

Getting Started with Industrial Augmented Reality Solutions

Practical Guidance for AR Project Planning, Execution, and Success

Augmented reality (AR) is helping industrial enterprises upskill workers by replacing traditional training and guidance materials with more effective, immersive experiences. Organizations around the world—and particularly those with operations spanning multiple geographies—are quickly becoming smarter, faster, and leaner using AR.

IDC estimates that companies will spend \$19.2 billion on hardware, software, and services relating to AR in 2019¹.

Implementing an AR solution requires proper planning, including identifying the technology that will best fit your needs, as well as how it will be adapted into existing process, workflows, and systems. Relative to other operational technology innovations, AR has a much faster time-to-value that can be achieved with little programming expertise depending on the solution. But like any industrial technology, AR must be implemented properly for successful adoption. From proof of concepts and functional pilots, to fully-deployed, scalable solutions, this white paper details the critical steps that will guide AR project owners through getting started with industrial AR and achieving the fastest possible ROI.

Step One:

Identify the Business Case

Organizations that have already implemented AR are seeing measurable ROI in several areas of their business, including training, manufacturing, service, and sales and marketing. Growing numbers of retiring workers and inefficient and costly to maintain training materials and service documentation are common challenges that can hamper workforce efficiency. Offering capabilities such as remote over-the-shoulder guidance, virtual demonstrations that provide full-scale product visualization, and step-by-step procedural guidance or instructions, AR can solve these challenges, along with many others—when correctly implemented.

To better understand where AR can provide the greatest value to your business, you first need to determine your biggest pain points.

1. IDC. How Augmented Reality Drives Real-World Gains in Services, Training, Sales and Marketing, and Manufacturing

Common Pain Points	Likely Symptoms	How AR can help
<p><i>Shortage of qualified workers: Experts are retiring, turnover rates are high, headcount is decreased, and recruiting is difficult.</i></p>	<ul style="list-style-type: none"> • Expertise is difficult to maintain and utilize with no steady flow of workers to fill open jobs • High money and time-cost to recruiting and upskilling new workers, with slow ROI • Difficulty meeting customer expectations and SLAs • Frequent disruptions in production to train new workers 	<p>AR can narrow the skills gap by improving knowledge transfer and accelerating ramp up times for new workers.</p> <p>AR over-the-shoulder remote expert guidance can improve mobility and increase job satisfaction for aging workers, while helping companies retain waning tribal knowledge.</p> <p>Companies using AR have greater agility to keep pace with customer demands and shifting priorities.</p>
<p><i>Poor training and communication methods</i></p>	<ul style="list-style-type: none"> • Training and service materials are time-intensive to produce and maintain • High maintenance and distribution costs for printed technical documentation • Workers only have access to inaccurate and difficult to understand service information • New workers are harder to attract • Increased safety concerns with new employees 	<p>AR provides workers with a more effective way to experience technical product information for training, maintenance, and service purposes.</p> <p>Companies that onboard using AR technology can quickly upskill inexperienced or seasonal workers by improving collaboration with skilled experts.</p> <p>As a result, companies using AR can more effectively recruit and retain new workers that are accustomed to learning with the assistance of digital technology.</p>
<p><i>Increasingly complex products</i></p>	<ul style="list-style-type: none"> • Products are expensive and difficult to physically demonstrate at events and showrooms • Lengthy sales cycles due to custom configurations for built-to-order products • High product shipping costs with global customer base • Limited ability to pursue additional sales opportunities 	<p>Digital product demonstrations make it easier and more cost-effective for manufacturers to preview and demonstrate large, heavy, and complex built-to-order products.</p> <p>Prospective customers can use AR experiences to view interactive digital product demonstrations at full scale, in any location or environment.</p> <p>Manufacturers can accelerate sales cycles with AR, allowing them to increase revenue and customer satisfaction.</p>

If any of these challenges are familiar to you, implementing AR at your organization may be easier than you think. Identifying the best pilot business case along with key KPIs that you can use to prove ROI—such as reduced training time, better first-time fix rates, or increased customer satisfaction—is the first step to understanding how AR fits into your business strategy. Select one high impact use case and set a tangible goal, like reducing year-over-year unplanned downtime by 25%. Establishing goals will help you level-set expectations, while positioning AR as a transformative solution that addresses your specific business challenge.

