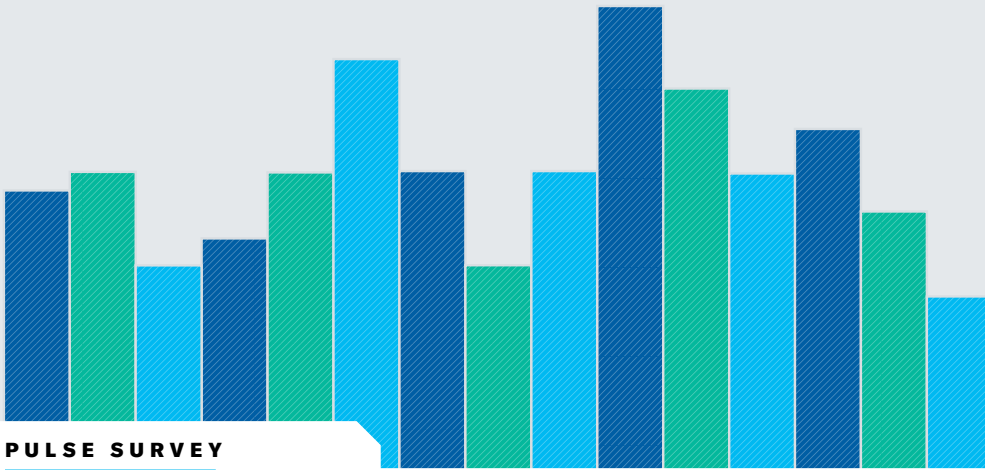Harvard Business Review

ANALYTIC SERVICES

Supporting Manufacturers' Shift to Remote Work with Cloud-Based Solutions

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For many manufacturers, the pandemic has been a struggle—especially early on. As with many industries globally, some key players in manufacturing were caught flat-footed in long-entrenched ways of working. They found they had an immediate need for greater visibility into the supply chain, faster forecasting of changes in demand, and better tools for completing their work from home. They tried to quickly cobble existing solutions together into something new that would support sudden changes in the workforce, workplace, and supply chain, but they found that approach didn't really work. The pandemic quickly showed many that they were unprepared for shocks to the system and needed new tools, which resulted in a dramatic turn toward adoption of cloud technologies.

We estimate a decade's worth of cloud technology adoption—and the remote collaboration, distributed workforce efficiency, and global visibility it brings—has taken place over the past 19 months. Organizations that were already taking steps toward the cloud and digital transformation before the pandemic have fared well, with those that quickly moved to the cloud a close second. Organizations playing catch-up on the cloud have struggled the most.

Even before the pandemic, key indicators were pointing toward productivity stagnation in manufacturing. We expect manufacturing to reverse this trend by increasingly turning to cloud-based software solutions, coupled with data and artificial intelligence, to be both an engine that powers innovation and a resiliency shock absorber. Cloud solutions offer multiple paths for manufacturers to diversify their business models and revenue streams.

Yet rethinking how you plan, design, and manufacture products is no small task. The good news, according to this new research from Harvard Business Review Analytic Services, is that cloud technology is helping manufacturers become more flexible and efficient so they can face future disruptions. Real-world experiences have been powerful factors shaping attitudes in manufacturing.

At Autodesk, we believe digitalization and automation are the answer, and we see evidence across the manufacturing industry that our customers, peers, and competitors agree. Numerous leading heavy industry companies have recently acquired technologies that will enable them to better automate production and increase productivity by getting more out of the data, infrastructure, and systems they already have in place. Everyone is recognizing a need to increase the level of sophistication in manufacturing in order to stay competitive.

The pandemic may have exposed urgent reasons to use cloud technology, but there is no going back to outdated manufacturing processes. I encourage you to read this report, sponsored by Autodesk, to understand how companies are finding their way forward with greater resiliency in the manufacturing industry.
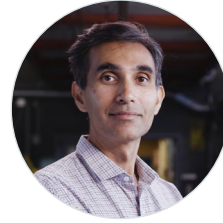
Srinath Jonnalagadda
Vice President, Industry Strategy, Design and Manufacturing

Autodesk

Supporting Manufacturers' Shift to Remote Work with Cloud-Based Solutions

The pandemic suddenly significantly disrupted the culture and daily operations of many manufacturing firms. Non-production workers were sent to work from home, digital transformation projects were accelerated, and customer demand patterns and supply chain operations were plunged into disarray. But amid the fallout, manufacturers were presented with an opportunity to hit the fast-forward button on several fronts, from designing remote work arrangements to using cloud in new and different ways to support that work. The question was whether these forced experiments would make a lasting impact on working style norms in the manufacturing industry.

