Understanding Convergence: The Next Wave of Digital Transformation

By Charlene Li, Altimeter
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EXECUTIVE SUMMARY

In the last two years, companies have had to accelerate their rates of digital transformation to cope with the impact of the COVID-19 pandemic. Previously innovative practices such as virtual communications, personalized digital engagement, immersive modelling, rapid prototyping, and efficient collaboration are now mainstream.

The disruption caused by the pandemic has created two classes of companies. The first, with a low level of digital maturity, struggled to implement these innovative practices, and is still in the process of catching up. The second, with high levels of digital maturity, has thrived, and already implemented most of the latest innovative practices. This group is looking to prepare for the next wave of digital disruption, which we believe is a series of market movements and innovative practices we can broadly call **"convergence."**

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INTRODUCTION

Convergence is the blending of previously separate technologies, processes, and data to create new combinations of products, services, and experiences that reshape industry structures. Most companies today believe they will be impacted by convergence to some degree in the next few years. The more digitally mature companies anticipate a greater impact on their business, while the less mature companies are not as focused on it yet.

We identified four levels of convergence:

Process Convergence:
Formerly discrete processes and workflows are now being connected across our business for greater efficiency and integrated goals.

Technology Convergence:
Technologies such as Cloud, IoT, AI, Supply Chain, Augmented and Virtual Reality are converging to create new use cases and solutions.

Data/information Convergence:
Formerly siloed data/information is now more accessible and being used across our business and industry to power a range of new products and services.

Industry Convergence:
Formerly discrete industries are becoming more similar and connected, creating new opportunities for value creation.

Our research found that a business' level of digital maturity tends to dictate which level of convergence it believes has the most impact on it. Less mature companies tend to focus on process and technology convergence to achieve gains in efficiency. The more digitally mature companies focus on data and industry convergence with the goal of innovation.

By understanding the different levels of convergence, and assessing their own stages of digital maturity, companies can better prepare for the next wave of digital transformation. Companies that identify and act on the opportunities created by convergence early are well positioned to gain an early competitive advantage.

DIGITAL TRANSFORMATION'S DISRUPTION OF THE STATUS QUO

The COVID-19 pandemic's impact on digital transformation was swift and apparent. It immediately exposed the businesses that were digital laggards and rewarded the ones who had high levels of digital maturity. Businesses across every industry scrambled to optimize virtual customer interactions, supply chain logistics, ecommerce, and personalized digital communications. If companies were hesitant, or dragging their feet before, the pandemic forced them to accelerate their digital transformation initiatives at breakneck speed. In weeks and months, we saw them implement transformation initiatives that would normally have taken years.

In our survey of 749 leaders across key industries (Architecture, Engineering and Construction, and Design and Manufacturing), we found that two-thirds (65%) of respondents experienced "great" or "moderate" disruption to their businesses due to digital transformation (Figure 1). An even larger percentage (71%) expect to experience continued disruption due to digital transformation in the next two years.
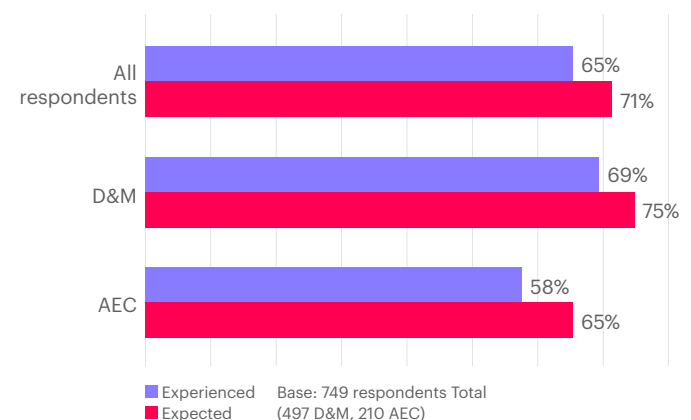
The pandemic-produced acceleration drove home two key truths for many

businesses. First, that disruption due to digital transformation is outsized and inevitable. And second, that digital disruption is continuous and accelerating.

However, not all companies experienced, or viewed digital disruption equally. Among the industries we surveyed, respondents from the design and manufacturing sectors were more likely to have experienced major disruption

Figure 1:
Most Respondents Expect to See More Disruption from Digital Transformation in the Future

"To what extent has digital transformation disrupted your industry in the past two years? To what extent do you expect digital transformation to disrupt your industry in the next two years?" Percent that responded "Great Extent" or "Moderate Extent".

	Experienced	Expected
All respondents	65%	71%
D&M	69%	75%
AEC	58%	65%

Experienced
Expected

Base: 749 respondents Total
(497 D&M, 210 AEC)

to their businesses. They also expected to experience further digital disruption in the coming years.

This makes sense, as design and manufacturing firms have worked hard to digitize operations across their organizations in recent years and are correctly anticipating continued innovations in the technologies and practices they deploy.

The Importance of Digital Maturity

In addition to variations by industry, we also found noticeable variations in responses by how digitally mature a company rated itself. Our respondents indicated their levels of digital maturity by self-selecting themselves into one of the following stage definitions.

Stage 0: "Digital transformation is not a priority for us, nor do we expect it to become one in the short term."

Stage 1: "We've just begun to build a business case for digital transformation."

Stage 2: "We're starting to understand customer journeys, improving digital skills, mapping processes and seeing early traction."

Stage 3: "We've begun to digitize our operations at scale, but modernizing platforms and processes is happening on a departmental basis."

Stage 4: "We have digitized operations and are now focused on integrating them so that data can be used more strategically across the organization."

Stage 5: "We have laid a strong digital foundation and are now focused on leveraging data and AI to optimize processes; products and services; and customer experiences."

Digging into our survey results, we found that expectation of future and further disruption was strongly correlated with digital maturity (see Figure 2).

Figure 2:
Expectation of Future Disruption from Digital Transformation, by Digital Maturity Stage.

"To what extent do you expect digital transformation to disrupt your industry in the next two years?" Percent that responded "Great Extent"

Digital Maturity Level	Percent
Stage 5	50%
Stage 4	38%
Stage 3	31%
Stage 2	15%
Stage 1	23%

Base: 677
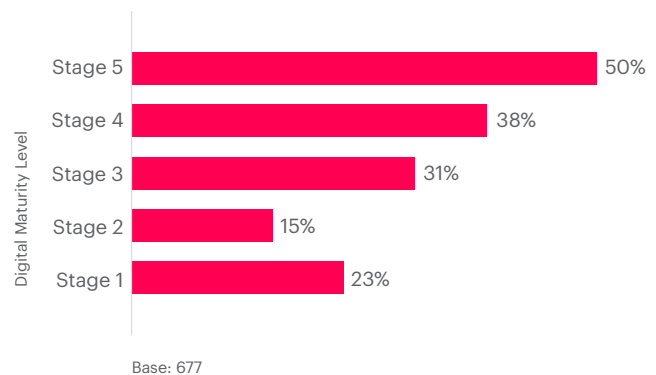
This finding indicates that digitally mature companies, having undergone significant changes to their business, are in a better position to not only recognize future digital disruptions, but also prepare for them. Companies who have already undergone the difficult process of digitization, increasing digital literacy, and changing key processes would conceivably have more access to data on disruptive trends, and are more likely to be agile enough to respond to them.

Technology Adoption Varies by Digital Maturity Stage

The technologies used also differed substantially by digital maturity stage. Respondents in more advanced stages of digital maturity were more likely to use all types of technologies, and saw substantial increases in the use of cloud collaboration, digitization, factory automation, and digital twin (Figure 3).

