



Solve the skills gap with a new take on reality

Improve workforce productivity in the manufacturing industry and empower frontline workers with mixed reality training protocols using Vuforia Expert Capture and Vuforia Studio on Microsoft HoloLens 2.



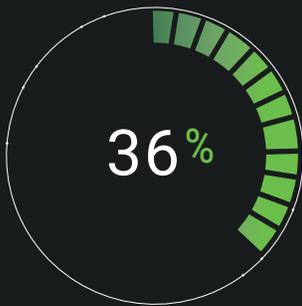
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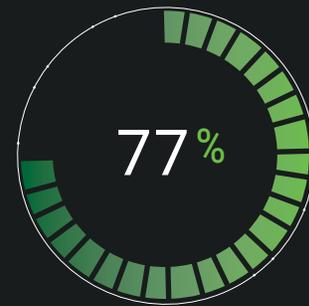
What challenges are manufacturers facing today?

The worker shortage gap in manufacturing

According to a recent Deloitte study,¹ the US manufacturing skills gap could leave as many as 2.1 million jobs unfilled by 2030.

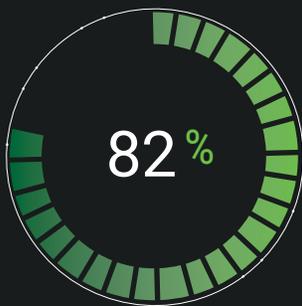


US manufacturers surveyed believe that finding the right talent is now **36% harder than it was in 2018**, even as the unemployment rate has nearly doubled the number of available workers.

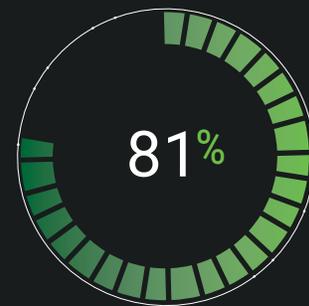


77% of surveyed manufacturers say they will have ongoing difficulties in attracting and retaining workers in 2021 and beyond.

The struggle to fill jobs is real



82% of manufacturers report they are now unable to increase revenue growth from not filling jobs.



81% say they can no longer maintain production levels to satisfy demand.

Addressing the skills gap in today's challenging work economy has never been more important.

The high cost of training and the opportunity of remote solutions

Not only is there a skills gap, but there is one other crucial challenge that plays a role in worker shortage: Training costs.

Cost is undeniably one of the largest challenges faced in training and development for manufacturing companies. From instructor fees and travel expenditures to time-consuming onsite demonstrations that span different locations, ensuring worker competency requires substantial resources. And this doesn't even take time into consideration, which is a huge factor that can impact production and productivity levels.

The pandemic was the impetus for the work-from-home economy. And while this may not be a suitable long-term option for some industries, it has posed an opportunity for manufacturers when it comes to training. With the climb of remote work, the manufacturing industry is becoming more amenable to digital solutions that help them ensure business continuity. More than 90% of manufacturers believe that digital transformation is important for their success.² And one of the primary driving forces for this newfound consideration is the ability to cut down the cost associated with onboarding, training, and the delivery of services.

Effective knowledge transfer to the frontline worker

Augmented and mixed reality invites newfound productivity and profitability

The greatest opportunity to mitigate current training challenges around knowledge retention and scaling deep industry expertise comes through augmented reality (AR) and mixed reality (MR) solutions. Adopters of Microsoft HoloLens 2 technology

and PTC's portfolio of mixed reality SaaS applications view these investments as a critical recruitment tactic for attracting the next generation of front-line workers and reducing onboarding time for new hires.

Discover Vuforia Studio and Vuforia Expert Capture for HoloLens 2

Vuforia Studio

Efficient, scalable AR authoring and publishing

Vuforia Studio is a flexible augmented reality (AR) solution that enables the authoring and publishing of immersive 3D training content, step-by-step instructions, and virtual product demonstration for use cases across the industrial enterprise. Customers can easily transform existing CAD and IoT data into detailed AR experiences that provide critical information to front-line workers when and where they need it most.