Roughly a year and a half later, it seems those changes are taking root. Nearly three-quarters (74%) of respondents surveyed by Harvard Business Review Analytic Services (all working at manufacturing companies that had some remote work in place over the past 18 months) say that their company's managers generally reviewed remote work negatively prior to the pandemic, and just 30% agreed that their company's management welcomed remote work as an option for corporate employees (i.e., non-production line/factory workers). But since the start of the pandemic, the tables have turned. The percentage saying their management views remote work negatively today was just 29%, while the portion saying that, going forward, their management will welcome remote work as an option for employees was 68%. At the time of the survey (August 2021), fully 90% reported that employees at their companies were in favor of a hybrid or remote work environment.

HIGHLIGHTS

86% of survey respondents report that cloud technologies are a **critical component of their operations today**, up from 58% saying this was the case prior to the pandemic.

69% say one of the most helpful **benefits of cloud** their organization has seen during the pandemic is **increased data accessibility**.

68% agree that, going forward, their company's management **welcomes remote work for corporate employees**, up from 30% saying this was the case prior to the pandemic.

Due to rounding, some figures in this report may not add up to 100%.

At the time of the survey (August 2021), fully 90% reported that employees at their companies were in favor of a hybrid or remote work environment.

The survey findings show that attitudes toward remote work have been transformed. Manufacturing leaders are using what they've learned to redefine their workplaces. "One of the things that the pandemic has done is lofted this whole conversation of space to the C-suite," says Kate Lister, president of Global Workplace Analytics, a research-based workplace strategy consulting firm based in Carlsbad, Calif. "It used to be that real estate would initiate a remote work program to reduce real estate costs. HR would initiate to improve attraction and retention of talent. Now the conversations about the places and spaces of work are happening at the very top of the org chart. And they're looking at [them] in terms of organizational strategy, not simply as a tactical solution to the problem du jour."

The degree to which manufacturers feel they rely on cloud architecture—as well as their attitudes toward cloud—were also transformed. Of those currently using cloud tools, a notable 84% increased their use of cloud-based solutions as a result of the pandemic. Fifty-eight percent of all the respondents reported that, prior to the pandemic, cloud technologies were a critical component of their operations; when asked about today, 86% said they were critical.

It seems that real-world experiences have been powerful factors shaping attitudes in manufacturing. Increased reliance on cloud-based solutions to support the remote work experiment demonstrates cloud's role as an important enabler for this working model as well as in helping manufacturers become more flexible and efficient in the face of future disruptions. The shift in thinking about remote and hybrid work styles has been similarly transformative, suggesting that these arrangements are likely to play a much larger role in manufacturing moving forward.

"I feel certain employers who reject remote and hybrid will not survive," Lister says. Remote work "is the way of the future. The agility that it provides is what we need more than perhaps anything so we are able to make those pivots as we need to in the future."

The task facing manufacturers now is to understand and apply the lessons gleaned from their recent experiences with remote work and cloud technologies. These tasks include preserving gains while finding solutions to the challenges they experienced in managing a remote workforce, adapting these to the more hybrid work arrangements many are now adopting, and ensuring the culture successfully embraces this new model. The assessment process also requires incorporating new insights about cloud usage into manufacturers' digital transformation strategies. This step is necessary to ensure a hybrid workforce can continue to access the data and tools it needs to execute key activities such as product development while also increasing its resilience and innovation capabilities.

Lessons from a Forced Experiment

Apart from a handful of specific roles, most manufacturing jobs have long been performed on the premises. Very few manufacturing staff worked remotely prior to the pandemic. "I do think [remote work] was happening [at manufacturing companies], but it certainly wasn't happening on any

sort of wide scale," says Carolyn Lee, executive director of The Manufacturing Institute, the Washington, D.C.-based education and workforce partner of the National Association of Manufacturers.

