Microsoft

hypothesis

Mixed Reality Intelligence

Manufacturing Edition

December 2020

Table of Contents

Microsoft   hypothesis

Learn More

To learn how mixed reality solutions can support and enhance your business, or to connect with a mixed reality specialist, please visit https://aka.ms/MixedRealityDesk.

Microsoft

hypothesis

Background

As companies across the world begin employing immersive technologies to drive efficiencies, Mixed Reality is poised to change the way businesses operate. Mixed Reality blends the digital and physical world by overlaying 3D digital objects onto the user's physical world, offering a way for users to interact organically using head-mounted devices (HMDs). Located at the center of the virtuality continuum, the capabilities of Mixed Reality render it uniquely positioned to transform the workplace as we know it.

Microsoft has been at the forefront of the immersive technology market and a trailblazer in Mixed Reality, innovating in both hardware and software to offer cross-platform Mixed Reality solutions. With the introduction of HoloLens, the first untethered Mixed Reality headset designed with business use cases in mind, Microsoft established itself as a leader in the Mixed Reality space and validated the enterprise value of this nascent industry by partnering with prominent entities in contracts worth up to half a billion dollars.

In October 2020, Microsoft and Hypothesis embarked on an initiative to hear from IT and Business Decision Makers across three countries with the goal of developing a deeper understanding of how Mixed Reality is being utilized across three key industries: manufacturing, retail, and healthcare. This paper deep dives into how manufacturing organizations are using and considering Mixed Reality technologies. While the primary data collected are quantitative, this report also illuminates customer stories that bring said data to life, providing a comprehensive picture of Mixed Reality use in the market today.

Furthermore, this report also aims to uncover the ways in which Mixed Reality may evolve in the future.

Microsoft   hypothesis

Methodology

Microsoft commissioned Hypothesis Group, an insights, design, and strategy agency, to execute the Mixed Reality Intelligence research.

The Mixed Reality Intelligence Research occurred in October 2020, when a 15-minute online survey was conducted with over 700 decision makers involved in mixed reality decisions at mid-market and enterprise companies from a range of manufacturing, healthcare, and retail companies across the US, Germany, and Japan.

In addition, the research deep dives into customer stories from interviews between Microsoft and mixed reality decision makers at enterprise companies around the world that use HoloLens 2.

Manufacturing Customer Stories

LOCKHEED MARTIN | AIRBUS | L'ORÉAL

Microsoft   hypothesis

Who We Talked To

BDMs & ITDMs
in Manufacturing
who work at mid-market or
enterprise-size companies
(500+ employees)

