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Mixed Reality Improves Speed, Quality, And Throughput While Reducing Costs For Manufacturers

Manufacturers stand to gain significant benefits from mixed reality applications. Manufacturing organizations are experiencing significant challenges in the face of the COVID-19 pandemic, including complex operation requirements and high costs; high uptime and throughput requirements; increasing employee safety; and training and experience standards. To improve the quality and throughput of work, reduce downtime and operation costs, ensure business continuity, increase inspection frequency, and provide a safer environment for employees, manufacturers should investigate mixed reality applications.

Microsoft HoloLens 2 is an untethered, self-contained holographic headset that allows users to leverage enterprise-ready mixed reality (MR) applications while working "heads up" and "hands free." Microsoft boasts a vast ecosystem of applications and services in addition to solutions from third-party partners that enable industry-specific use cases. Manufacturers in any sector can use Remote Assist to conduct routine inspections and audits, set up and deploy new equipment, address break/fix issues faster and with less labor, and train new workers.

To better understand the benefits, costs, and risks associated with Microsoft mixed reality using HoloLens 2, Microsoft commissioned Forrester Consulting to interview 23 decision-makers from 21 organizations that are customers of Microsoft HoloLens 2 and conduct a Total Economic Impact™ (TEI) study.[1]

This abstract will focus on the manufacturing industry's use of Microsoft's HoloLens 2 to leverage mixed reality applications, as well as its value to their organizations.

CHALLENGES

Understanding the drivers and objectives for mixed reality solutions investments is crucial in evaluating their financial and qualitative impact on a business. Manufacturers' challenges fell under four categories: deployment of equipment/materials, break/fix occurrences, inspection of facilities, and training. Decision-makers within manufacturing investigated how Microsoft HoloLens 2 could solve key challenges, including:

- Firms struggled with some inconsistent or poor service quality, hindering customer experience (CX).

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- Travel restrictions due to the pandemic prevented or increased risks of travel for crucial deployments, inspections, and repairs.
- Field workers had limited knowledge, which caused excess repeat trips, the need to send multiple technicians, and occasionally, the need to send high-cost experts.
- Avoidable errors caused expensive downtime and delays, costing anywhere from thousands to millions of dollars in lost sales, wasted labor, and direct costs.
- Training field employees was cost-prohibitive due to travel costs and time.
- High staffing turnover and shortages hindered the ability, speed, and cost of hiring and training enough workers to meet demand.
- Firms struggled with expensive fabrication and transportation of models for sales and design phases.

> **"Taking the time to set down and pick up instructions isn't adequate. To help, people need to see what you're doing, and that only works if it's from a device on your eyes. Setting down a phone with video isn't enough to see what you're doing, and your hand or angles can block the view."**
>
> *Training and technical services director, life sciences manufacturing*

OPPORTUNITIES

Microsoft HoloLens 2 empowers a variety of use cases for manufacturers. Experts may remotely instruct onsite technicians through installation of new equipment at plants and collaborate with experts as needed, avoiding travel costs and accelerating deployment speed. Experts may also remotely oversee inspections led by onsite technicians, reducing the number of expert technicians needed onsite and improving compliance through recorded sessions. Lastly, remote experts may guide onsite technicians and workers to quickly resolve complex, critical, and disruptive issues, reducing issue resolution from weeks to days or days to hours. Decision-makers investigated Microsoft HoloLens 2 to seize new opportunities, including:

- Reduce the number of people needing to travel.
- Enable remote inspections.
- Enable remote servicing.
- Provide heads-up, hands-free instructions to improve worker speed, quality, and safety.
- Empower workers with self-guided learning.
- Minimize back-and-forth in highly regulated sites like clean rooms or on ladders.
- Build and sell support models including custom mixed reality apps and HoloLens 2 devices.
- Demonstrate offerings in 3D to customers to accelerate sales.

OBJECTIVES

Decision-makers hoped to achieve the following goals as they investigated Microsoft HoloLens 2, including:

- Ensure continuity, especially during the pandemic, and protect health and safety.
- Accelerate training, reduce training costs, and avoid travel costs.
- Improve learning and knowledge retention.
- Accelerate task completion and increase capacity.
- Improve quality of work and minimize downtime.
- Improve first-time fix rates and reduce errors and rework.

- Accelerate production, deployments, and service.
- Reduce demand and stress on leaders and experts and improve EX.
- Improve CX, increase sales, reduce operating costs, and increase profit margins.
- Enable innovation and strengthen brand image.