Almost three in five (59%) of respondents to the survey report that everyone or almost everyone worked in the office prior to the pandemic, with few or none working remotely and another 20% saying that most workers were in the office. Just 13% had more workers out of the office than in. That breakdown suited the management of most manufacturers just fine, judging by the 74% that previously viewed remote work negatively. **FIGURE 1**

Those numbers changed dramatically with the onset of the 2020 work-from-home orders, when 60% of manufacturers saw most non-production line/factory workers working remotely—22% with everyone or almost everyone remote and another 38% with most remote and just a few in the office. That experience clearly made an impact; while 32% of respondents somewhat agreed that, looking back to before the pandemic, their management's view of remote work was negative, just 21% report that was true for them at the time of the survey, nearly a year and a half after the forced remote work experiment began. Even more dramatically, 42% strongly agreed that negative view was true for their managers before the pandemic, but just 7% said this was still the case at the time of the survey.

"The biggest holdback to remote work traditionally has been managers not supporting it. Once they've done it themselves, their attitudes typically shift. We're seeing that now," Lister of Global Workplace Analytics explains.

Aligning with that shift, 30% of respondents agree that their company's management welcomed remote work as an option for corporate employees (i.e., non-production line/factory

"The biggest holdback to remote work traditionally has been managers not supporting it. Once they've done it themselves, their attitudes typically shift. We're seeing that now," says Kate Lister, president of Global Workplace Analytics.

workers) prior to the pandemic, while 68% say going forward their company's management will welcome remote work. Notably, many months into their remote work experiences, 90% of employees at their companies are in favor of a hybrid or remote work environment, according to respondents.

Offering greater flexibility in where the work takes place is quickly becoming a key factor in attracting and retaining talent, whose diversity enhances innovation, analysts say. With an all-time high of 889,000 job postings in the manufacturing sector as of September 2021, companies are eager to lure workers by offering the benefits they most value, and for many, this means the option to work remotely. Research by the National Association of Manufacturers trade group found recruitment to be just as large a challenge as supply chain disruptions right now, notes Lee, of The Manufacturing Institute.

"You have the ability to source more of your specific and top talent because you're furthering the ability for people to live where they want to live," says Mark Johnson, cofounder and senior partner at Innosight, a Lexington, Mass.-based growth strategy consulting firm. "And to the extent that talent helps the company be more productive and innovative, I think it's all moving it in the right direction."
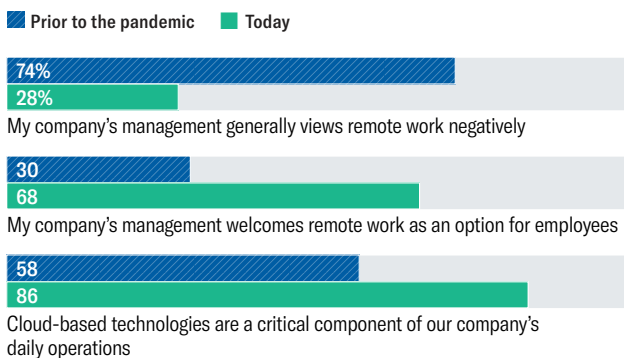
Office furniture brand Herman Miller, which has long studied workplace trends, already employed some geographically dispersed workers prior to the Covid-19 pandemic. But now the company has begun actively recruiting talent around the world, says Ryan Anderson, vice president of global research and insights at MillerKnoll, the new parent company of the Herman Miller and Knoll brands, in Zeeland, Mich. It's part of a larger initiative to allow workers more choice over where and when they work.

"The data is now becoming clearer that the more flexibility you offer an employee, the more engaged they'll become," Anderson says. "That means very positive work experiences as well as very positive outcomes for the organization."