62%
**Familiar with
Mixed Reality**
*Self-stated &
Pass a knowledge test*

95%
**Have influence/
decision making power
on Mixed Reality
strategies**

84%
**in Mixed Reality
adoption or
evaluation**

87%
**Use or plan to use
HMDs for Mixed
Reality**

Final Audience

Microsoft   hypothesis
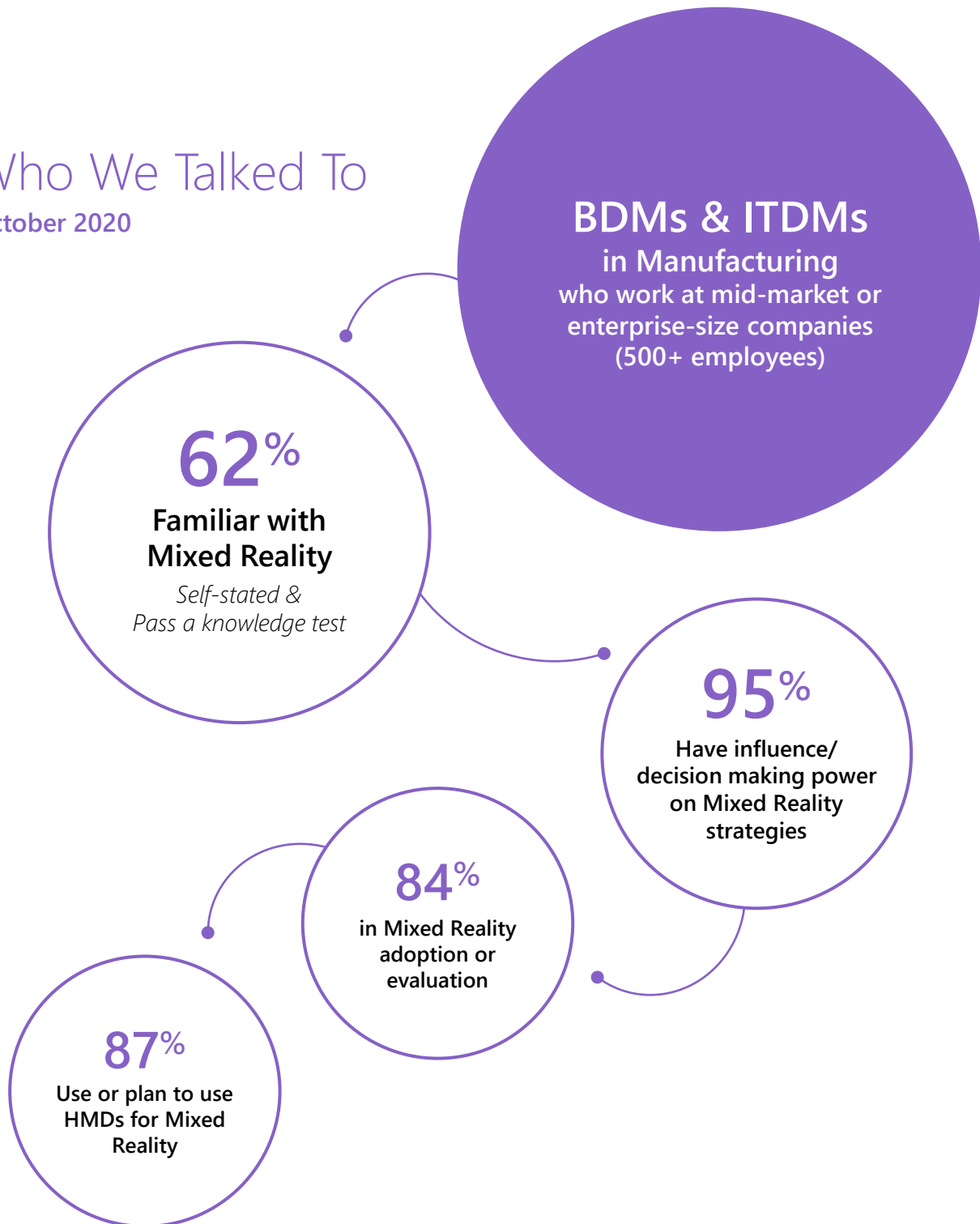
Things To Know About Mixed Reality

1   The majority of manufacturing organizations are currently using Mixed Reality solutions via HMDs and usage is projected to grow in the next 12-24 months. Mixed Reality is seen as a critical asset to organizations (97% agreement) among those who are currently using it or considering it for the near future.

2   Implementation issues like integration and deployment prevent current users from adding new solutions to their portfolios. For prospective users who are in the consideration stage, budget, timing, and lack of knowledge are the largest barriers to adoption.

3   Manufacturing organizations are currently utilizing Mixed Reality most for Task Guides & Task Management solutions, with Design & Prototyping trailing closely. Usage of Mixed Reality for Remote Assistance is lowest but projected to grow in the next year.

4   Over half of all manufacturing organizations expect a return of 30% or more on average from their investment in Mixed Reality across Task Guides & Task Management, Design & Prototyping, and Remote Assistance solutions. Customer success stories from Lockheed Martin, Airbus, and L'Oréal demonstrate how HoloLens 2 solutions meet and exceed these industry expectations.

