standard document formats and owner- or contractor-specified technology requirements impede the flow of project-related content. Project progress regularly founders on the shoals of document completion and transmittal challenges.

More critically, project viability hinges on having the right professionals, subcontractors, and equipment to get the job done. Challenges in capacity planning and tactical resource scheduling therefore have the most visible day-to-day impact on an AEC firm's ability to execute. Translating pipeline and backlog into expected design skill and trade labor

needs as well as associated recruiting and subcontracting plans over the next six to twelve months requires experienced human resources or practice management professionals with integrated insight into sales and operations.

Projects & Job Sites: On-time, on-budget and profitable delivery demands the right client engagement, project scope, plan, leadership, resources, execution, oversight and more. So much must be done right, and so little needs go wrong for failure along any critical vector.

AEC firm leadership recognizes that consistent application of proven methodology and best practice is an important factor in getting projects right at every step. In practice, however, many architects feel a creative calling, engineers seek technical improvement on past results, and tradesmen optimize throughput. Moreover, even the best-laid plans and standard operating procedures encounter project- and context-specific realities at the jobsite that require flexibility and adaptation rather than mindless adherence to protocol.

The pursuit of excellence in project execution necessarily becomes a balancing act between mindful application of repeatable practices and intelligent innovation in response to local feedback. Which places individual professionals, intermediate managers, and the project manager solidly in charge of delivering results. Leadership's responsibility then is to provide the tools, rules, and exception paths to support efficient and effective project execution at every level in the organization.

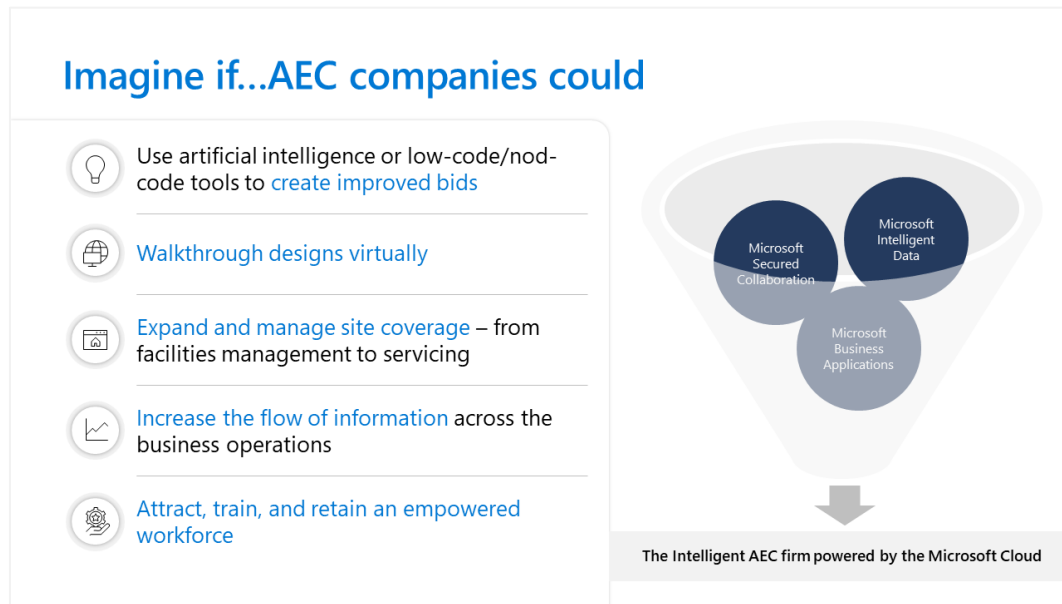
Financial Controls: Project cost, time, quality, , risk, and other controls are de rigueur and broadly accepted methods like Earned Value Management (EVM) offer quantitative foundations for monitoring and oversight. Easy availability and transparency of measures and targets help push decision-making closer to where execution takes place, accelerating project delivery. Unfortunately, discipline- and role-based decisions still tend to happen in siloes that mask interdependencies and cascading effects. So, for both technical and financial decisions, empowerment requires guardrails or collaborative methods like IPD to bubble decisions up to the right logical level to avoid unintended consequences.