Convergence: The Next Stage of Digital Transformation

The acceleration caused by the pandemic created two different classes of companies. On the one hand, we had businesses that had to play catch up, and implement digital practices that customers have now come to expect as table stakes. On the other hand, we had companies who were well prepared, and even thrived during the pandemic. As our data shows, these digitally mature companies are now anticipating, and preparing for the next wave of digital disruption, which we believe is "convergence."
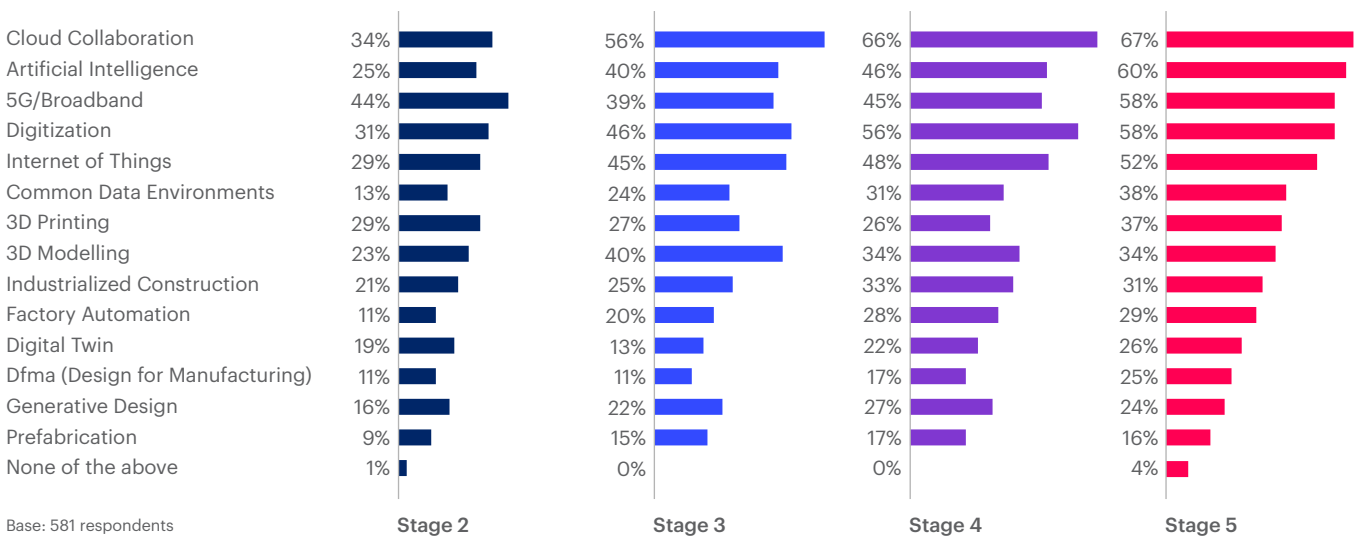
For the purposes of this report, we define convergence as the blending of previously separate technologies, processes, and data to create new combinations of products, services, and experiences that reshape industry structures.

Most businesses today recognize convergence as a trend that will impact them in some form. Our research found that 58% of all respondents had either given some thought to convergence or believed that it is one of the most critical influences on their business.

However, that doesn't necessarily mean convergence has entered the mainstream. Several interviewees confessed they use the term convergence sparingly, partly because of the lack of a consensus definition, and partly because it's not a part of their everyday work.

Figure 3:
Technology Used in Digital Transformation, by Digital Maturity Stage

Percent who said their company was using each as part of its digital transformation strategy, among those who have a digital transformation strategy in place

	Stage 2	Stage 3	Stage 4	Stage 5
Cloud Collaboration	34%	56%	66%	67%
Artificial Intelligence	25%	40%	46%	60%
5G/Broadband	44%	39%	45%	58%
Digitization	31%	46%	56%	58%
Internet of Things	29%	45%	48%	52%
Common Data Environments	13%	24%	31%	38%
3D Printing	29%	27%	26%	37%
3D Modelling	23%	40%	34%	34%
Industrialized Construction	21%	25%	33%	31%
Factory Automation	11%	20%	28%	29%
Digital Twin	19%	13%	22%	26%
Dfma (Design for Manufacturing)	11%	11%	17%	25%
Generative Design	16%	22%	27%	24%
Prefabrication	9%	15%	17%	16%
None of the above	1%	0%	0%	4%

Base: 581 respondents

"I would never use the term convergence in my daily interaction with the business or my IT organization," said one executive. **"I can have that conversation with CIOs but not with old school IT professionals and leaders – they'll look at me sceptically."**

This would imply that while many companies are actively dealing with the downstream impact of convergence, they may not yet recognize convergence as a trend on its own.

In other organizations, however, convergence was a topic of critical importance. We found that digital maturity was a strong predictor of how much a company believed it would be impacted by convergence (Figure 4).

Fifty-nine percent of companies with the highest digital maturity (Stage 5) said convergence was one of the most critical influences on their business. As the levels of maturity decrease, so does recognition of convergence as disruptive trend. This makes sense, as less digitally mature companies are still playing catch up and struggling to implement practices and innovations that are the current goals of digital transformation. It would be difficult to convince them to bypass those efforts and focus on a still nebulous idea of convergence. With 58% of companies

Figure 4:
Higher Digital Maturity Stages Are More Likely to See Convergence as a Critical Influence

Percent Who Selected "Convergence is one of the most critical influences on my business"

Digital Maturity Level	
Stage 5	59%
Stage 4	26%
Stage 3	17%
Stage 2	15%
Stage 1	7%

Base: 677 respondents
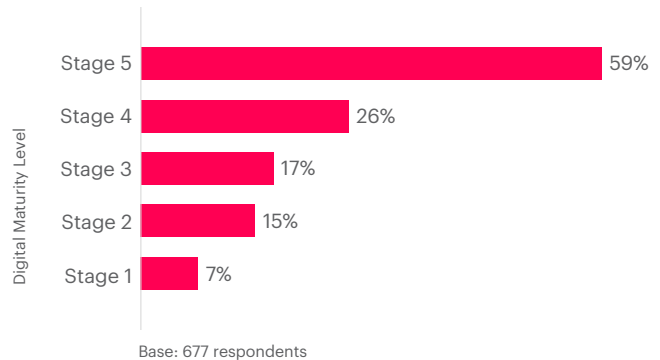
at Stage 3 or lower levels of digital maturity, convergence is still a peripheral conversation.

This does not mean, however, that less mature companies should wait until they reach later stages of digital maturity to think about and prepare for convergence. In fact, to reach Stage 5 and reap the rewards of convergence, the foundation for convergence needs to be built as early as possible.

The first step to building that foundation is to understand all the ways convergence is taking place and identify the categories that will have the most impact on the business.
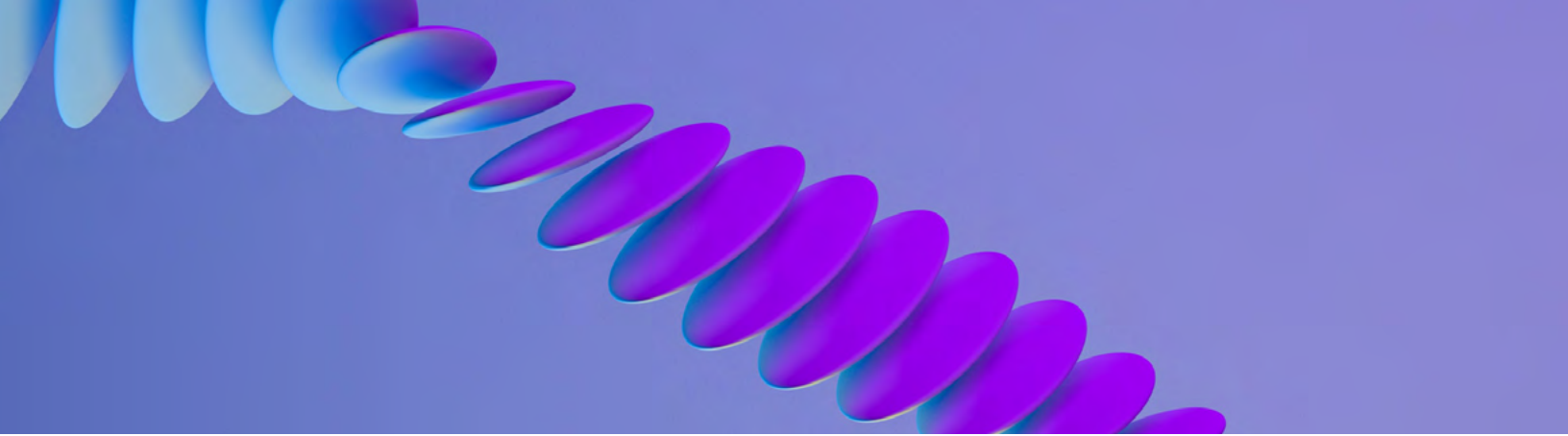
THE FOUR LEVELS OF CONVERGENCE

Convergence is an umbrella term for the outcomes of many different developments and innovations happening in the digital world today. Digital transformation initiatives lead to new capabilities, which in turn create synergies, efficiencies and even new product and service offerings. To help better describe these developments, it's useful to group them under four broad categories of convergence:

Process Convergence: Formerly discrete processes and workflows are now being connected across our business for greater efficiency and integrated goals.