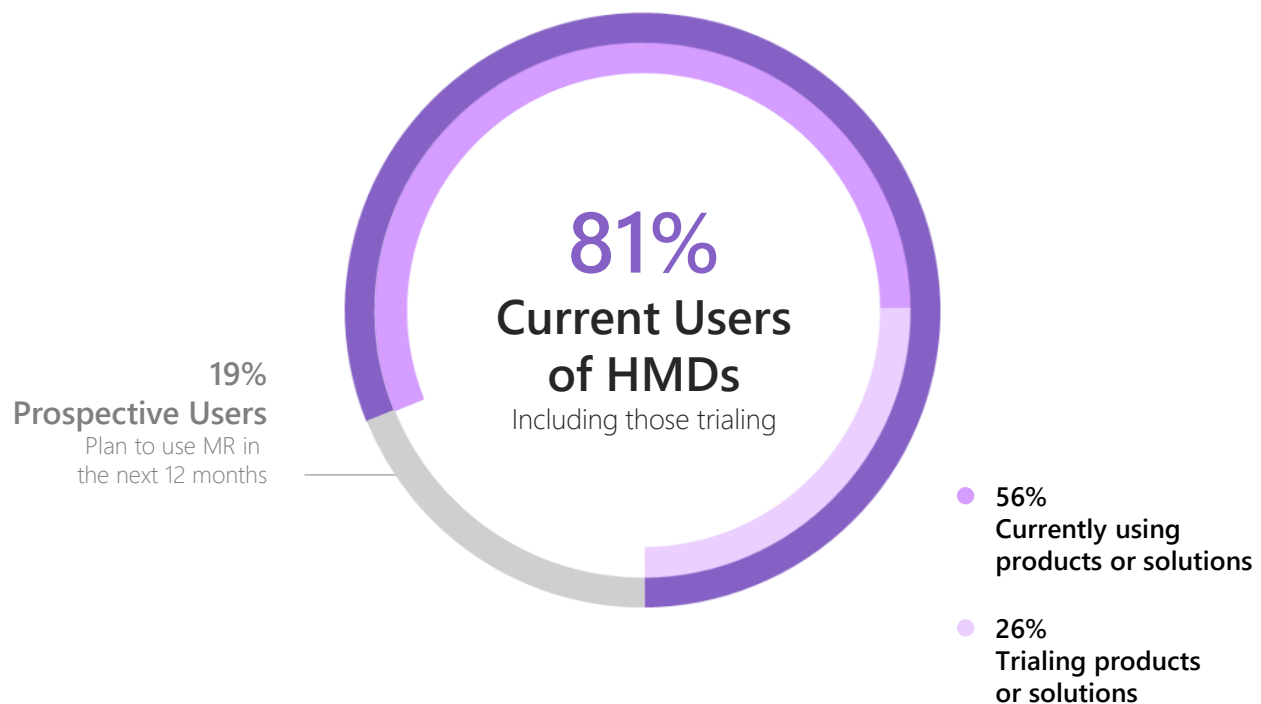Microsoft   hypothesis

Mixed Reality in
Manufacturing

The Big Picture

Given the nascency of Mixed Reality, Manufacturing organizations find themselves in various stages of implementation. Among those surveyed, north of 80% are currently using Mixed Reality products and solutions in some capacity, with more than half reporting that these technologies have already been integrated into their business models; among current users, only 1-in-4 remain in the trial stage. That said, even those in the former group are relatively new to Mixed Reality: 2-in-3 have been using the technology for less than two years. Of the countries examined, Mixed Reality usage is highest in Germany, where current users comprise 91% of organizations surveyed. This number is lowest in Japan, where only 72% of organizations fall into this category, and is equivalent to the overall mean (81%) in the United States. **(Exhibit 1)**

EXHIBIT 1. CURRENT VS. PROSPECTIVE USERS OF MIXED REALITY

81%
Current Users of HMDs
Including those trialing

19%
Prospective Users
Plan to use MR in the next 12 months

● **56%**
Currently using products or solutions

● **26%**
Trialing products or solutions
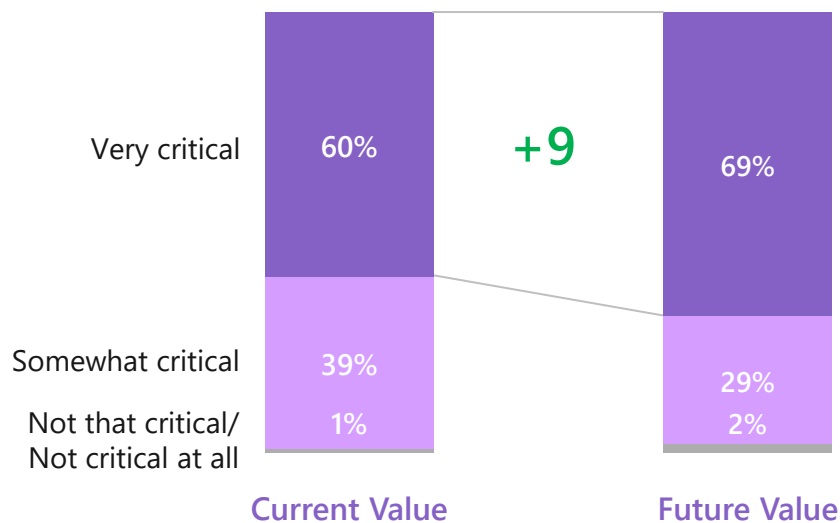
Microsoft   hypothesis