Vuforia Expert Capture

Knowledge capture and work instruction solution

Vuforia Expert Capture provides up-to-date information on how to successfully perform tasks when and where workers need it most directly in front of them as they are carrying out operations on the factory floor. This helps organizations create high-value augmented reality content that can be used for upskilling employees and training new hires while conserving company resources.

PTC and Microsoft are bringing mixed reality to your factory doorstep

Immersive, hands-free experiences on HoloLens 2 let workers visualize and interact with digital information like 3D overlays and real-time data to perform tasks more efficiently. And by deploying authoring software like Vuforia Studio and Vuforia Expert Capture on HoloLens 2 devices,

organizations can combine digital and physical worlds in profound ways to reduce servicing errors, improve first-time fix rates, lower overhead costs, and reduce the number of physical prototypes needed in initial training phases.

Increase worker productivity, improve employee retention, and reduce training costs with mixed reality

Create better content to streamline work procedures

Access content creation solutions to quickly create and deliver augmented and mixed reality (MR) content that transforms operations.

[LEARN MORE](#) →

Transfer knowledge seamlessly to your workforce

Empower frontline workers with augmented expert guidance so they can perform their jobs quickly, accurately, and safely.

[LEARN MORE](#) →

Reduce downtime and increase efficiency

Keep your field service agents heads up and hands free with critical information in their line of sight when and where they need it most.

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Create better content to streamline work procedures

Are you looking for ways to make employees more efficient, effective, and agile?

Manufacturing organizations are under pressure to improve productivity, efficiency, and agility to remain competitive. As products become more complex and the workforce less experienced, augmented and mixed reality solutions can help reduce

downtime from manufacturing changeover and maintenance errors. They can also offer a variety of use cases for other departments in your business, from sales to marketing and human resources.

Microsoft HoloLens 2 and Vuforia Studio

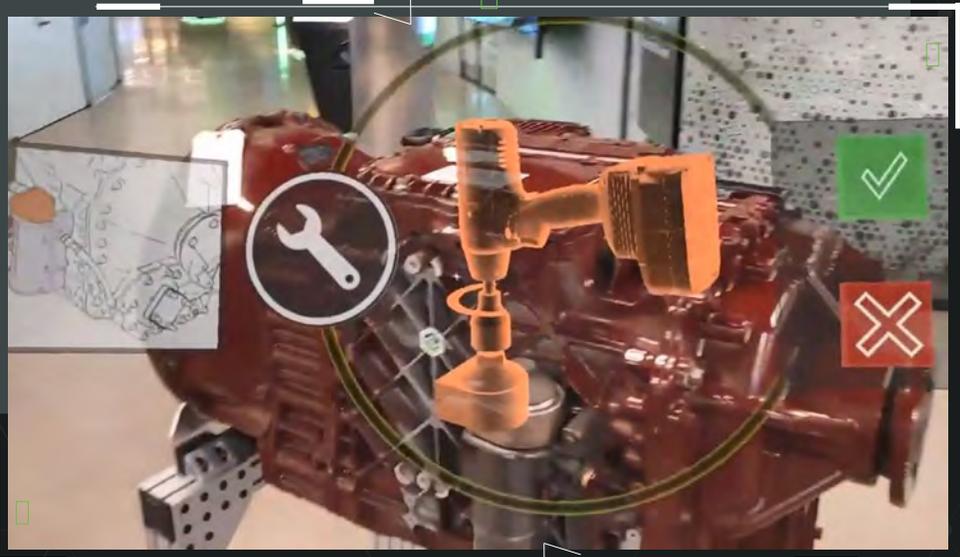
Organizations are unlocking new business opportunities and productivity with Vuforia Studio. Using this powerful “best of both worlds” content authoring environment with built-in support for gestures and voice commands, HoloLens 2 device customers can **efficiently** leverage their 3D CAD data to create immersive AR and MR experiences

with the added **flexibility** to customize and enhance experiences via JavaScript. The immersive AR experiences created with Vuforia Studio can be accessed and viewed across the enterprise with the Vuforia View app, which is free to download in [the HoloLens store](#).