Technology Convergence: Technologies such as Cloud, IoT, AI, Supply Chain, Augmented and Virtual Reality are converging to create new use cases and solutions.
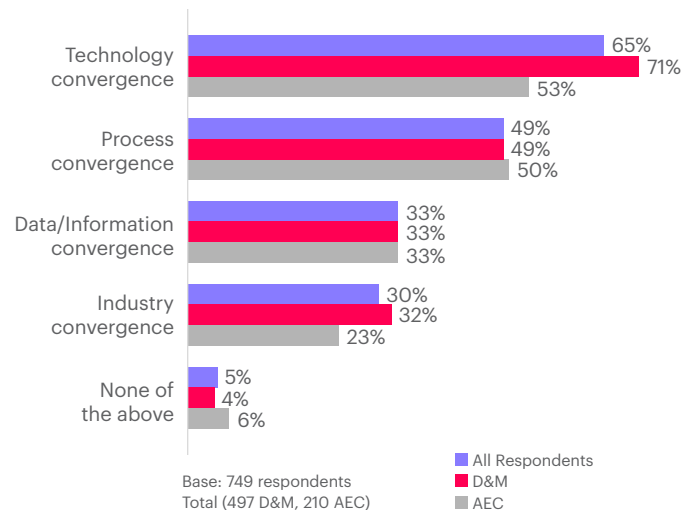
Data/information Convergence: Formerly siloed data/information is now more accessible and being used across our business and industry to power a range of new products and services.

Industry Convergence: Formerly discrete industries are becoming more similar and connected, creating new opportunities for value creation.

By creating convergence levels, we can chart the impact each type of convergence has, and how it varies by industry (Figure 5).

Figure 5:
Technology and Process Convergence Have the Greatest Impact on Industry

"Below are some common types of convergence. Which are affecting your industry today?"

	All Respondents	D&M	AEC
Technology convergence	65%	71%	53%
Process convergence	49%	49%	50%
Data/Information convergence	33%	33%	33%
Industry convergence	30%	32%	23%
None of the above	5%	4%	6%

Base: 749 respondents
Total (497 D&M, 210 AEC)

Very few respondents (5%) in our survey said none of the above convergences impacted them, which highlights the widespread impact and reach of each of these industry developments.

Overall, respondents were most likely to perceive technology convergence as having the greatest impact on business, followed by

process convergence. This highlights how ongoing developments and innovations in tools and practices are usually at the forefront of any transformation efforts. Since these changes are easily recognizable, adapting to them is a more straightforward and quantifiable process. On the other hand, data and industry convergence may be perceived as less impactful since these changes are slower, and their impact on the business takes longer to become apparent.

Technology convergence saw the greatest difference by industry sector, with D&M seeing the greatest impact and AEC the least.

Digital Maturity Drives Convergence Priorities

We know that digitally mature companies view digital disruptions and their impact in a fundamentally different way than less digitally mature companies. This is also true for how they quantify the beneficial impact of different convergence categories (Figure 6).

Process convergence dominated at Stage 1 and 2, because early digital transformation initiatives typically target the digitization of existing processes, creating ample opportunities for process convergence. For less digitally mature companies, efforts focused on transforming processes may have

an easier time securing investments since their impact is more apparent, in a shorter period.

At Stage 3, the digital transformation focus shifts to scaling digital maturity, especially across entire departments or functions. For example, to scale innovative practices and unify the efforts of different channels, marketing may combine several disparate and channel-specific tools into a single digital marketing platform. This highlights how process convergence leads to technology convergence.

We see the focus of technology convergence peak with Stage 4 companies because of their focus on integrating platforms to gain synergies across the organization.

Once platforms and processes have been integrated, it creates a strong foundation for data convergence. Focus on data increases substantially in Stages 4 and 5 as the converged technology platforms create opportunities for newly integrated data, analytics, and insights to deliver value to multiple stakeholders across the business.

It's only at Stage 5 when industry convergence gains traction, as this is when digital maturity is at the point where the organization can leverage data and AI to

Figure 6:
The Benefits of Each Convergence Type Differs by Digital Maturity Stage

Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5

No Impact of Convergence

Process Convergence

Technology Convergence

Data Convergence

Industry Convergence

create new converged products and services that tap into relationships and partnerships with external partners. It's important for companies to build their own internal digital capabilities first, before they can partner with other, similarly mature businesses to reap the benefits in their shared industry space.

Let's take a deeper dive into each convergence focus area to understand the opportunities – and the challenges – that each one poses.

Process Convergence

Process convergence is typically the starting point for most companies as they embark on their digital transformation initiatives. As key processes become more digitized, the boundaries that kept them separate start to blur when technology makes it easier to share communication, data, and goals. As a result, businesses have an easier time recognizing the benefits of integrating certain processes.

For example, in the past, ecommerce and digital marketing were two separate practices within a firm, with separate goals, teams, software and expertise. As companies started to see how both practices were operating in the same realm of customer engagement, the processes started to become more integrated, and today at many businesses, it isn't uncommon to see digital marketers working in close collaboration with ecommerce teams to prospect, attract, convert, and re-engage customers in a seamless journey.

Other areas of process convergence include design and manufacturing teams, who now recognize the benefits such as

lower cost, less waste, and faster production times when they integrate their formerly separate practices.

"By leveraging repetition in processes we have saved more than 50% of the production time with those processes," said Paul Murphy, CTO at architecture and engineering firm GHD. **"We're spending more time thinking about the client's problem rather than about how we were going to represent it."**

Another added benefit of process convergence is the preservation of data across different process collaborators. **"One of the things we're trying to do is integrate more information into models, bridging the information gap between design and what is constructed, solving problems before they are encountered in the field,"** said Trevor Hietpas, Manager, Ins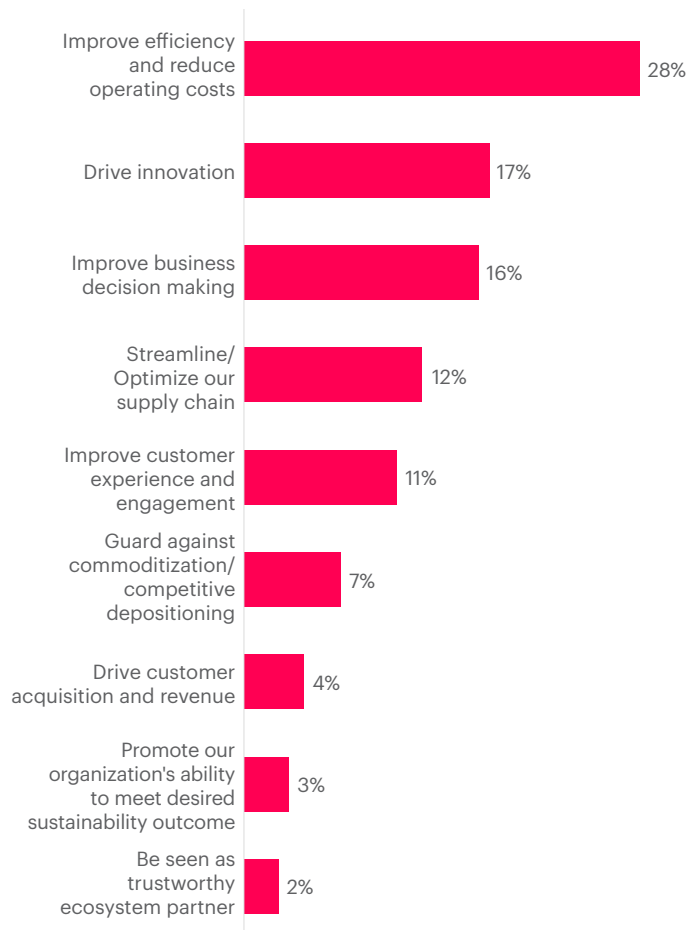ights and Analytics at The Boldt Company, a construction firm. **"For example, engineers can inform designers as to how constructible their design is."**

Antonios Kontsos, Professor of Mechanical Engineering at Drexel University, shared how a technology advanced manufacturing, coupled with IoT, AI, and 5G enables the creation of digital twins that allow for digital modelling of complex operations. **"If we embed data-driven procedures into the workflow from the start, we can realize huge benefits simply by harvesting the information coming directly from the asset to understand how they perform and fail, and then use the digital twin to model for optimization."**