FIGURE 1

Changing Attitudes

After months of remote work, manufacturers view remote work and cloud more favorably

■ **Prior to the pandemic** ■ **Today**

74%	
28%	

My company's management generally views remote work negatively

30	
68	

My company's management welcomes remote work as an option for employees

58	
86	

Cloud-based technologies are a critical component of our company's daily operations

Source: Harvard Business Review Analytic Services survey, August 2021

"The data is now becoming clearer that the more flexibility you offer an employee, the more engaged they'll become. That means very positive work experiences as well as very positive outcomes for the organization," says Ryan Anderson, vice president of global research and insights at MillerKnoll.

Adjusting to New Work Styles

The success of remote work to date didn't come without some hurdles and process challenges, however. While manufacturers were in varying stages of digital transformation as Covid-19 took hold, not all of these changes were designed with remote work in mind. So despite the disparity in progress, many faced similar challenges when it came to managing a workforce working from their homes and elsewhere.

The majority of respondents cite employee engagement (67%), collaboration (64%), product development/innovation (53%), and cybersecurity (52%) as factors that became harder as a result of employees working remotely due to the pandemic. **FIGURE 2**

"We as human beings need social interaction," and that became more difficult without in-person contact, says Innosight's Johnson. That lack of social interaction was particularly the case for colleagues beyond a worker's immediate team, adds MillerKnoll's Anderson.

"It's the weak ties. Those are the extended networks, the people who you might not have a reason to schedule a meeting with but who you really benefit from spending time with," Anderson says. Moving forward, "that sense of place and a sense of community is our top-of-mind priority to build up and reestablish."

Collaboration, particularly brainstorming and idea exchange activities such as the earlier stages of product development, also presented challenges.

"Most [manufacturers] simply did not have the tools they needed to collaborate remotely before the pandemic. Many still don't," says Lister. "I'm working with clients now that haven't even heard of virtual whiteboarding. It just wasn't on their radar."

Product development is one process that requires a range of work styles at various stages, from individually focused work to collaborative brainstorming to hands-on model development and testing. As staff worked from home, Herman Miller managed to continue developing new products, including merchandise such as gaming furniture developed in direct response to pandemic-fueled behaviors.
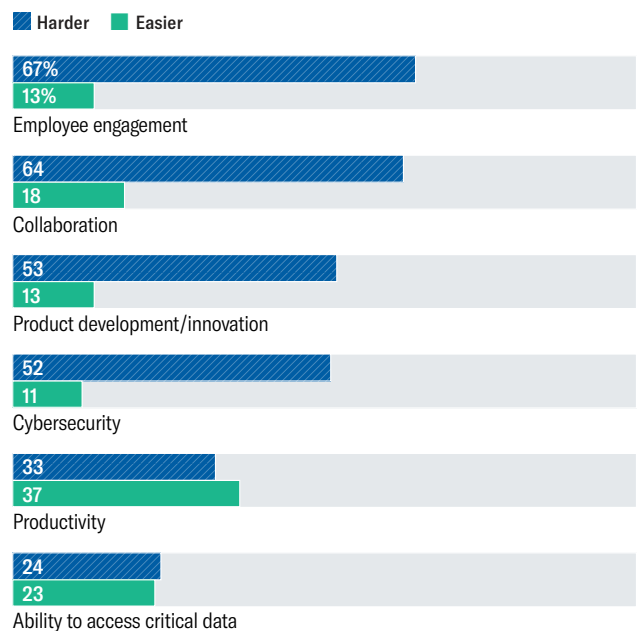
"Luckily, we had several digital product teams who were already dispersed, and we could use their model for the rest of the organization," says Kristen DeLap, director of digital product management at MillerKnoll. "Development and maintenance are the smoothest to transition to virtual settings, as the discussions center around feasibility and sequencing. Vision work and innovation discussions that might have previously been 'whiteboarded' needed a more intentional shift to digital collaborative tools that could be used both synchronously and asynchronously. Overcommunication of agendas and objectives for virtual meetings was, and continues to be, imperative to ensuring that folks come together prepared and with ideas to share."