SOLUTION CRITERIA

After identifying challenges and opportunities, decision-makers evaluated many different technology categories and ultimately selected Microsoft HoloLens 2 devices, based on the following criteria:

- **Heads-up, hands-free work and collaboration with robust capabilities and dependability.** Mixed reality enabled use cases typically possible with AR and VR while providing significant additional value at their intersection. HoloLens 2 enabled accurate real-world overlay of 3D assets, instructions, and collaborative markup while leaving workers free to see their surroundings and use both hands — providing a vast array of use cases with the trustworthiness, safety, and efficiency workers needed.
- **Simplicity to embed within Microsoft's ecosystem including Azure, Intune, Active Directory, Dynamics 365, Office, and Teams.** Decision-makers selected HoloLens 2 to accelerate time-to-value and reduce operational overhead with established ecosystems of Microsoft services, avoiding major customization, coding, or investment in other new tools.
- **Robust partner ecosystem of independent software vendors (ISVs) and systems integrators (SIs), many with highly specialized industry expertise and offerings.** The large and growing selection of ISV applications and SI expertise for mixed reality on HoloLens 2 enabled customers to accomplish a vast array of industry-specific use cases while lowering risk, accelerating deployment, and reducing costs.

Voice Of The Customer

"We saw HoloLens as a game-changing technology that had an ecosystem built around it to go places. We took a leap of faith with Microsoft and very quickly confirmed it was the right decision."

IT X-Reality leader, automotive manufacturer

"Mixed reality is the middle ground between virtual reality and augmented reality. You are sufficiently immersed to clearly see and interact with digital models and data, but not so immersed that you cannot do your work in the field. The transparent nature of the device allows you to continue doing your work while also having a relatively realistic experience of the data, information, or models."

Product line general manager, industrial manufacturer

"The mixed reality solutions from Microsoft are really great. … I'm very happy with it. It was so convincing to get it running with a very lean production and really have a chance to improve processes. And there's no drawback I see with HoloLens. I'm very convinced of this technology, just like our company is."

Digital transformation leader, electrical manufacturer

"The HoloLens device design is great. It doesn't require cables [or] backpack, and doesn't get hot at points of skin contact. You don't get motion sickness with these displays, and it has the best capabilities around."

Digital transformation leader, electrical manufacturer

- **Breadth and growth of mixed reality platform capabilities.** The availability and continuing advancement of application and Microsoft Azure capabilities for mixed reality allowed decision-makers to accomplish today's use cases while providing flexibility for those in the future using the same underlying technology.
- **Availability of specialized devices such as HoloLens 2 Industrial Edition and hard-hat integration options.** Decision-makers enabled more valuable scenarios by using mixed reality in clean rooms or at hazardous sites while meeting necessary safety and emissions requirements.
- **Successful proofs of concept (POCs).** Decision-makers ran small POCs for mixed reality applications and HoloLens 2 to test the concept and gain buy-in from key stakeholders with fast results.
- **Market recognition and growth of HoloLens 2.** Decision-makers viewed HoloLens 2 as category leader in extended reality given its significant market adoption and growth, which minimized concerns of risk.

> **If you don't invest in [mixed reality] innovation today … you would be far behind. We never know when there might be a point of change like touchscreens. At first, no one could use them and didn't want them. But suddenly, everyone switched and companies that didn't invest got left behind."**
>
> *X-Reality innovation leader, robotics manufacturer*

KEY BENEFITS FOR MANUFACTURING

Through the adoption of HoloLens 2 devices, the interviewed decision-makers at manufacturing organizations were able to address organizational challenges that had previously impacted safety, efficiency, operational cost, and business growth. Empowered by the robust capabilities of HoloLens 2, mixed reality services, and partner applications, organizations achieved multiple benefits, including:

Training efficiency. Mixed reality increased training efficiency, saving trainee labor while improving knowledge acquisition and retention.

- **Manufacturers reduced training time by 75%, at an average savings of $30 per labor hour.** Manufacturing firms must offer expansive training programs to teach skills and processes that are typically specific to their offerings. These tasks are highly standardized processes with preexisting 2D instructions and models, enabling faster deployment of mixed reality training across a broader slate of tasks than for most industries.
- **A life sciences manufacturer slashed one-on-one training costs while improving learning.** The training and technical services director shared, "A major part of how we end up paying for mixed reality technology is by stopping the high-cost, high-expense training and replacing it with more effective, immersive technology."