Across the board, current users agree that this emerging technology is critical to their success. Crucially, Mixed Reality is seen as a solution for both today and tomorrow: users are nine points more likely to describe the technology as very critical when assessing its future value as compared to the present. As a result, the majority of current users (65%) plan to increase their investment in Mixed Reality in the future, while the remainder expect to invest the same as they currently do; none of the organizations surveyed plan to invest less. **(Exhibit 2)**

With users committed to their investments and optimistic about the future, adoption and trial of Mixed Reality is expected to increase. "We are already seeing some improvements in productivity and we expect that will increase as we develop new processes," predicts an IT Decision Maker in discrete manufacturing. "This should be a net win for us." Looking toward the future, growth in HMD volume appears to be greatest among very large enterprises, who likely have more funds to invest in headsets. While companies of all sizes anticipate increasing the number of Mixed Reality HMDs utilized by more than 50% in the next 12 months, the largest organizations—that is, those with at least 5,000 employees—expect to more than double their HMD volume during the same time frame.

EXHIBIT 2. MIXED REALITY CURRENT VS. FUTURE VALUE

	Current Value	Future Value
Very critical	60%	69%
	+9	
Somewhat critical	39%	29%
Not that critical/ Not critical at all	1%	2%

Microsoft   hypothesis

Mixed Reality Barriers

Within Manufacturing, prospective and current Mixed Reality users cite distinct barriers to using the technology or using it more, respectively. For current users, implementation challenges are top of mind; the difficulty of integrating Mixed Reality with legacy systems and issues with timing and deployment are two of the most salient barriers for this group. Prospective users, on the other hand, identify budgetary and time constraints as their primary challenges. **(Exhibits 3 & 4)**

While the principal concerns of these two groups are quite distinct, similarities among other top barriers reveal that both current and prospective users would benefit from additional education and training on Mixed Reality. Participants cite a lack of knowledge about the technology as a top challenge, and additional barriers suggest that uncertainty around the implementation of Mixed Reality are also salient roadblocks for both groups. Knowledge and training barriers are particularly high among Japanese organizations, offering a possible explanation for their lower adoption rates as compared to Germany and the United States.

Furthermore, while German organizations likely face fewer barriers given their proclivity for Mixed Reality products and services, it should be noted that German users stand out in that they are most inhibited by security and liability concerns, neither of which surface as top barriers when data from the three countries are examined in tandem. **(Exhibits 3 & 4)**

EXHIBIT 3. BARRIERS TO USING MIXED REALITY <u>MORE</u> (TOP 5)

Top 5 Barriers For Current Users	
Too complex to integrate with legacy systems	28%
Still in the process of implementing current MR solutions	24%
Issues with timing and deployment	23%
Isn't a solution that meets our needs	21%
Don't know enough	20%

EXHIBIT 4. BARRIERS TO <u>CURRENTLY</u> USING MIXED REALITY (TOP 5)

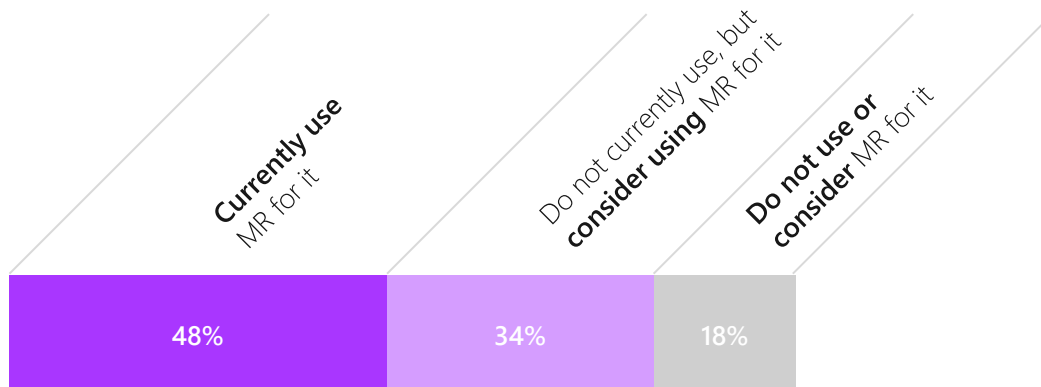| Top 5 Barriers For Prospective Users	
Don't have the budget	31%
Takes too long to implement	29%
Don't know enough	27%
Don't have enough deployment training	27%
Unsure about scalability in organization	27%