Transform your business

Industrial customers can use the immersive “hands-free” experiences created with Vuforia Studio and HoloLens 2 for a variety of business-critical use cases:

- Sales and Marketing – Enhance sales efforts and drive product adoption with visual product companions and digitized showrooms.
- Manufacturing and Service – Empower technicians with hands-free work instructions for service, step-by-step assembly, or inspection.
- Human Resources and Training – Increase information retention using immersive, interactive experiences.



Case study: Volvo Group

Situation

Volvo Group is one of the world's foremost manufacturers of trucks, buses, construction equipment, and industrial engines. Employing about 100,000 people and operating production facilities in 18 countries, this global enterprise requires stringent supply chain optimization and an endless pursuit of operational efficiencies.

Challenge

Engine quality control and assurance in Volvo's manufacturing plants are subject to rigorous quality checks, a task reserved for Volvo's most experienced technicians. In one plant, each engine requires 40 checks, with 200 possible quality assurance (QA) variants; the checks must be completed at the QA station in only eight minutes. Training new operators on these complex inspection procedures takes five weeks, which adds to the overall cost of quality. The laborious process is paper based, not only creating extraneous cognitive load for the operators, but also requiring time and resources to update, print, and distribute QA materials regularly.

Result

Using the PTC **Vuforia** augmented reality experience, operators at Volvo could now quickly recall the most up-to-date configurations in 3D to ease the burden of sorting through stacks of paper, creating gains in productivity, quality control, and overall process efficiency. The AR solution is delivered using mixed reality, which overlays 3D data and QA details directly onto the physical engines, utilizing computer vision to track and anchor the content. In addition to removing the cost and risk of the paper-based approach, the solution also enables the QA technician to capture specific defects through the AR experience, which can be sent upstream to improve engineering and manufacturing processes.

Using Vuforia solutions, Volvo achieved the following results:

- 60% reduction in training time
- 1000s of Euros saved per station per year
- Recruitment attractiveness

Solution

Volvo chose to utilize PTC not only for its leading Vuforia enterprise **augmented reality** suite of capabilities, but also for its end-to-end solution for creating and scaling a digital thread.³ The ability to integrate product and manufacturing lifecycle solutions across the value chain was a key differentiator for PTC.

Transfer knowledge seamlessly to your workforce

How do you upskill and transfer knowledge from your most experienced workers to new hires?

We've noted how millions of jobs with manufacturing organizations cannot be filled due to a growing skills gap. And the rise of remote working has contributed to these challenges. Vuforia Expert Capture helps resolve this issue by delivering the expert knowledge of your most experienced

people to the rest of your workforce. Easy access to standardized, first-person view instructions greatly improves workforce productivity and reduces waste, re-work, and downtime – all while achieving high levels of workforce safety and compliance.

Microsoft HoloLens 2 and Vuforia Expert Capture

By using the Vuforia Expert Capture application on HoloLens 2 headsets, experts can capture first-person, step-by-step video and images of procedures as they perform them. The entire process is controlled by voice commands, gestures, and can include location-based steps to enhance the value of training. Once a procedure has been captured, it

is revised and enhanced before publishing, using a drag-and-drop, cloud-based application that produces automatically built templates. When an employee is ready to use the captured work instructions, they can access them through the universal Vuforia View application in 3D by wearing a HoloLens 2 device.

Modernize training and worker instructions

Faster time-to-value

Quickly create and share expert procedural guidance from start to finish, without the need for CAD data, pre-existing assets, or development efforts.