Field task worker productivity. Mixed reality improved field task efficiency and reduced rework, saving field task worker labor.

- **Manufacturers improved efficiency of certain fieldwork tasks by 60% and reduced follow-up visits by 75%, saving $49 per hour.** Site visits, product deployments, inspections, maintenance, and repairs can all be assisted by instructions, visualization, and remote collaboration. Field technicians, engineers, or support staff typically support both customer- or company-owned sites within a particular region — boosting efficiency and quality of work increases their capacity for work and improves customer outcomes. ROI was particularly high for complex, expensive products.
- **A life sciences manufacturer slashed support costs by 30%, doubled customer response**

speed, and improved mean time to repair (MTTR) by 20% for field service calls. Remote support and MR instructions dubbed "electronic mentors" improve quality of work and first-contact resolution, as well as significantly reduce cost and demand for experts. The organization used Microsoft Dynamics 365 Remote Assist and Guides to support the effort and is in the process of scaling up mixed reality support, aiming to cover all of its 20,000 annual service calls.

> **"We have less boots on the ground but the same impact."**
>
> *Innovation portfolio manager, automotive manufacturing*

Task worker productivity. Mixed reality increased task efficiency and reduced rework for onsite task workers.

- **Manufacturers improved efficiency by 75% for 15% of onsite tasks and reduced rework by 50%, saving $30 per hour.** The complexity of workers' jobs in manufacturing continues to rise, as do the stakes and expectations. Mixed reality provided customers with detailed, accurate, and easily understood instructions and support to maximize ROI on high-value work.
- **An aerospace manufacturer slashed task time by more than 90% with instructions, visualization, and real-time data from sensors and IoT devices.** The X-Reality principal investigator shared: "Using mixed reality, we've cut task time by about 90%. We reduced activities with two to three technicians working two to three days down to one technician in 2.5 hours. A separate eight-shift activity can be completed in about 6 hours. We've taken other 8-hour activities down to about 45 minutes. Overall, we're bringing times down significantly by 91% to 93%."

Leader productivity. Mixed reality recaptured leaders' time for training, instruction, project coordination, planning, and customer enablement, driving significant labor costs per leader.

- **Manufacturers improved leader productivity by 30% for training, project planning, and design workloads, saving $43 per hour.** Manufacturing leaders reduced training effort, shortened project planning and design, minimized errors and delays, and reduced downtime with MR. Augmented leadership roles include plant, production, field service, and technical project managers.
- **An electrical manufacturer streamlined leader workflows while boosting sales and reducing costs and labor.** Leaders used mixed reality visualization to gain customer buy-in, optimize plans to ensure deployment success, and shorten sales cycles. Self-guided training and instructions reduced active instruction time for leaders, and remote collaboration boosted efficiency when their insight was needed. Mixed reality further prevented errors and reduced customer-impacting issues, preventing leaders from spending time rectifying problems.

Specialized expert productivity. Mixed reality increased expert work efficiency and prevented major work trips, saving annual labor costs per specialized expert.

- **Manufacturers reduced 156 annual hours of training and task work per expert; they also prevented 75% of monthly trips with 90% of labor per trip avoided, saving $92 per hour.** A significant portion of manufacturing expert workloads are addressable with MR. Further, travel is a particularly large portion of their jobs; however, it can often be easily avoided with better task worker training, instructions, and remote guidance only when needed.

- **An automotive manufacturer saved expert time and costs with remote support of field staff.** The IT X-Reality leader shared: "With [Remote Assist on] HoloLens, we can extend our eyes and environment to someone who isn't there. We can show the expert the exact area with a problem and the screens they need to see, instead of just describing it."

OPERATIONAL COST SAVINGS

Reduced average expert and leader consumables for design, testing, and demonstration by **10%**

Reduced average trainee consumables by **80%**

Reduced average annual PPE costs by **50%**

Operational cost savings. Mixed reality minimized consumables usage for instruction and training, materials costs for design, testing, and enablement, and personal prot ective equipment (PPE) usage. MR also trimmed total business operating costs through better processes, quality, and maintenance.