Perhaps surprisingly, more survey respondents, at 37% compared to 33%, say productivity is a factor that became
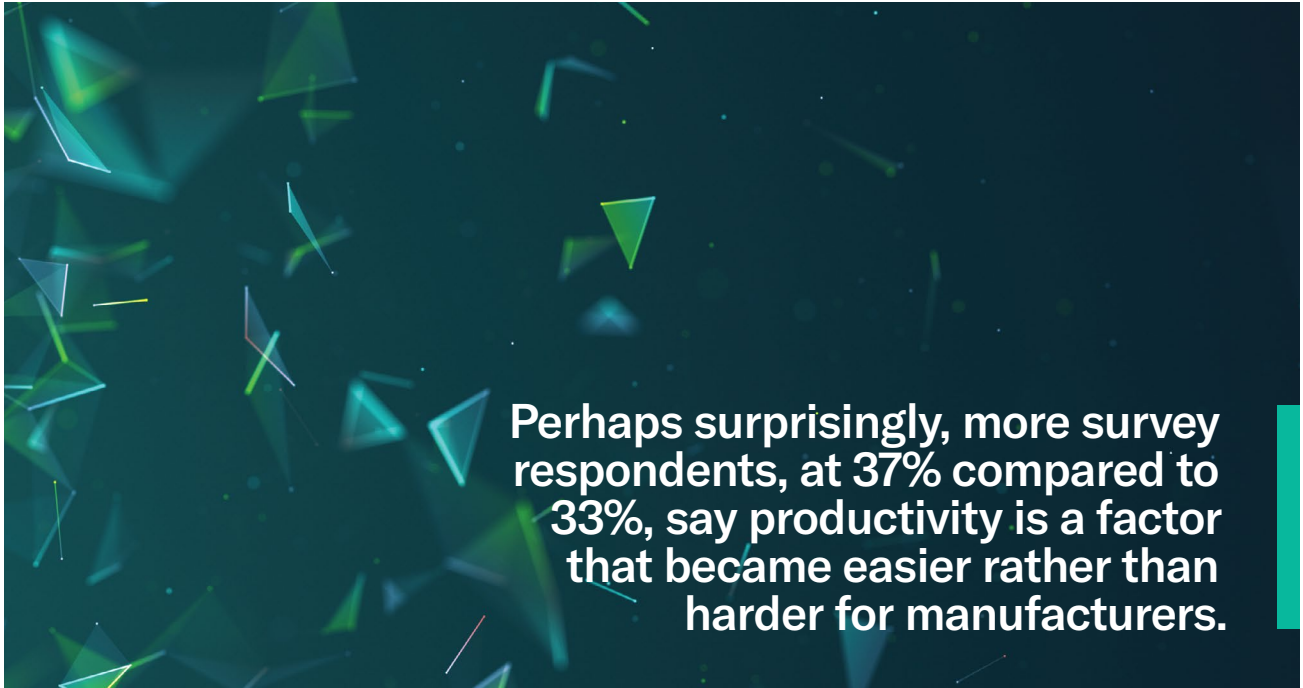
FIGURE 2

Engagement, Collaboration Top Pandemic Challenges

Productivity fared comparatively well for manufacturers shifting largely to work from home

■ Harder ■ Easier

	Harder	Easier
Employee engagement	67%	13%
Collaboration	64	18
Product development/innovation	53	13
Cybersecurity	52	11
Productivity	33	37
Ability to access critical data	24	23

Source: Harvard Business Review Analytic Services survey, August 2021

Perhaps surprisingly, more survey respondents, at 37% compared to 33%, say productivity is a factor that became easier rather than harder for manufacturers.

easier rather than harder for manufacturers. The success of productivity contradicts many beliefs previously held by executives with negative views of remote work.

"We've learned that [remote work] improves productivity and that the technology is really nailing that because you don't have to wait for everybody to get together—you can keep going," says Lee.

A Larger Role for Cloud

Thanks to ongoing digital transformation initiatives, many manufacturers were already in some phase of cloud adoption when the pandemic began. This head start proved advantageous when these companies needed new ways to provide the data and tools workers required to perform their jobs.

The vast majority (92%) of survey respondents currently use cloud-based software/tools, and prior to the pandemic, most respondents' companies were satisfied with them; just over two-thirds (68%) said that prior to the pandemic, their companies had a positive attitude toward cloud-based technologies, and 58% agreed cloud technologies were a critical component of their company's daily operations.