Easier expert content creation

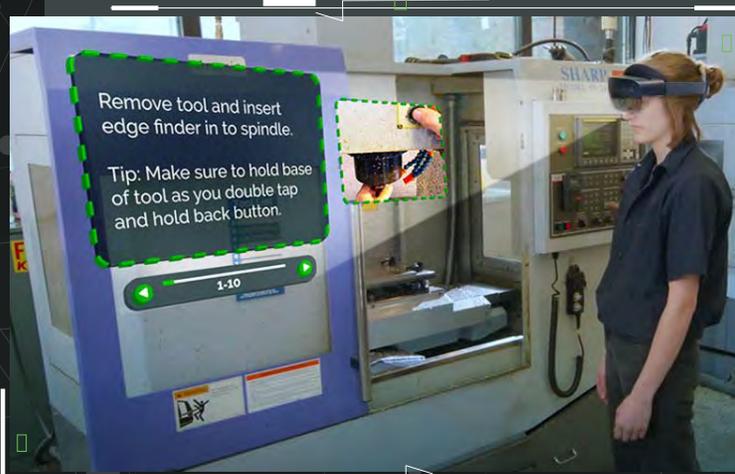
Subject matter experts can record step-by-step instructions hands-free while they work, making sure high-value expertise doesn't disappear upon retirement or job transitions.

Spatial location awareness

Improve accuracy, safety, and efficiency with HoloLens 2 by connecting each step of a procedure to specific locations and objects as required for task completion.

Edit, enhance, and deliver

Drag and drop your captured steps, additional content, and multiple procedures in the purpose-built procedure editor and keep it up to date dynamically for multiple formats.



Case study: A global pharmaceutical company

Situation

Pharmaceutical manufacturing is rapidly increasing in complexity. This requires more intricate procedures, more effective training, and more demand for knowledge retention from front-line workers. Lengthy standard operating procedures (SOPs) are a core part of training, but to the new digitally inclined workforce, they can seem redundant and difficult to follow.

Challenge

The need for effective training is further exacerbated by the fact that technical experts are in short supply. Experts are frequently pulled away from their core duties for new hire training and for troubleshooting. As part of an industry with a high turnover rate, improving operator training can materially impact factory productivity.

Two factors made the pharmaceutical company's processes more prone to operator error:

1. Difficulty locating and updating their thousands of SOPs in a timely fashion. (New workers are tasked with learning 250 SOPs before being allowed on the factory floor.)
2. Difficulty following paper-based SOPs for more intricate procedures like line clearance.

Results

- By using PTC Vuforia Expert Capture – an augmented work instruction and training solution – the pharmaceutical company is creating work aides to accompany SOPs.
- Improved work aides have streamlined worker training, reduced errors and operating costs, and improved productivity.
- The potential cost savings is estimated at \$27M per factory.

Solution

The company rolled out Vuforia Expert Capture deployed on HoloLens 2 to dramatically enhance SOPs. This gave them an easy way to extract knowledge from experts and deliver it in a digestible format to less experienced individuals. The non-expert operator can now perform the exact same steps quickly with the correct level of knowledge. Previously, the way they tried to transfer knowledge was not scalable; this solution filled that void.

Reduce downtime and increase efficiency

How are you keeping your workforce up to speed with complex technical maintenance and servicing tasks?

The Industry 4.0 era has come with several updated and newer versions of manufacturing machinery and equipment. This necessitates that manufacturers keep their workforce up to speed with increasingly complex technical maintenance

and servicing tasks, which can severely compromise their top-line productivity. That's why over 50% of Fortune 500 companies have purchased a HoloLens 2 device to revolutionize training with frontline workers.

HoloLens 2 and Vuforia Studio

Experiences created with Vuforia Studio for the Microsoft mixed reality headset empower your field service agents with critical documentation and service maintenance data while they stay heads up and hands free. With fully articulated hand tracking, workers can touch, grasp, and move holograms in ways that feel natural. This enhances learning

retention while boosting factory productivity and output in addition to lowering costs. Display all the important, relevant information, including real-time IoT data, directly into your technicians' lines of sight and make tasks far more efficient with actionable experiences.

Keep your business moving forward

How do you balance the need for quality with the need to ensure business continuity in a constantly changing world?

- 66% of manufacturers identify quality as a key metric for Industry 4.0 transformation.⁴
- 56% of manufacturers expect high remote worker rates to continue beyond the pandemic.⁵

As manufacturers bounce back from the recent pandemic, there is a significant opportunity to leave the hassles of the past behind and focus on new processes and models that can help organizations achieve more with less. Discover how mixed reality experiences on HoloLens 2 devices can transform your industry and move you ahead of the competition.