- **Manufacturers derived dependable consumables and operating cost savings with MR investments.** Companies reduced: 1) average consumables by 80%, saving $1,000 per trainee; 2) average consumables for design, testing, and demonstration by 10%, saving $15,000 per expert and leader; 3) average annual PPE costs by 50%, saving $134 per employee; and 4) total operating costs by 0.14%.
- **A manufacturing company in the power sector reduced rework waste by 90%, avoided expensive delays and issues, and cut expert trips by 10% — driving a per-device payback period of only 4.9 months.** The company found significant savings by accelerating work and preventing and mitigating issues. It avoided materials waste and wasted labor (or overtime) during production stoppages, premium and rush freight to make up for delays, and noncompliance costs and warranty claims caused by issues, errors, or delays.

Travel and incidentals savings. Mixed reality reduced annual travel and incidentals costs for specialized experts and field task workers.

- **Manufacturers saved an average of $3,500 per avoided expert trip and $50 per avoided field worker trip.** Expert travel for manufacturers was excessively expensive (ranging between $1,000 to $7,000 per trip) for several reasons: Trips were often booked at the last minute to address major issues; trips were often to far-flung international sites or remote locales; and experts typically flew first class given their seniority and the wearing nature of these frequent major trips.
- **All manufacturers significantly reduced travel costs with mixed reality instructions and remote assistance.** The electrical manufacturer avoided between two and 15 visits per site per week. Each session now requires 30 to 60 minutes, whereas it used to cost at least three days of labor at €600 to €800 per day and as much as €6,000 in travel costs. Similarly, the automotive manufacturer avoided at least three days of labor and an average of €5,000 in travel costs per issue. Even when experts are based at the same site, the aerospace manufacturer found significant time savings by not having to wait for the expert to be free, get to the production line, and suit up for clean rooms.

> **"HoloLens with Remote Assist is a no-brainer. We want to buy two for every plant. They pay for themselves in no time at all, and then it's all benefits from there. It pays for itself in just travel costs alone."**
>
> *Innovation product director, power manufacturer*

Business growth. Business units leveraging mixed reality increased annual revenue.

- **Manufacturers increased revenue by up to 5% with mixed reality.** MR boosted sales by increasing throughput and reducing downtime for manufacturers. MR accelerated customer deployments and enhanced support, boosting CX and therefore retention and enrichment. MR also strengthened brand image to recruit prospects and assisted salespeople in closing deals. Firms also generated new revenue streams by offering and packaging new MR-enabled services.
- **Manufacturers increased throughput and capacity, driving increased sales and accelerating time-to-revenue.** Firms avoided 240 to 320 hours of average lost throughput per year by using mixed reality to improve training, reduce errors, and solve issues more quickly. Field staff also recaptured their efficiency savings to complete more customer deployments and service appointments per worker.

TOTAL ECONOMIC IMPACT RESULTS

Forrester aggregated customer data into a single industry-agnostic composite organization with a representative financial analysis.

Composite description. The composite organization is a global for-profit business based in North America that sells complex services and supports customers globally. It earns at least $1 billion in total revenue per year and employs more than 5,000 FTEs globally.

Deployment characteristics. A team of nine technologists deploys 105 Microsoft HoloLens 2 with apps for instruction, visualization, and remote collaboration over a one-year period. These devices are used regularly by 200 users and are leveraged to train up to 1,000 additional general workers per year.