Many of our respondents (28%) chose improving efficiency and reducing operating costs as the top benefit of process convergence, followed by driving innovation and improved decision making (Figure 7). This highlights why process convergence gets an easier buy-in than other types of convergence. It can deliver early and easy wins around initiatives that quickly impact the bottom line such as reducing costs or building better products.
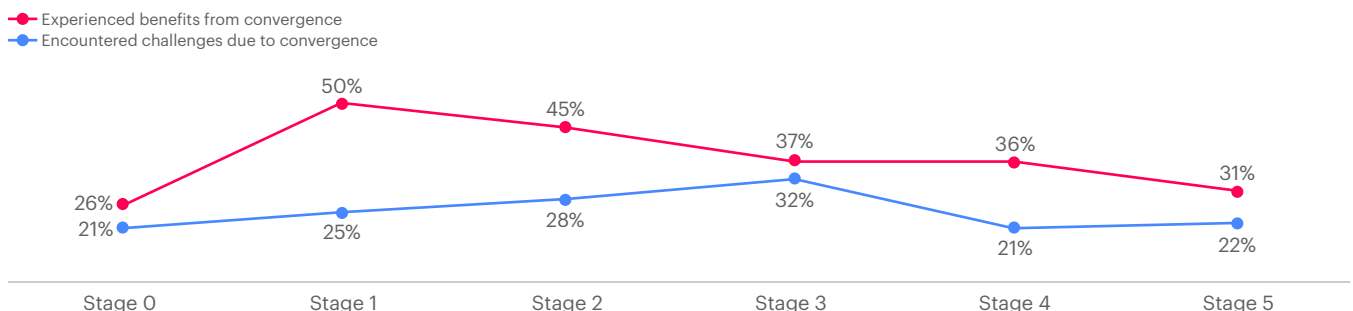
It also explains why process convergence is more of a priority for less digitally mature companies. Companies in Stage 1 (50%) and Stage 2 (45%) saw the biggest benefits of process convergence (Figure 8). But by Stage 3, the hard work of wringing more efficiencies from processes reduced the benefits and added challenges due to convergences. This would also suggest that there are diminishing returns to process convergence and once a company reaches a certain level of maturity, it should look to invest in more sophisticated areas of convergence such as technology or data to receive increasing benefits.

Figure 7:
The Benefits of Process Convergence

Benefit	%
Improve efficiency and reduce operating costs	28%
Drive innovation	17%
Improve business decision making	16%
Streamline/Optimize our supply chain	12%
Improve customer experience and engagement	11%
Guard against commoditization/competitive depositioning	7%
Drive customer acquisition and revenue	4%
Promote our organization's ability to meet desired sustainability outcome	3%
Be seen as trustworthy ecosystem partner	2%

Base: 283 respondents who experienced benefits from process convergence

Figure 8:
Organizations in Stage 1 and 2 Saw the Greatest Benefits from Process Convergence

- Experienced benefits from convergence
- Encountered challenges due to convergence

	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Experienced benefits	26%	50%	45%	37%	36%	31%
Encountered challenges	21%	25%	28%	32%	21%	22%

Base: 749 respondents

Technology Convergence

Technology convergence is the natural progression from process convergence as the tools and software being used by different business teams start to integrate and become multi-functional rather than single use. Connected or smart devices are a great example of technology convergence, where we see formerly single use products such as a watch get upgraded to Apple Watches and Fitbits that can track heart rates, make phone calls, and communicate with other devices, along with the original function of telling time.

Today's most innovative technologies such as cloud computing, IoT, AI, Augmented and Virtual Reality are the foundational elements of many technology convergent solutions. They allow products and services to offer much more than their core value proposition and instead deliver a portfolio of benefits to the user. These include data storage, predictive analytics, cross-device communication, and simulation, all within a single device or software. Although it seems like table stakes now, it wasn't too long ago that we needed separate devices or software to perform those tasks separately.

We also see this type of multi-functionality in business software such as email marketing platforms that are now upgraded to handle social media posts, landing pages and integrations with sales systems. It's far more efficient than buying separate tools for each of those tasks, and it incentivizes teams to collaborate with a focus on the customer, rather than their individual goals.

These technology upgrades reflect the converging processes that have brought siloed teams together and given them the mandate to collaborate. The upgrades are also not cheap and require a sizeable investment upfront. That's why technology convergence requires a higher level of digital maturity to justify the investment. Without doing the hard work of aligning teams and streamlining processes, high-end software can become more of a burden than a solution.
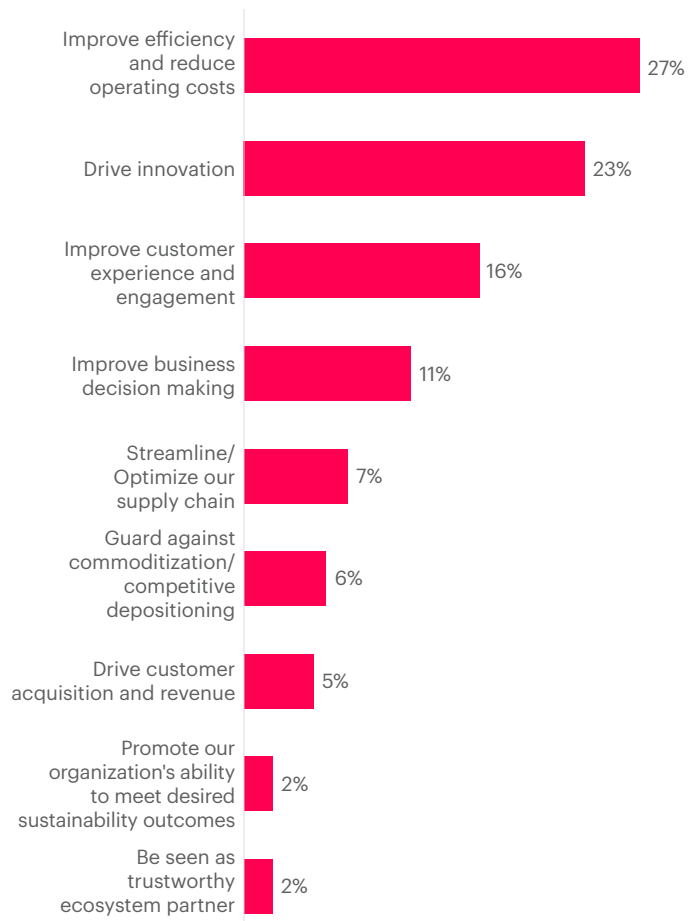
However, that high upfront cost is offset by the improved efficiency and reduced costs of multi-functional software. Much like process convergence, respondents rated these as the top benefits of technology convergence (Figure 9).

The impact of these benefits varied across different industries and levels of maturity. The more mature Design and Manufacturing industry saw a much greater benefit from technology convergence than other industries, implying that D&M businesses have many more use cases for integrating teams and processes than other companies, who still see the benefit in having teams stay in their lane, perhaps to allow for better specialization.

"We believe in having more integrated project team relationships," said Hietpas. **"We want to be reading from the same sheet music, and mechanisms like a shared risk pool help align the incentives of the whole project team."**

As digital maturity increases, so does the beneficial impact of technology convergence, peaking with companies in Stage 4 (Figure 10). However, increasing benefits come with increasing challenges,
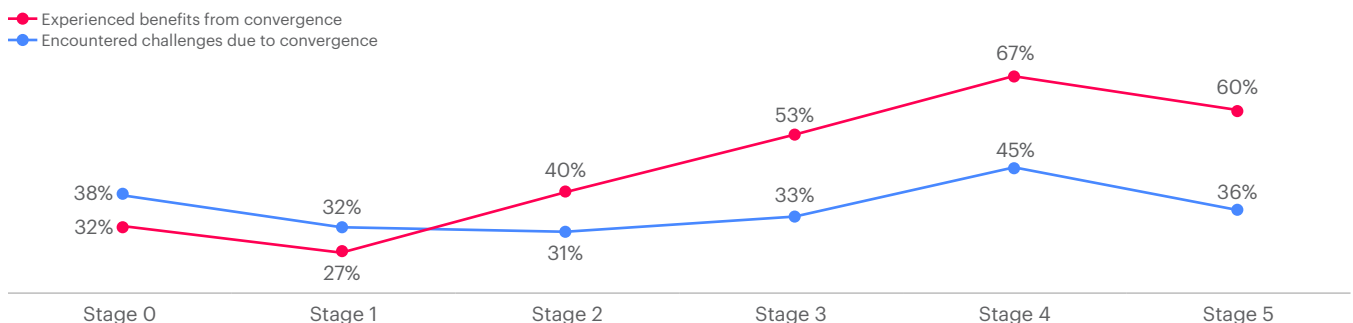
Figure 9:
Benefits of Technology Convergence

Benefit	Percentage
Improve efficiency and reduce operating costs	27%
Drive innovation	23%
Improve customer experience and engagement	16%
Improve business decision making	11%
Streamline/Optimize our supply chain	7%
Guard against commoditization/competitive depositioning	6%
Drive customer acquisition and revenue	5%
Promote our organization's ability to meet desired sustainability outcomes	2%
Be seen as trustworthy ecosystem partner	2%

Base: 376 respondents who experienced benefits from technology convergence

highlighting the added complexity that comes with operating multi-functional platforms across collaborating teams.