Microsoft   hypothesis

Task Guides and Task Management

Deep Dive into **LOCKHEED MARTIN**

Task Guides and Task Management represent a primary use case for Mixed Reality in Manufacturing, as headsets are able to virtually display critical resources like detailed guidelines, safety information, and lengthy documentation that an employee needs to complete complex manufacturing tasks. Nearly half of all manufacturing organizations currently use Mixed Reality for Task Guides and Task Management. **(Exhibit 5)**

Lockheed Martin is a company on the cutting edge of this trend. Lockheed Martin is utilizing HoloLens 2 for Task Guides and Task Management to build the Orion Spacecraft, the only spacecraft that can take humans into deep space. NASA contracted Lockheed Martin to oversee the manufacture and assembly of the spacecraft, which required finding workarounds to paper instructions or tablet screens that are cumbersome and prone to human error. Thus, Lockheed Martin is using HoloLens 2 to allow workers to collaborate remotely and help produce higher quality spacecrafts at lower costs, in less time. Voice commands guide workers through every step, with holographic instructions overlaid on relevant parts during assembly.

EXHIBIT 5. USAGE VS. CONSIDERATION OF MIXED REALITY FOR TASK GUIDES & TASK MANAGEMENT

Currently use MR for it	Do not currently use, but consider using MR for it	Do not use or consider MR for it
48%	34%	18%

Microsoft   hypothesis

Given the formidable challenge of balancing cost, production time, and quality when the stakes could—quite literally—be life or death, HoloLens 2 has allowed Lockheed Martin to elevate and prioritize all three of these factors simultaneously. While most organizations reduce human error by approximately 30% by using Mixed Reality for Task Guides and Task Management, Lockheed Martin has found even greater success in this endeavor: since first implementing HoloLens 2 in 2017, the company has experienced zero human errors or rework requests. This improvement is quite exceptional; building a spacecraft requires millions of tasks—each with zero room for error—and Microsoft's HoloLens 2 has allowed Lockheed Martin to bring this expectation to fruition.

> *"The fact that we haven't had any errors across all of these activities is phenomenal."*
>
> Shelley Peterson
> Principal Investigator for
> Augmented & Mixed Reality
> Lockheed Martin

USING HOLOLENS 2 FOR TASK GUIDES & TASK MANAGEMENT

Microsoft   hypothesis

Beyond this vast improvement in quality, Lockheed's integration of Mixed Reality for Task Guides and Task Management has had far-reaching implications for their bottom line. With respect to cost, Lockheed is now saving $38 per fastener--and this is no small savings when a single Orion spacecraft has over 57,000 of them. Vis à vis production time, HoloLens 2 has reduced touch labor by 90%; what was previously an 8-hour shift can now be completed in 45 minutes. While the majority of organizations prioritize increasing employee performance and reducing human error over accelerating task completion, Lockheed demonstrates that these outcomes are not mutually exclusive and in fact, can go hand in hand.

Of the organizations not currently using Mixed Reality for Task Guides and Task Management, a majority (65%) are considering implementing it in the future. As success stories like Lockheed Martin's continue to proliferate, adoption of Mixed Reality is poised to continue growing. That said, the research identified some international asymmetries: Japanese organizations are less likely to use Mixed Reality for Task Guides and Task Management (34% vs. 48% overall), reflecting the country's lower adoption rates more generally. Because knowledge and training barriers are particularly high in Japan, it is likely that increased education around the ROI of Mixed Reality for Task Guides and Task Management could increase interest in this market.