Case study: Howden

Situation

For over a century, Howden's global engineering business, which has over 6,000 employees in 26 countries, has focused on providing customers with industrial products and quality solutions that help multiple sectors improve their everyday processes – from mine ventilation and wastewater treatment to heating and cooling.

Challenge

Howden's equipment typically operates as process critical in their customer's environment and any unplanned downtime is very costly, yet for the most part these blowers are unmonitored. As a customer-focused organization with equipment installed in over 100 countries, Howden wanted to move from a reactive service approach to building a collaborative partnership with their customers that would improve after-market Long Term Service Agreements (LTSAs) and help them achieve success. To enable customers to optimize equipment performance and operational efficiencies, they needed to improve their service and maintenance processes by providing invaluable insight into their equipment in a visual and easily consumable way.

Result

Scalable mixed reality solutions from Microsoft and PTC allow Howden customers to prevent the challenges and costs associated with unplanned downtime and better align overall maintenance strategies which were previously based only on conjecture and after-the-fact analysis. These innovations ultimately save them a significant amount of time and associated costs. Plant operators, who are not experts on compressors, now have 160 years of compressor knowledge at their fingertips through the easily consumable mixed reality experiences on Microsoft HoloLens 2.

Solution

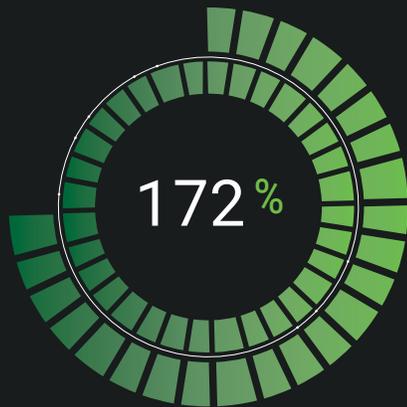
Howden knew that HoloLens 2 and mixed reality had huge potential for the company and that they wanted to use the immersive, hands-free capabilities to help customers easily visualize and understand this information. But they needed an affordable, scalable solution for creating MR content that incorporated IoT data and provided step-by-step instructions on how to solve problems.

They chose the PTC Vuforia Studio Augmented Reality solution to create immersive mixed reality experiences on HoloLens 2 devices. With Vuforia Studio, content creators can now leverage the richness of their existing 3D models and easily incorporate IoT data to deliver compelling augmented reality experiences that help improve efficiencies and enable safer, more productive workers.

How can augmented and mixed reality shape your business?

The combination of PTC and Microsoft products enables companies to grow top-line revenue, improve the bottom line, and gain a competitive advantage with scalable, secure digital transformation solutions.

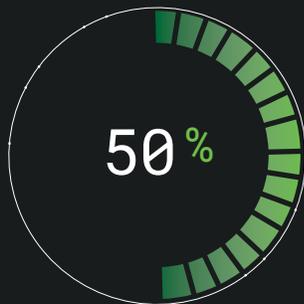
Companies deploying Vuforia Expert Capture and Vuforia Studio on mixed reality headsets like HoloLens 2 are uncovering newfound business value, including:⁶



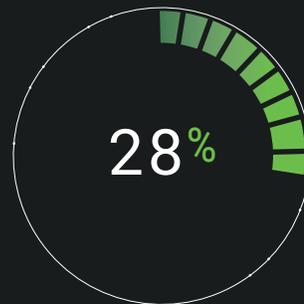
172% Return on investment



10% Less scrap and rework



50% Faster training times



28% Less unscheduled downtime

LEARN MORE ABOUT VUFORIA



¹ **Deloitte Study**

² **Forrester Research**

³ **PTC Report on Digital Threads**

⁴ **Readers Choice 2020: Quality 4.0: The 3 Most Important Technologies for Manufacturers**

⁵ **COVID-19's Impact On Manufacturers: Expect More Layoffs, But Also More Working From Home**

⁶ **Forrester Total Economic Impact**

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