When the pandemic hit and many workers headed home, many organizations turned to cloud to enable data and tool accessibility to support this new way of working. The majority of respondents (83%) who use cloud increased their use of cloud-based software/tools somewhat or significantly as Covid-19 impacted operations. Not a single respondent said their use of cloud-based software/tools decreased because of the pandemic.

"Our head of IT had created a migration strategy well in advance of the pandemic, and that work was largely underway and much of it was completed before the pandemic hit. And I definitely think it provided us a lot more opportunity to work from anywhere," says Anderson. "The applications and the content that we needed were so accessible."

As anyone working remotely during the pandemic might expect, communication and collaboration tools such as messaging platforms/apps and shared online documents were the cloud-based software or tools manufacturers used most in the period that began as shutdowns started to take hold. These solutions delivered for their users, with 98% of those using cloud reporting that communication/collaboration tools helped them work successfully. **FIGURE 3**

Respondents from companies reporting cloud use cite similar success in every other category of cloud-based tools they were asked about, including remote work tools such as laptops, screen sharing, and remote access to servers (98%) and cloud-based data accessibility tools such as data in the cloud, dashboards, and self-service analytics (92%).

While some workforces may have struggled to use communication and other tools from their newly remote workspaces in the early days of the pandemic, that investment has set the stage for a more distributed approach to work moving forward, says Lister.

"One of the things this has done is forced organizations to move their processes to the cloud," she says, and that's helped advance use of tools for collaboration, workflow transparency, and more asynchronous work processes. "Most were headed
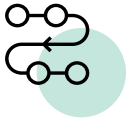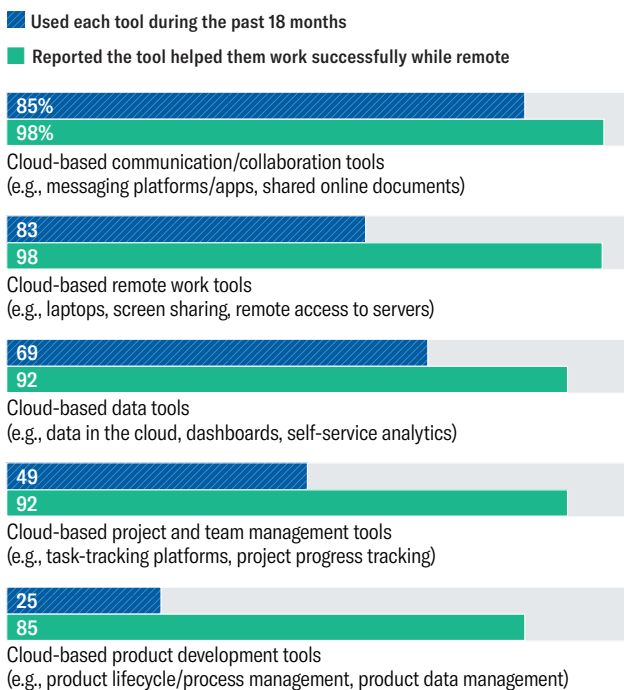
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FIGURE 3

Cloud-Enabled Productivity

Manufacturers relied heavily on cloud-based tools and saw success

■ Used each tool during the past 18 months
■ Reported the tool helped them work successfully while remote

85%
98%
Cloud-based communication/collaboration tools
(e.g., messaging platforms/apps, shared online documents)

83
98
Cloud-based remote work tools
(e.g., laptops, screen sharing, remote access to servers)

69
92
Cloud-based data tools
(e.g., data in the cloud, dashboards, self-service analytics)

49
92
Cloud-based project and team management tools
(e.g., task-tracking platforms, project progress tracking)

25
85
Cloud-based product development tools
(e.g., product lifecycle/process management, product data management)

Source: Harvard Business Review Analytic Services survey, August 2021

there anyway, but the pandemic accelerated adoption" of these tools and processes.

At Herman Miller, for example, cloud tools were a key to enabling clear communication within and across teams in a way that the manufacturer hopes to sustain as its workforce becomes increasingly global and works across time zones.

"People have not just kept their content in the cloud but also their conversations in the cloud, to make sure that they're including everyone. We've worked toward better clarity," says Anderson. "We've been quite intentional about moving on to this future state where we can enjoy the chance to be colocated but not lose what we built."