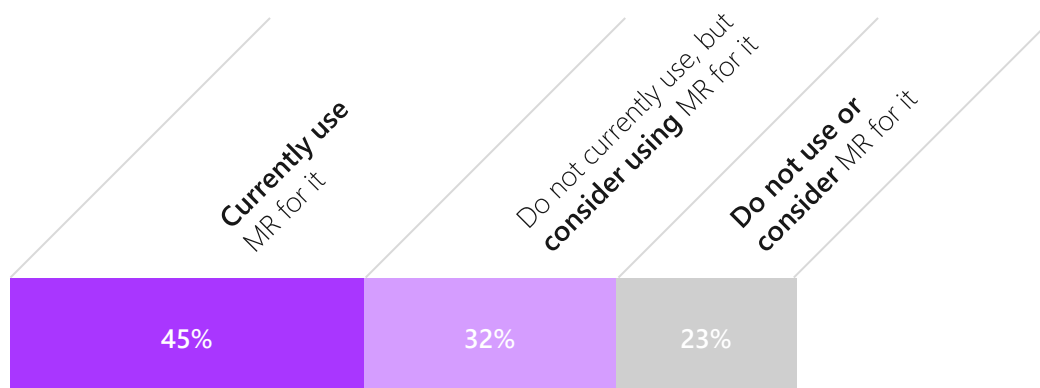

LOCKHEED MARTIN'S ORION SPACECRAFT

Microsoft   hypothesis

Design and Prototyping

Deep Dive into **AIRBUS**

Like Task Guides and Task Management, Design and Prototyping represents a key Mixed Reality use case within Manufacturing. In Mixed Reality, 2D design modeling files are converted to high quality 3D digital replications that employees can interact and interfere with via motion control. This allows teams to quickly iterate and collaborate on new product designs and assess whether their designs are fit for industrialization. Similar to Task Guides and Task Management, almost half of all manufacturing organizations currently use Mixed Reality for Design and Prototyping. **(Exhibit 6)**

Airbus is a company leading the way here by leveraging HoloLens 2 for Design and Prototyping solutions to meet their ambitious production goals. Airbus built 10,000 aircrafts in its first 40 years and aims to build 20,000 more in the next 20. To do this, the company needs to deploy cutting-edge tools and technologies to accelerate production and find new ways of working. Airbus is using Microsoft Azure Mixed Reality and services like Azure Spatial Anchors and Azure Remote Rendering with HoloLens 2 to expedite aircraft design, and manufacture, facilitate collaboration, and change how complex ideas are communicated.

EXHIBIT 6. USAGE VS. CONSIDERATION OF MIXED REALITY FOR DESIGN & PROTOTYPING

Currently use MR for it
Do not currently use, but consider using MR for it
Do not use or consider MR for it

| 45% | 32% | 23% |

Microsoft   hypothesis

Like Lockheed Martin, Airbus was among the first major manufacturing organizations to identify the potential for Mixed Reality to increase production speed while simultaneously prioritizing quality and safety, and has been partnering with Microsoft on this front since 2015. Jean-Brice Dumont, Executive Vice President of Engineering at Airbus, explains that "[Airbus's] challenge in the coming years is to manufacture more aircrafts faster, and for that we need to enable our workers to be much better equipped and to be much more effective in what they do." Microsoft Mixed Reality technology, he believes, is the solution that meets the moment.

"Mixed Reality can help us to increase quality, safety, and security. The level of human error is significantly reduced, and in aerospace, increased quality is increased safety – and needless to say, security goes with that."

Jean-Brice Dumont
Executive Vice President of Engineering
Airbus Defense and Space

Microsoft   hypothesis

Among organizations currently using Mixed Reality for Design and Prototyping, more than 3-in-5 report an ROI of 30%+. For Airbus, these returns have been particularly salient: with HoloLens 2 solutions helping Airbus designers virtually test their designs to see if they are ready for manufacture, the company has seen the process accelerate by 80%. Beyond these already-measurable improvements, Airbus expects to increase efficiencies of complex tasks during assembly by 30% while simultaneously increasing quality, safety and security. They have already identified more than 300 use cases for Mixed Reality in an effort to utilize this technology to its full capacity.