At the business group and firm-wide level, challenging economic times and owner buying-power in a competitive market have left many AEC firms holding portfolios of projects that were won at higher than desired risk levels. Whether looking at aggregate utilization, realization and staff retention rates across an engineering practice or broad liquidity, margin and committed cost ratios in a construction company, CFOs and line leaders need to know which levers to pull to find solid ground. For many firms, the next few years will be a time to build a backlog of higher margin and lower risk deals at various durations that bring Key Performance Indicators (KPIs) back into the green and balance an uneven scorecard.

Recognizing this, many firm leaders are asking this question: how can we identify problems early and act quickly, delivering operational visibility and decision-making authority to front-line managers while implementing policies and controls that can evolve rapidly with market demand and changes in the available talent pool? In short, how can we create an agile and resilient organization that flexes to its environment?

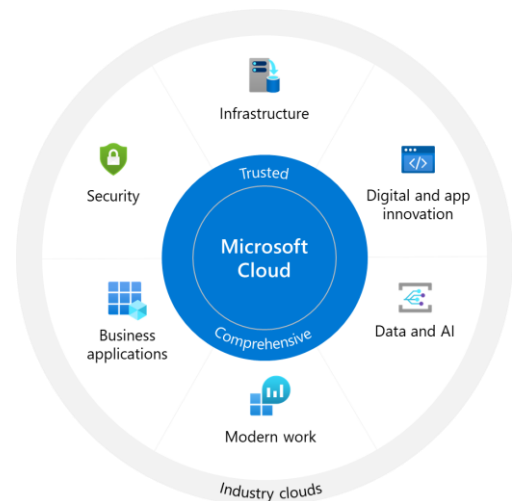
The right executive vision and commitment to cultivate aligned cultural norms comes first. However, at operational and administrative levels, there must also be the right supporting processes and enabling systems – systems designed and built for change. This is where Microsoft and our solutions for the Modern AEC Firm can help firm leadership build for the future.

Imagine If



Enabling the Modern AEC Firm

Microsoft is uniquely positioned to help AEC firms transform into dynamic organizations that are market responsive, collaborative, and able to realize the full potential of their people. To ensure that we build for the future, Microsoft focuses on delivering innovative, proactive, modern business solutions that offer security, flexibility and interoperability. Firms can deploy individual elements to meet specific needs or a fully integrated business suite, and can add and subtract functionality to meet tomorrow's challenges. Taken in sum, Microsoft business solutions deliver on the promise of enabling people to do their best work whether in the office or on the job site and whether in project delivery, functional or administrative roles.