Figure 10:
Benefits and Challenges of Technology Convergence, by Digital Maturity Stage

- Experienced benefits from convergence
- Encountered challenges due to convergence

	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Experienced benefits from convergence	32%	27%	40%	53%	67%	60%
Encountered challenges due to convergence	38%	32%	31%	33%	45%	36%

Base: 749 respondents

Data Convergence

The increasing digitization of our world has created a vast amount of data that is now more accessible than ever for businesses. With the use of ever-improving technology platforms, companies can access digital and analog data from multiple sources, for a variety of use cases. In the past, we've seen business teams access data limited only to their domains or job functions. We're now seeing the trend of teams accessing data from multiple, often disparate sources and leveraging them for business success.

Peloton is a great example of a machine that operated off a single source of data (a person riding an exercise bike) and eventually turned into platform that brings together multiple data sources to create a uniquely immersive experience for the rider. It's a data-driven convergence of hardware with an offering covering classes, entertainment (such as digital music) and connection with a community of like-minded people, all within a single point of access.

For internal processes, business teams are no longer restricted to data specific to the platforms they use within their tasks. For example, product designers can access UX testing data from one platform, analog survey data from another, and real-time user behaviour from another to continually optimize their product. These data sources may live in different repositories and be managed by different owners, but their convergent use within the product team generates value that is greater than the sum of

their parts.

The benefits of data convergence differ significantly from the previous two convergences in process and technology. If achieving efficiency was the main objective in process and tech convergence, improving the customer experience and engagement is what's driving data convergence (Figure 11). By bringing multiple sets of data together, customer engagement teams have a better chance of recognizing customer needs and

Figure 11:
The Benefits of Data Convergence
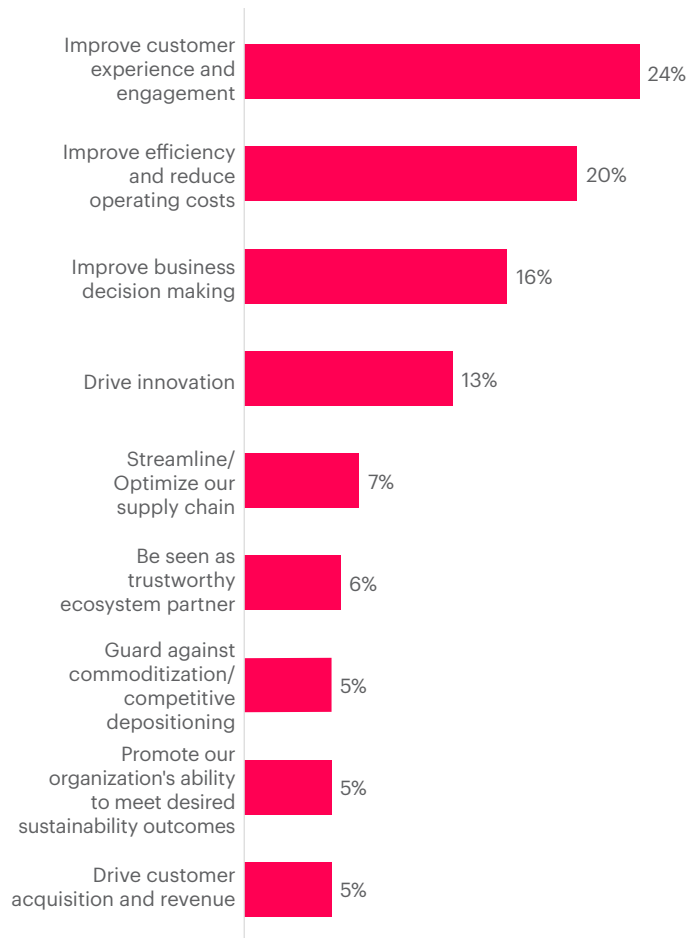
Base: 190 respondents who experienced benefits from data convergence

delivering the most relevant messages or offers to them, on the channels they prefer. In addition to bringing data in, companies should also consider how they will share data externally across networks of partners, vendors and other collaborators.

"Construction is a very fragmented industry, so bringing things together allows companies to manage risk, but then no one firm has the whole picture," said The Boldt Company's Hietpas, "to build the dataset we need to start to share data across firms and projects. I'm looking for ways to have convergence in terms of the data we give and the data we get."

One of the recommended ways to harness the benefits of data convergence is to invest in a central repository that can ingest data from multiple sources, provide access and analytics to multiple stakeholders, and serve as a conduit for sharing data externally. This is often a "data lake" type platform, although smaller scale platforms such as Customer

Data Platforms may also be enough to get the job done.

Like process and technology convergence, data convergence had more benefits for companies as they became more digitally mature (Figure 12). This highlights how harnessing multi-source data starts delivering a return on investment only when a company already has experience with converging processes and technology. The key challenge at the higher stages then becomes the prioritized integration of data sources with technology platforms to leverage actionable insights.

Industry Convergence

If process, data, and technology convergence mostly impacted the internal workings of a company, industry convergence is where external forces are driving the integration. It is when previously disparate industries or ones that operate in parallel find ways to collaborate for mutual benefit. This collaboration can take many forms, including

Figure 12:
The Benefits and Challenges of Data Convergence, by Digital Maturity Stage

- ● Experienced benefits from convergence
- ● Encountered challenges due to convergence

	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Experienced benefits	11%	15%	16%	22%	36%	40%
Encountered challenges	15%	17%	9%	17%	28%	23%
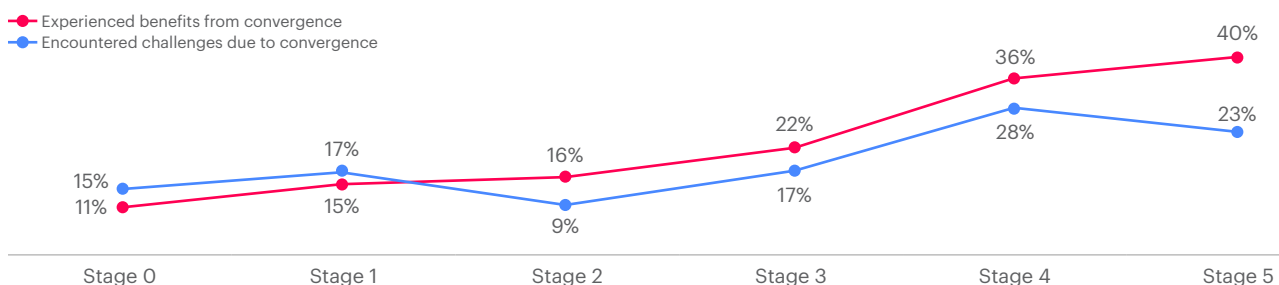
Base: 749 respondents

partnerships, transactional relationships, or simply shared resources.

A large-scale example of this is Disney's Shanghai Disneyland Park, whose rides and attractions are technological wonders, showcasing immersive experiences designed by a convergence of architects, artists, engineers, technologists, digital media producers and more.
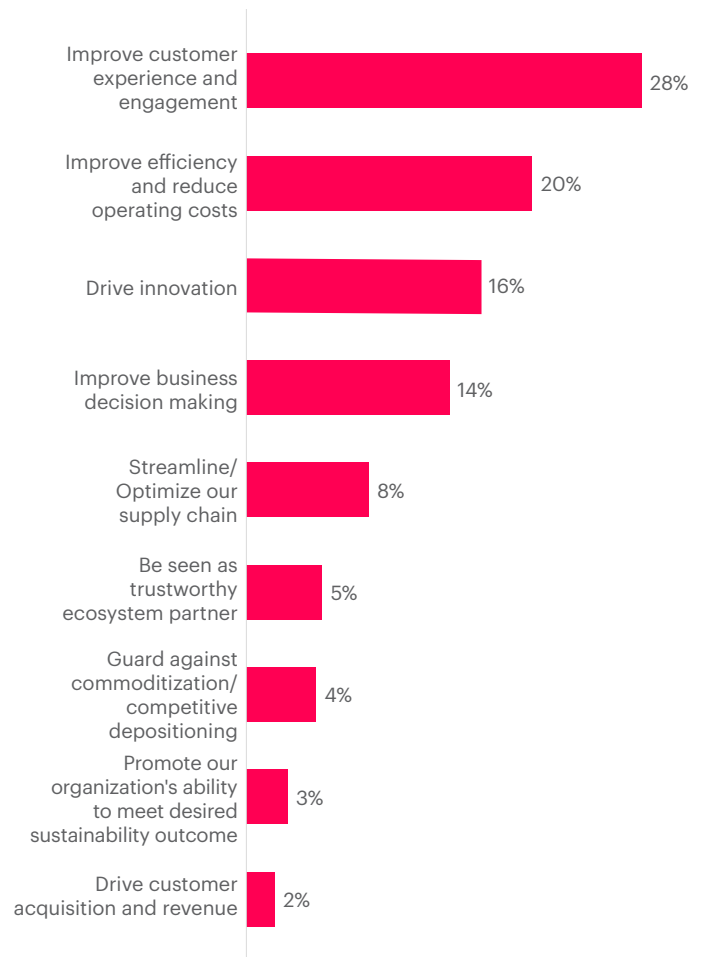
The multi-industry collaborators were able to design these complex experiences using sophisticated Building Imaging Modelling software that allowed different teams to work in parallel on projects, which in the past would have been done sequentially. Not only does this allow speed, but also a holistic way of delivering a great end-to-end customer experience.