Of the organizations not currently using Mixed Reality for Design and Prototyping, slightly more than half (58%) are considering implementing it in the future. In considering whether to implement Mixed Reality for Design and Prototyping, organizations are primarily concerned with accelerating project innovation and design validation. As success stories like Airbus's continue to circulate throughout the industry, the potential for Mixed Reality to support these ROI expectations will become increasingly clear.
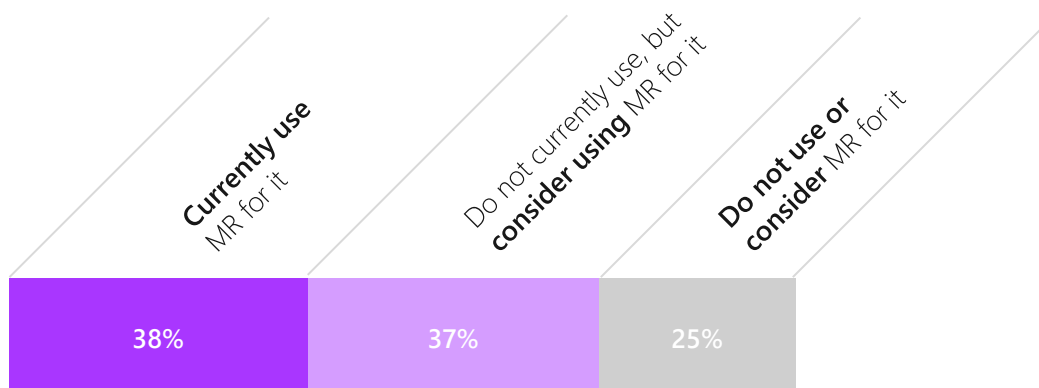

AIRBUS FLEET

Microsoft   hypothesis

Remote Assistance

Deep Dive into L'ORÉAL

Beyond facilitating and streamlining on-site tasks, the Manufacturing industry has begun employing Mixed Reality to allow employees to be two places at once. Remote Assistance implemented via Mixed Reality connects remote employees to collaborate with each other by streaming real time, 3D videos of what they are working on. Experts anywhere in the world can conduct routine inspections and audits, deploy new equipment, or assist first line workers in new and critical tasks as needed, without having to physically travel to sites. Remote Assistance remains the least prevalent use case of Mixed Reality examined here; still, 3-in-4 organizations surveyed are either current or prospective users. **(Exhibit 7)**

In a prime illustration of this capability, L'Oréal is tapping into Dynamics 365 Remote Assist via HoloLens 2 to connect remote experts to field technicians from various locations. When a part breaks down on a machine, new equipment must be installed or an audit must be carried out; however, it is not always easy to explain the process simply by phone, and bringing experts on site requires time and resources. L'Oréal is now able to benefit from the expertise of those who are not on site to carry out these operations in an efficient, cost-effective way.

EXHIBIT 7. USAGE VS. CONSIDERATION OF MIXED REALITY FOR REMOTE ASSISTANCE

Currently use MR for it	Do not currently use, but consider using MR for it	Do not use or consider MR for it
38%	37%	25%

Microsoft   hypothesis

> ❝
>
> *"Thanks to this solution, we optimize inter-site communication, we share best practices more easily, and above all we benefit from the expertise of the best."*
>
> Guillaume Duverger
> Manufacturing Excellence Project Engineer
> L'Oréal

It is unsurprising that L'Oréal is leading the march for this under-utilized Mixed Reality application: the company has been quick to embrace immersive technologies as a bridge to the future and has been investing heavily in them since 2012. As with other Mixed Reality use cases, Remote Assistance is proving to be a worthy investment. Manufacturing organizations that currently use Mixed Reality for Remote Assistance estimate an average improvement of 31% in accelerating issue diagnosis and resolution, and L'Oréal boasts even greater success at 50% improvement in this respect.


USING HOLOLENS 2 FOR REMOTE ASSISTANCE

Microsoft   hypothesis

For L'Oréal, time is everything, and the ability of Remote Assistance to transmit knowledge through space and time with the same precision as on-site assistance has proven to be an incredible asset. "Saving time at L'Oréal is very important," explains Christian Georges, Manufacturing Excellence Director at L'Oréal. "We can now easily debug a situation and bring more comfort to our employees." The attested capability of Remote Assistance to both expedite inspections/audits and accelerate issue diagnosis/resolution is key, as these benefits represent the two most desirable outcomes according to organizations surveyed.

Furthermore, Remote Assistance has benefits that extend beyond time savings and convenience. Less travel means less employee fatigue and reduced CO_2 emissions, and inter-site communication can be optimized to share best practices more easily and connect to the best experts. L'Oréal has also seen improvements in employee performance and morale, as well as their ability to meet production deadlines.