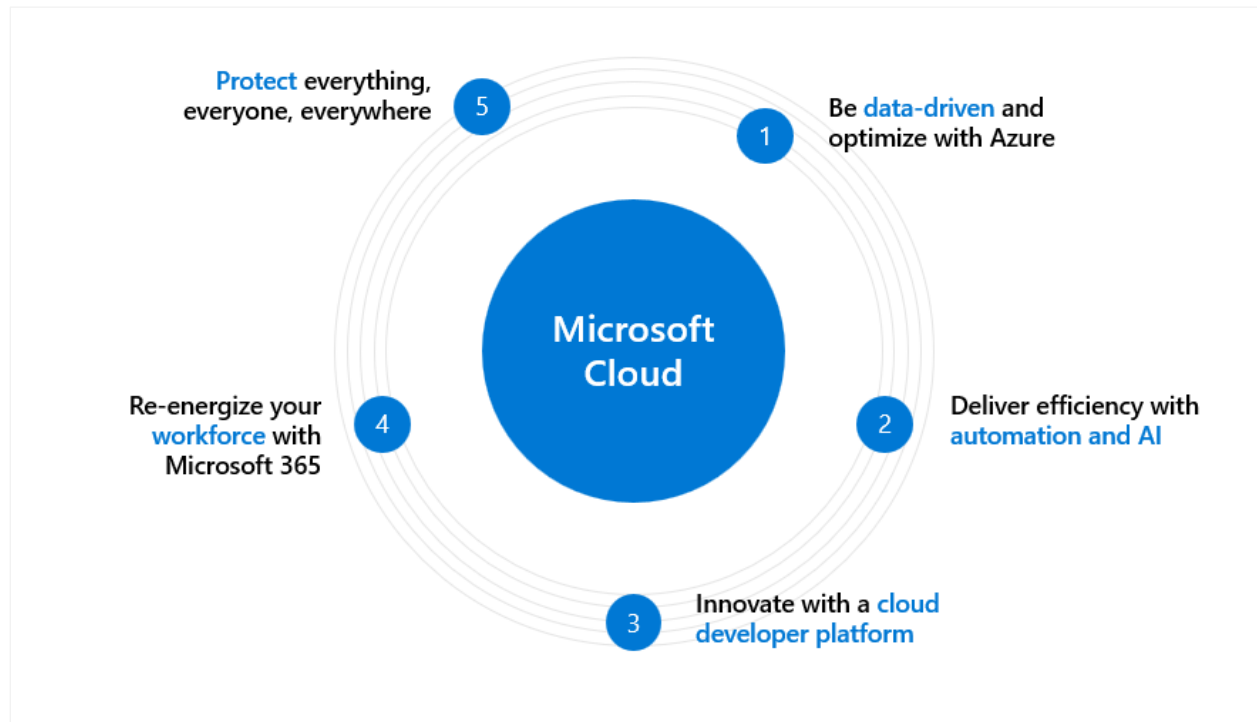
Freeing individuals to drive results

At the heart of every organization are the people who make things happen. People garner insight from business applications to drive decisions that advance organizational objectives. They manage relationships internally and externally to drive relevant actions forward. The most successful firms are powered by individuals who are contributing fully, able to make a difference, and committed to their organization's success. Microsoft can help individuals and organizations realize their full potential and drive significant impact by offering an end-to-end business solution that is flexible and easy to use.

Microsoft is deeply committed to helping professionals and staff perform at their best and achieve greater job satisfaction through improved ability to collaborate with colleagues and productively serve clients. For this reason, we emphasize easy-to-use tools designed to work the way people work. Our tools are built to work together seamlessly, supporting and linking key levers of the business and enhancing both individual performance and firm-wide operations.

Capitalize on talent and catalyze innovation 	Today, our AEC industry solutions can help firms capitalize on available talent by enabling job scheduling and balanced resource utilization across time zones and business units. For example, we give human resource directors the ability to maintain central profiles of employees and subcontractors that can be shared across subsidiaries and locations to make it easier to identify human capital assets that may be tapped to deliver services. With powerful competency and availability-based search capabilities, practice managers and schedulers can rapidly find and assign the right person for the right job at the right time and place. And at an even deeper level, resources can be hard-booked or soft-booked to jobs or proposals-in-process to manage the human capital supply chain that is at the heart of every AEC operation.
Cultivate unique client experiences 	We support increasingly virtual and diverse project teams with rich planning and collaboration environments that help reduce administrative overhead and focus the project team on the job at hand, catalyzing creativity and innovation. And we help firms harness these capabilities to cultivate unique client experiences and evolve repeatable yet highly distinctive and client-responsive service experiences across distributed teams. Project managers can then focus on client relationships while easily delivering job estimates based on vetted and adjusted templates for common design and build requests. Project managers, in turn, can focus on team dynamics while taking advantage of work-breakdown structure templates for project planning, sophisticated budgeting and cost controls, time and expense entry and approval workflows, and project analytics. And team members can spend less time onboarding and more time getting to know each job and executing on tasks.
Compress time to insight and action 	We then embed increasingly industry-specific information and performance measures into our solutions to help compress time to insight and action. By putting richly contextual and role-specific information at their fingertips, we help individuals ranging from office-based to job-site tradesmen and from project accountants to compensation analysts work smarter, streamlining and accelerating project execution and firm operations. Financial leaders, in particular, can build on integrated project management and accounting, sales and marketing, and human capital management functionality to obtain a complete and holistic view of their business. They can streamline reporting and improve accountability across the organization while ensuring compliance with risk management practices through consistent business processes and policies across multiple locations.