Much like theme parks, "smart cities" of the future will also rely heavily on the expertise of multiple convergent industries to bring them to life. For example, Busan, the first smart city in Korea, created a platform to collect converged data from sensors that can monitor elements such as water quality, and disaster readiness, as well as capture logistical data from industries for shipping.

Other examples include electric vehicles getting energy from the grid. The auto industry and the utilities service haven't had to overlap, until now. This has led to follow on convergence between local and regional governments and other authorities who need to work together to make transportation more safe and eco-friendly.

Much like they did for data convergence, respondents chose improved customer experience and engagement as the top benefit of industry convergence (Figure 13). Once a company has gone through the hard work of leveraging process, tech, and data convergence, they are in a much better position to start deploying industry convergence to their advantage. By building cross-industry synergies through partnerships, acquisitions, and home-grown innovations, these digitally mature companies can deliver far more valuable and innovative products or experiences for their customers, compared to if they had done it alone.

Figure 13:
The Benefits of Industry Convergence

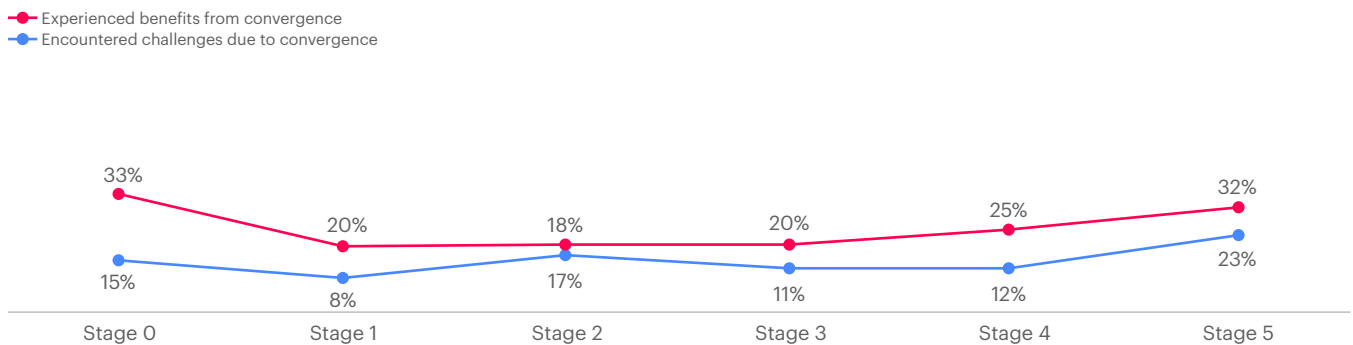| Benefit	Percentage
Improve customer experience and engagement	28%
Improve efficiency and reduce operating costs	20%
Drive innovation	16%
Improve business decision making	14%
Streamline/ Optimize our supply chain	8%
Be seen as trustworthy ecosystem partner	5%
Guard against commoditization/ competitive depositioning	4%
Promote our organization's ability to meet desired sustainability outcome	3%
Drive customer acquisition and revenue	2%

Base: 179 respondents who experienced benefits from industry convergence

Matthias Fritz, former Managing Director at Fanuc, the market leading robot manufacturer, shared that the company formed deep partnerships with 15 software application companies to offer complete solutions to automotive manufacturers. "It was a game-changer, making us so much more competitive because we offered a complete, turn-key solution to OEMs," Fritz explained. One key move was developing an internal R&D team to create a software interface, making it easy to hook into existing platforms.

It's no surprise that the most digitally mature companies are the ones best positioned to leverage the benefits of industry convergence. (See Figure 14). Building up their own maturity across internal processes gives them the credibility to build partnerships with similarly mature or innovative partners across the ecosystem.

Figure 14:
The Benefits and Challenges of Industry Convergence, by Digital Maturity Stage

- ● Experienced benefits from convergence
- ● Encountered challenges due to convergence

	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Benefits	33%	20%	18%	20%	25%	32%
Challenges	15%	8%	17%	11%	12%	23%

Base: 749 respondents

THE CHALLENGES OF CONVERGENCE: WHERE TO START

While the benefits of convergence may seem apparent at every stage of digital maturity, many companies face challenges in implementing the steps they need to take in order to fully realize these benefits. Some of the top challenges include:

Culture

Resistance to change is a problem at many companies, especially large ones with legacy systems and practices. This resistance can be particularly strong when it comes to the broad thinking and cross-siloed approach that is the key element of convergence. Most teams can have a difficult time believing the need for increasing the reach and influence of innovative technologies beyond their dedicated functions.

"I think the view of IT being disparate and distinct from the core business is still alive and well in the minds of the BOD and leaders in businesses we serve," said Rich Miller, Vice President of IT at architecture, engineering and construction firm Burns and McDonnell. **"They don't see IT permeating everything they do, and my role is to educate them on what's happening in the industry."**

Merging disparate teams can also help fill in blind spots they would otherwise experience. Fritz explained that they paired experienced production line managers with IT people who could collect and interpret data. **"Working alone, the IT guy just sees fluctuations in the data. But working with production line people gave them the context to interpret the data, understand what was meaningful, and write effective algorithms,"** said Fritz.

Designing for Convergence

Convergence requires designers and project planners to have far more expansive and disciplined thinking than they have in the past to design for convergence. They also need training and familiarity with the right tools to help facilitate that kind of thinking. For example, a designer today must have the discipline to design for automated assembly.

"Consider floormats in cars, they're floppy and not rigid. That's not a problem for people, but for a robot, dealing with a floppy object is a mathematical impossibility," explained John Suh, Vice President and Founding Director of New Horizon Studio, an R&D team for Hyundai Motor Group. **"So you have to account for**

those things to be manipulable by a robot. However, designers like the freedom to design in an unconstrained way. But if you want micro assembly, you need to design for that."

Data for Machine Learning

A lot of the innovative processes brought about by convergence are made possible through the power of AI. While AI can be a powerful technology that creates high efficiency, there is a risk of deploying it incorrectly. Feeding AI engine outdated, or biased data can create a snowball effect of the machine continuously learning and doing the wrong thing.

One of the biggest challenges is removing bias from AI algorithms. Tim Baker, a professor in mechanical engineering at University College London, described how they were optimizing a drone for range. Conventional wisdom is to strip down the drone to make it as light as possible. But the AI came back with a design that packed with batteries and more than two times heavier. **"Creating a virtual twin and simulating it in a virtual world can be done before committing to creating the actual device,"** Baker explained.

"But it works only if you can build in the freedom for the AI to make its own design decisions."

Hiring the Right Skills

As with any other innovation, hiring people with the right skills to thrive on convergence is challenging, especially since they are scarce and in high demand at the start of the disruption curve. Human resources teams are under constant pressure to find qualified people who can enable convergence, both through their own work, and their upskilling of coworkers. It's a reminder that no matter how much companies invest in the best technology platforms, in the end, it all comes down to the people that use them.