While Remote Assistance is the most under-utilized application of Mixed Reality of the three examined in this report, differences across the three national markets suggest that the lower utilization numbers may be driven, in part, by Japanese organizations. That is, Japanese manufacturers are less likely than the group as a whole to currently use Mixed Reality for Remote Assistance (28% vs. 38% overall).
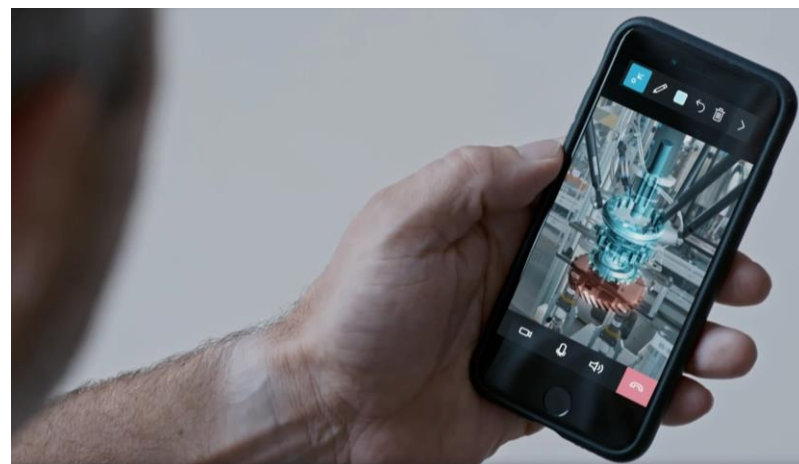
MICROSOFT MIXED REALITY AT L'ORÉAL

Microsoft   hypothesis

Final Thoughts

As immersive technologies continue to transform reality as we know it, Mixed Reality has emerged not as a VR-light but as a business tool in its own right. With its unique ability to blend the real and the digital, Mixed Reality offers solutions that are as diverse as they are innovative, boasting use cases ranging from connecting remote experts with onsite technicians to enhanced assembly procedures. Ideas that felt like science fiction just a decade ago are now quite literally at our fingertips, and bold companies must think creatively about how they can use Mixed Reality to differentiate themselves in an increasingly competitive digital marketplace.

Across markets and industries, the benefits of implementing Mixed Reality technologies are vast, and three major themes emerge. First, by integrating digital elements into real spaces, Mixed Reality reduces the constraints imposed by toggling between our physical environments and our screens. Second, Mixed Reality solutions offer distinctive advantages for education--be it corporate or academic--by allowing students and trainees to develop hands-on experience performing tasks that could be detrimental or costly if executed by novices in a real-world context. Finally, Mixed Reality allows us to do something that was previously unthinkable: be two places at once. Infinitely more sophisticated than video calling, Mixed Reality technologies can transport individuals who are miles apart into the same digital space, allowing them to interact with their surroundings and with one another as if the space between them had all but vanished. Particularly in the context of a global pandemic, this ability to emulate togetherness feels indispensable.

Microsoft   hypothesis

Detailed Research Objectives & Audience Recruit

The objectives of the research included:

1. Understand the current Mixed Reality landscape including adoption, challenges, and outcomes

2. Explore current Mixed Reality projects, including how Mixed Reality is being used within key industries and customer stories

3. Quantify ROI expectations of decision-makers and demonstrate how ROI is realized through customer stories

4. Uncover the ways in which Mixed Reality may evolve in the future

To meet the screening criteria, Mixed Reality professionals needed to be:

A business decision maker or IT decision maker at their company

Employed full-time at a mid-market or enterprise-level company (500 employees or more)

Ages 25-64

Familiar with Mixed Reality

Involved in decision making for Mixed Reality technologies

Adopting or evaluating Mixed Reality technologies

Work in Manufacturing, Healthcare, or Retail industries

Of the 241 manufacturing Mixed Reality professionals interviewed for the research wave in October 2020:

100 Mixed Reality Professionals were interviewed in the US

70 Mixed Reality Professionals were interviewed in Germany

71 Mixed Reality Professionals were interviewed in Japan

Note: Research was conducted during the global COVID-19 pandemic, which was at varying stages of escalation/containment

Microsoft   hypothesis