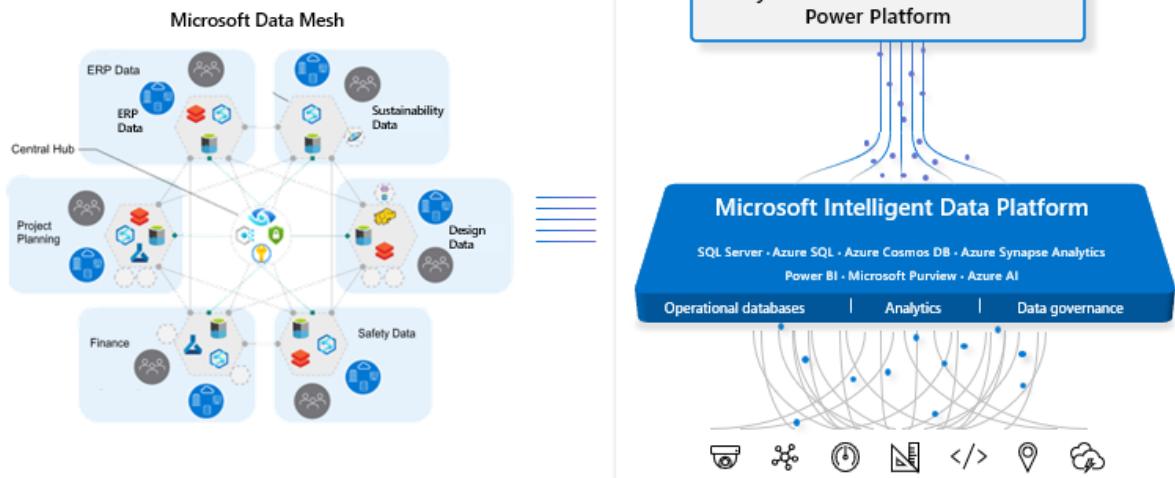
Importantly, Microsoft constantly strives to deliver reduced total cost of ownership for organizations that adopt our solutions. To this end, our solutions build on the business processes and technology investments that many firms already have in place—the everyday business practices and associated productivity tools like Microsoft Project, Excel, Outlook, SharePoint, and Windows that users are already familiar with. This reduces the time needed for training and change management through easy and intuitive user experiences that foster productivity, firm-wide adoption, and a faster return on investment.



The result is a portfolio of integrated-by-design solutions that equip and indeed free individuals to do their best work within an increasingly connected organization and wider ecosystem. With this holistic approach to business solutions, Microsoft can help AEC firms design and build for change and thereby elevate both individual and organizational performance.

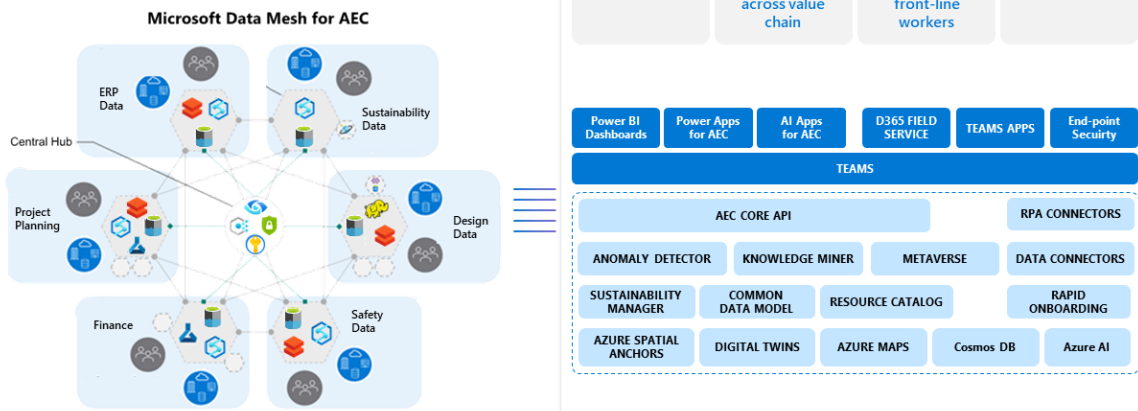
Proposed Solution & Reference Architecture

Microsoft Intelligent Data Mesh
(DDID = Data-driven Intelligent Decisioning)



Blueprint: Microsoft Cloud Vision for the AEC Industry

Microsoft Intelligent Data Mesh for AEC
(DDID = Data-driven Intelligent Decisioning)





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