"It's quite difficult to find the people who have the right skills," said one interviewee. **"We couldn't find enough platform engineers, so the government and university tried to attract them by giving them access to internship programs with provided scholarships."** They added, **"With our advanced Maritime Lab, we showed the technology to students to encourage them to join us and collaborate with engineers and companies."**
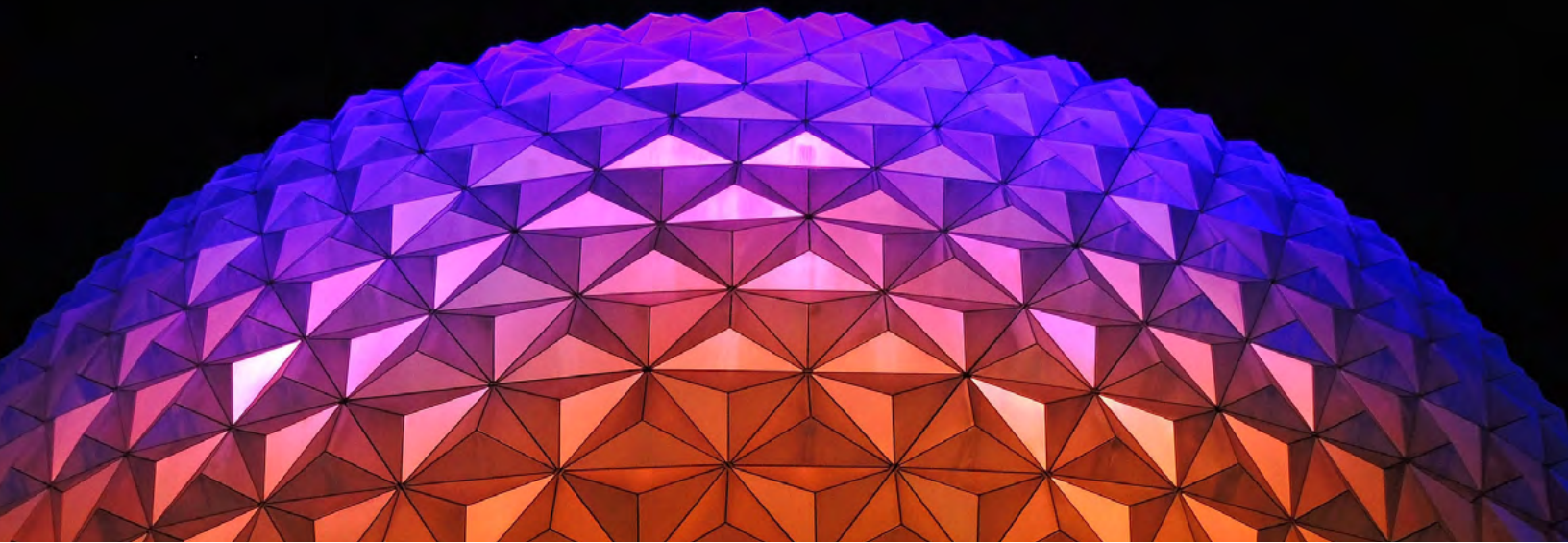
GEOGRAPHIC HIGHLIGHTS

The survey included respondents from six geographies: China, France, Germany, Japan, UK, and US / Canada. Since digital maturity is a key driver of convergence, let's take a closer look at how it differs by geography by comparing the percentage of respondents who are at Stage 4 or Stage 5 of digital maturity (Figure 15). Most countries hovered close to the global average of 42% in Stage 4 or 5 except for Japan at 32% of respondents and China at 52% of respondents.

Figure 15:
Advanced Levels of Digital Maturity by Geography

Percent of Respondents in Stages 4 & 5 of Digital Maturity, by Geography

	Global	US/Canada	UK	Japan	Germany	France	China
	42%	42%	32%	43%	40%	39%	52%
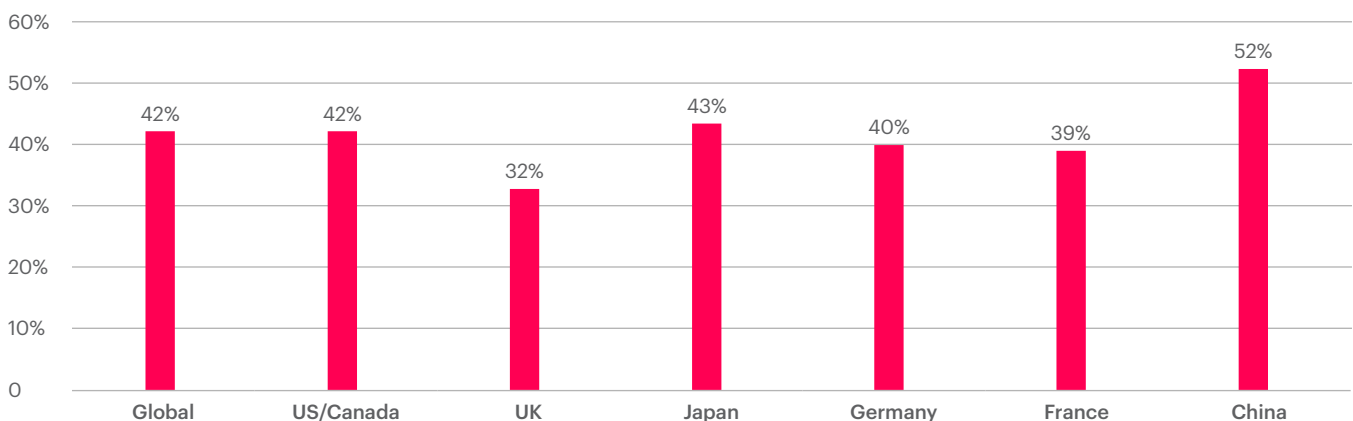
Base: 749 respondents