Setting the Foundation for Hybrid Work

As manufacturers plan for a more hybrid approach to work for non-production employees, they're taking a close look at what worked and what didn't throughout the forced remote work phase. This analysis includes considering not just which cloud-based tools drove success but how those tools supported a new way of working.

Manufacturers credit the use of cloud during the recent months of increased remote work with a wide range of benefits. The benefit cited by the most respondents as being a helpful outcome of remote work is increased data accessibility, cited by 69% of respondents. **FIGURE 4**

As these results suggest, data accessibility is a key enabler of an increasingly distributed or hybrid workforce, Lister says. "Whether you're nine floors, nine miles, or nine time zones away, having access to the files and tools you need is critical. Fact is, just about everything organizations have had to do to accommodate remote work will make them more effective, regardless of where people are."

Manufacturers using cloud also report that increased business agility/flexibility (47%) and process/workflow efficiency (46%) resulting from their use of cloud-based technologies were some of the most helpful outcomes during the remote work period.

"There are a thousand different reasons why we need to make sure that we're really adaptable and agile and flexible with the way we work moving forward," says Anderson. "I think we were, but we're much better now because we've had the chance to be very intentional about it and to talk openly about this over the course of the last year and a half."

Leveraging Pandemic Lessons for a Hybrid World

These findings reinforce what analysts have been saying in recent months: The future of work will be unlike what we experienced during the pandemic or anything that came before. Instead, many predict a hybrid environment, where some work is performed in person, some remotely, and some alternating between the two. It's now up to manufacturers to take what they've learned and apply it to this new way of

FIGURE 4

Access and Agility Lead Cloud Benefits

Manufacturers using cloud enjoyed widespread impacts

What benefits of cloud-based technologies have been the most helpful to your company during the past 18 months of remote work? [SELECT UP TO FIVE]

69%	Increased data accessibility
47	Increased business agility/flexibility
46	Increased process/workflow efficiency
33	New/improved employee experiences
30	Increased business resiliency
27	Support for faster and/or better decision making
21	Better security
20	New/improved customer experiences
20	Ability to meet changes in demand
9	Increased speed to market
7	Increased ability to innovate
6	Ability to develop new products, services, or business models

Source: Harvard Business Review Analytic Services survey, August 2021

"Whether you're nine floors, nine miles, or nine time zones away, having access to the files and tools you need is critical," says Kate Lister, president of Global Workplace Analytics.

Equalizing experiences includes both cultural and technical changes. For example, some are using smart videoconferencing devices that leverage cameras, large displays, and advanced sound technology to create equity among those in a meeting room and those working remotely, along with providing equal access to resources.

"Technology can be the hero of the story by enabling that virtual presence," says Lee. "I think that's a great opportunity for the use case around 5G for low latency engagement so that you can, in real time, transmit data and see data and engage with that data."

Hybrid-friendly policies and practices reinforce how such technologies are to be used and infuse those into the culture. At Herman Miller, "we have deeply engaged our learning and development team, who have been conducting seminars and learning opportunities," says Anderson. "We are talking about things like, 'How do you begin to use our facilities more without accidentally marginalizing people?' We don't want decisions made in the hallway after a meeting. We don't want content that was in the cloud migrating back to a piece of foam core or a whiteboard sitting in one facility where other people can't access it."

The manufacturer recently created a new position, director of employee digital experience, to better support new ways of working.

Repurposing space is another area of experimentation. While some companies have sold off or downsized real estate, others are redesigning their spaces to support the collaborative activities that work best in person, reducing space allocated to individual work that research shows is best performed in more isolated spaces.

"They're going from, in many cases, 70% desk space, 30% team or social space—conference rooms, meeting rooms, coffee bars, that kind of thing—to the reverse, mostly collaborative space, because people will do their focus work at home," says Lister.

working. Under pressure to fill substantial workforce shortages, many are actively sharing ideas within the manufacturing industry to drive this process forward, Lee says.

These strategies include discovering new ways to equalize remote and in-person work experiences, reconfiguring workspaces for new needs, and restructuring the tech stack and the use of cloud to support broader accessibility of software tools and data.