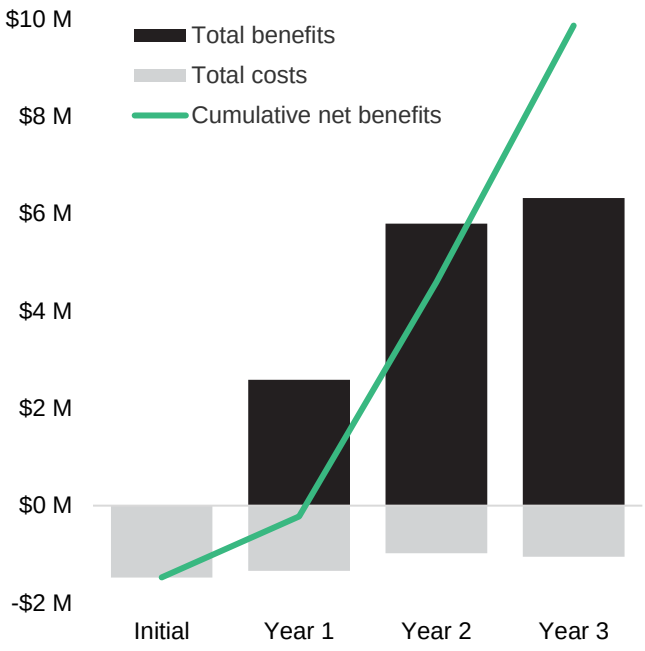
ROI
177%

NPV
$7.6M

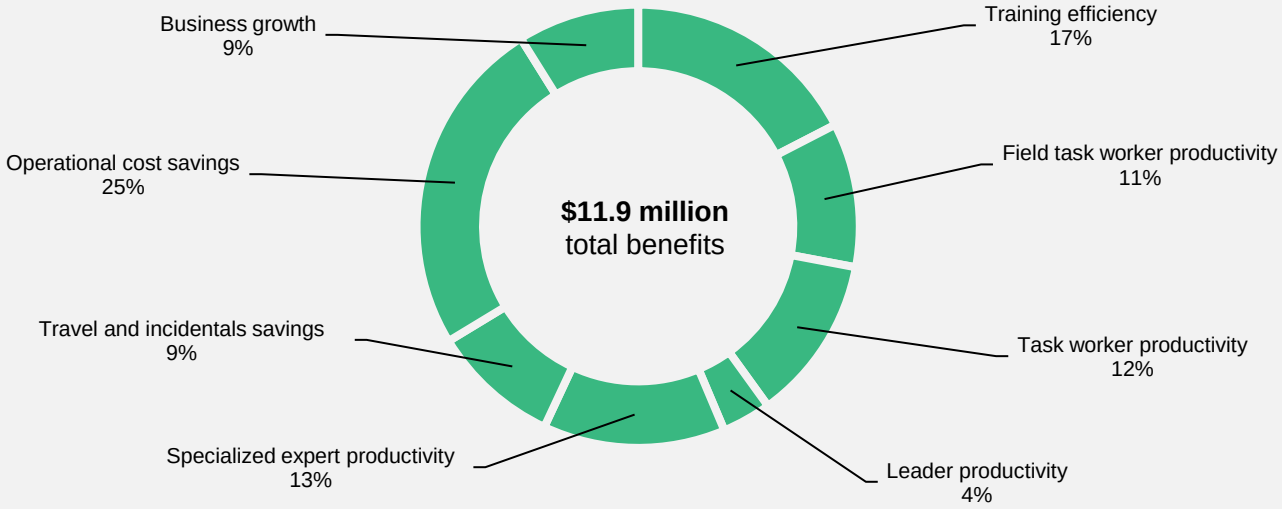
PAYBACK
13 months

Results. Forrester's risk-adjusted financial analysis for a composite organization shows a three-year ROI of 177%, an NPV of $7.6 million, and a payback period of 13 months with $11.9 million in total benefits versus $4.3 million in total costs.

Three-Year, Risk-Adjusted Cash Flows



Three-Year, Risk-Adjusted Total Benefits, By Category



MORE INFORMATION ABOUT THE TEI STUDY

For more information, download the full study conducted by Forrester Consulting on behalf of Microsoft: "The Total Economic Impact™ Of Mixed Reality Using Microsoft HoloLens 2," November 2021.

DATA COLLECTION FOR THE TEI STUDY

Forrester interviewed 23 decision-makers from 21 organizations representing diverse roles, industries, and regions that have deployed a range of mixed reality applications via Microsoft HoloLens 2 devices:

- Off-the-shelf applications from Microsoft, including Dynamics 365 Remote Assist and Guides.
- Off-the-shelf applications offered by partner independent software vendors.
- Custom-built or highly-customized applications built by partner systems integrators.
- Custom-built applications by internal teams.

Forrester also interviewed leaders from 13 ISVs and eight SIs that offer mixed reality solutions for HoloLens 2, along with Microsoft stakeholders representing HoloLens 2, Azure, and Dynamics 365. Forrester enhanced and validated the analysis using analyst expertise, Forrester research, third-party research, and public market data.

Data Demographics

Interviews conducted by Forrester:

- Interviews with 23 decision-makers from 21 organizations using Microsoft HoloLens 2
- Interviews with 13 leaders from mixed reality ISVs and eight leaders from mixed reality SIs

Primary industries:

- Manufacturing
- Architecture, engineering, and construction
- Healthcare
- Education

Organization sizes:
Enterprises with between $500 million and $100 billion in annual revenue

Regions:
Organizations with global operations based in North America, Europe, and Asia

Mixed reality deployment size:
Deployments ranged from five to 400 Microsoft HoloLens 1 and 2 devices, with between 10 and 3,000 mixed reality users

[1] Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.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