United Kingdom

Although respondents in the UK reported significantly lower percentages of high digital maturity, they said that the impact and benefits of convergence were almost exactly on par with global respondents. Technology use by UK respondents was like their global counterparts, with cloud collaboration use slightly higher (60% versus 56% globally), 5G/broadband (49% versus 46% globally), and Internet of Things (47% versus 44% globally). Two types of technology were used significantly less by UK respondents, 3D printing (22% versus 29%) and digital twin (11% versus 20%).
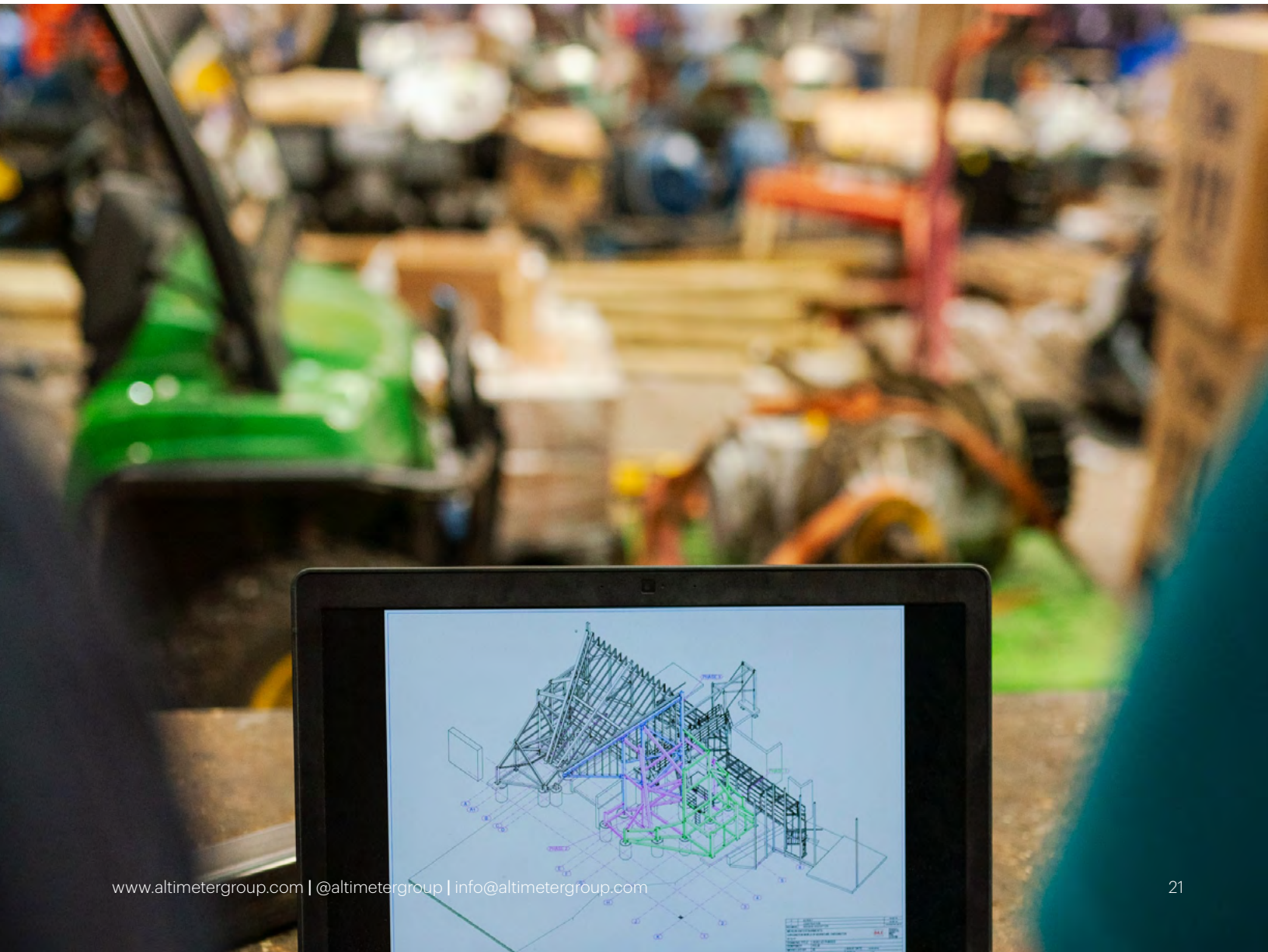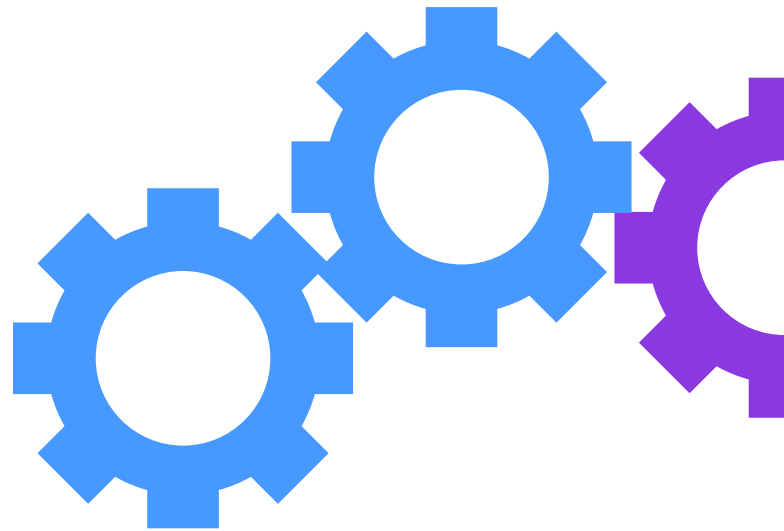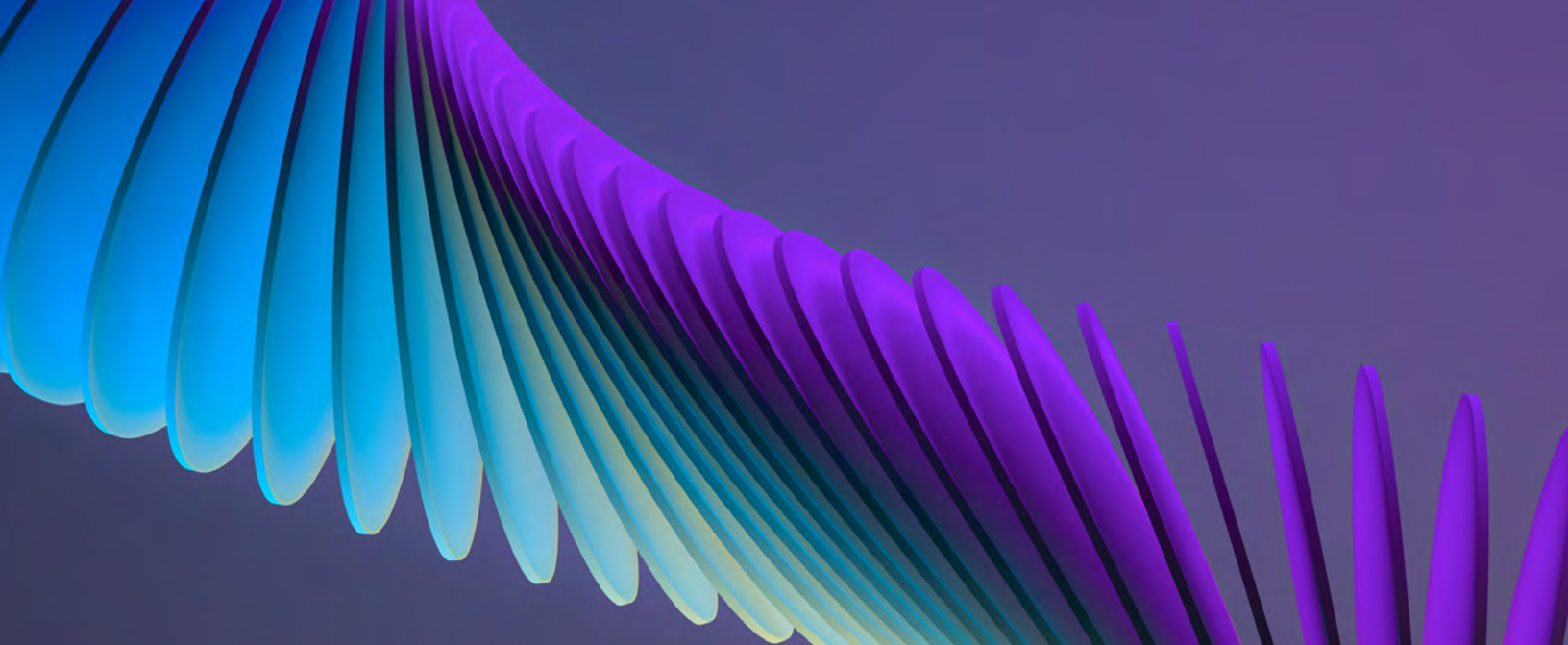
CONCLUSION

Understanding convergence and making it work for your organization is an under-leveraged competitive advantage. Our survey results highlight how inevitable and far-reaching the impact of convergence will be on key businesses. That's why the businesses who move quickly to understand and identify convergence trends within their industry are sure to have a competitive advantage.

By assessing their digital maturity and top investment priorities, companies can use this data to benchmark themselves against our respondents and chart a roadmap for transformation. This will allow them to effectively prepare for the coming disruption, and even thrive in it.

This report also shows that less mature companies don't necessarily have to wait to achieve high levels of maturity to prepare for convergence. They can start taking steps today that would allow them to leapfrog maturity stages, and even prepare more effectively than companies that have higher maturity today.

Although technology is a major underlying element of convergence, ultimately, it comes down to people. Having the right culture and leadership will be the primary drivers of success.

"Future competitive advantage will come down to leadership," said Miller at Burns and McDonnell.

"The leaders who with greatest focus, and agility to manoeuvre and change as usual, will win."

METHODOLOGY

In July 2021, we surveyed 749 software buyers and users about convergence and digital transformation, drawing from leaders in architecture, manufacturing, engineering, construction, real estate, media and entertainment. We also interviewed experts, practitioners, and academics, whose comments reflect their personal opinion and may not reflect the opinions of their employers. Our deepest gratitude to the following people for their contributions:

- Boldt, Trevor Hietpas, Manager, Insights and Analytics
- Burns and McDonnell, Rich Miller, VP of Information Technology
- Drexel University, Antonios Kontsos, Professor of Mechanical Engineering
- Hyundai Motor Group, John Suh,
  Vice President & Founding Director of New Horizons Studio
- GHD, Paul Murphy, Chief Technology Officer
- Fanuc, Matthias Fritz, Former Managing Director
- University College London, Tim Baker, Professor of Mechanical Engineering

All findings and analysis are independent and represent Altimeter's body of research.

ABOUT US

About Charlene Li, Senior Fellow

Charlene is a Senior Fellow at Altimeter, a Prophet company. For the past two decades, Charlene has been helping people see the future. She's an expert on digital transformation, leadership, customer experience and the future of work. She has authored six books, including the New York Times bestseller "Open Leadership" and is co-author of the critically-acclaimed book "Groundswell." Her latest book is the bestseller **The "Disruption Mindset".**

She's also an entrepreneur and Founder and CEO of Altimeter, a disruptive analyst firm that was acquired in 2015 by Prophet. Before starting Altimeter Group, she was vice president and principal analyst at Forrester Research. Charlene was named one of

the Top 50 Leadership Innovators by Inc, and one of the most creative people in business by Fast Company.

Charlene is frequently quoted by leading media channels such as The Wall Street Journal, The New York Times, and The Associated Press and has shared her insights on 60 Minutes. She is a highly sought-after public speaker and has inspired audience at conferences such as the World Business Forum, World Economic Forum, TED, and South by Southwest.

Charlene is a graduate of Harvard Business School and received a magna cum laude degree from Harvard College.

About Altimeter, a Prophet Company

Altimeter is a research and consulting firm owned by Prophet Brand Strategy that helps companies understand and act on technology disruption. We give business leaders the insight and confidence to help their companies thrive in the face of disruption. In addition to publishing research, Altimeter analysts speak and provide strategy consulting on trends in leadership, digital transformation, social business, data disruption, and content marketing strategy.

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Autodesk is changing how the world is designed and made. Our technology spans architecture, engineering, construction, product design, manufacturing, media, and entertainment, empowering innovators everywhere to solve challenges big and small. From greener buildings to smarter products to more mesmerizing blockbusters, Autodesk software helps our customers to design and make a better world for all. For more information visit autodesk.com or follow @autodesk.

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