"Organizations that have not moved the bulk of their data to the cloud, that have not adopted software as a service, need to make it a priority if they want to compete," says Global Workplace Analytics' Lister.

Technology as Key Enabler

Underpinning all of this work is ensuring a technology platform capable of facilitating new work styles, including ensuring access to critical cloud-based tools and a shared single source of data regardless of physical location.

Manufacturers that had already broken down silos and made more data and tools available in the cloud made the transition to remote work more seamlessly, and in fact, some were able to improve on current processes. For example, to replace in-person shift changes, some firms leveraged communication and documentation tools to facilitate digitally enabled, socially distant handoffs.

"Their communication went more smoothly, and they actually got more information from the prior shift on the floor," says Lee. "[These organizations] opened communications, recorded more information, and shared more information with more people so things could get addressed faster, which I don't think anyone would have assumed as an outcome of the change in operations."

Moving forward, Lee anticipates manufacturers leveraging such capabilities to speed projects, boost efficiency and productivity, and redirect resources. This approach will also strengthen their resilience for future disruption, she says.

"I think we've got to support a platform-agnostic way of working," adds Lister. "Organizations that have not moved the bulk of their data to the cloud, that have not adopted software as a service, need to make it a priority if they want to compete. A lot of fixes have just been bolted on to get them through, but now they need to think about how to make those systems talk to each other in a way that can help them improve performance, make processes more efficient and effective, and work outcomes more measurable," she says.

Moving forward, manufacturers must now take a more considered approach to building out their platforms, one that wasn't possible in the rush to adjust to sudden needs, she says. "The pandemic has brought a cornucopia of new technologies and upgrades to old technologies to the market. Future success is going to be about continual process improvement. Organizations should be constantly experimenting, questioning old assumptions and technologies, and keeping an eye to the future. Those who wait for the tried-and-true brand name to deliver the best solution will be left in the dust."

Getting a secure, cloud-based infrastructure in place also sets the stage for new capabilities, including discovering more use cases that derive value from newly accessible data and uncovering new opportunities for automation.

"Security is first and foremost, but any organization that wants to excel or survive in the years ahead should have already or be in the process of moving things to the cloud, adopting software-as-a-service solutions, looking at consolidating data streams, big data analytics, and other ways of using data to better understand where they are relative to where they need to be," Lister says. "Digital streams are becoming more ubiquitous and better able to talk to one another, which means we're able to get more information out of that data. Down the road, it will also be predictive."

Moving into a Cloud-Enabled, Hybrid Future

Real-world experiences have strongly influenced attitudes about both remote work and the importance of cloud as a key enabling technology in manufacturing. From a largely negative view of remote work and lukewarm opinions on the importance of cloud, many manufacturers have now become believers in both.

"We were able to accelerate the pace of some of the changes that were underway," says Anderson. "Our team stepped up, we got better, we got faster. We launched some of the most important initiatives we have in years in the midst of the pandemic. We even onboarded new employees and started entire new teams. We adapted fairly well."

As they contemplate what the next phase of work will look like, manufacturers are taking these newfound lessons into account. While the specifics are still murky, what is clear is that remote work appears destined to play a much larger role moving forward, and cloud-based solutions will be right at the center, helping manufacturers achieve the flexibility and resilience they'll need to face whatever comes next.

A total of 318 respondents at manufacturing organizations drawn from the HBR audience of readers (magazine/newsletter readers, customers, HBR.org users) completed the survey. Aside from introductory questions, all other questions were asked only to those whose organizations had some amount of remote work as a result of the pandemic; the below profiling is reflective of those respondents.

Size of Organization

46%
10,000 or more employees

26%
1,000 – 9,999 employees

6%
500 – 999 employees

23%
499 or fewer employees

Seniority

26%
Executive management/ board members

41%
Senior management

26%
Middle management

All other grades were less than 7% each.

Key Industry Sectors

100%
Goods manufacturers

Job Function

21%
General/executive management

14%
Operations/production/ manufacturing

10%
Sales/business development/ customer service

All other functions were less than 8% each.

Regions

42%
North America

25%
Europe

19%
Asia Pacific

9%
Latin America

4%
Middle East/Africa

Figures may not add up to 100% due to rounding.

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