Step Two:

Communicate and Collaborate to Maximize Success

Successful AR solutions have one thing in common; they deliver the right content to the right users in ways that save time and improve results. Working with subject matter experts who are well-versed in your content is a great way to ensure you're building an effective AR solution. As your AR pilot project unfolds, you should take a collaborative approach to implementation, quality control, process development, and project evaluation. Having a trusted team who understands your AR goals will help you to identify and overcome potential obstacles, while providing additional project support. It's therefore important to get the right people involved early and often, including an executive sponsor that can secure resources and shield the project from shifting priorities and stakeholders.

Identify frontline users and content contributors

With any business-facing AR experience, project owners should get input from across the organization, including both end users and subject experts. Frontline users might consist of maintenance engineers, service technicians, operators, or trainees—these are the team members who will help test and validate the usefulness of content in the early-stages of projects. Meanwhile, subject matter experts will have backgrounds in process engineering, documentation, training, innovation, product development, R&D, or IT—these individuals will have deep institutional knowledge and expertise to help create and refine curriculum.

Contributors need to understand their role and what tasks they need to complete, have strict deadlines to keep things on track, and give feedback when appropriate. Listen to your internal resources, as well as external partners or consultants, as they can offer valuable insights into the process or workflow you are trying to improve with AR.

"To maximize the power of Augmented Reality, organizations need to bring actual practitioners in at every stage of the implementation process."

- Tom Paquin, Research Analyst, Aberdeen Market Intelligence Company

When communicating benefits to users, position your AR project as a change program. This may earn you some volunteers who can reveal what really matters to users and provide greater insights into the value of AR for your organization.

Getting buy-in from sponsors

Project owners should also be prepared to educate key decision makers on the value of AR solutions. A simple but effective demo that showcases the benefits of your pilot can quickly generate interest and create enthusiasm, especially if it creates value for other departments and stakeholders. Be fully transparent about investment costs and returns, to ensure proper funding and sponsorship that will drive the first phase of implementation. These early first steps can influence your company's larger digital transformation journey, so proceed accordingly.

"Identify a strong champion for innovation. Innovation leadership is important. Always moving forward, a hundred people will say why you can't, keep showing them you can."

-Chad Crandell, Sr. Director, Augmented Reality CoE

Step Three:

Start Small with Short-Term Wins

According to research from IDC, an industry-leading research company, the number-one reason that businesses use AR is to increase manufacturing efficiency by helping workers perform their jobs more effectively³. To do that, AR experiences need to be simple, straightforward, and helpful to the end user. Iterating with a test audience can help you fine-tune any parts of the experience that are confusing or unclear. Experiment frequently and build momentum by taking a phased approach that generates quick visible wins.

Building the minimum viable product

When authoring that first AR experience for training or instructional purposes, it's important to keep your goals simple and direct. Focus on solving a clear and measurable problem, such as reducing product assembly time, or identifying and replacing a part that's causing a machine to repeatedly fail. Smaller goals like these are easier to test, measure, and refine to get the results you want, which will help your organization be successful when it develops future AR projects with increasing complexity.

“Find something simple that will deliver real business value and impact. Start with a basic product that only has a few parts.”

-Lance Cummins-Brown, Global Learning and Development Director, AGCO Grain and Protein

Be careful to avoid any embellishments that distract users from the primary purpose and benefit of the experience. Only include graphics, features, sounds, instructions, or animations that are essential to completing the task at hand. Simple, easily authored experiences result in faster time-to-value and simplified use for workers (especially important when those workers are in hazardous environments).

Collaboration-driven AR applications

In addition to the target user and author of the AR content, consider if the experience itself could benefit from being directly collaborative. Certain AR applications enable shared-view experiences, which allows pairs of users to work collaboratively. In the context of maintenance, repair, and overhaul, technicians who are lacking product knowledge or work experience can use AR to get visual guidance and over-the-shoulder support from a more knowledgeable remote expert.

When using AR for augmented guidance, you should proactively identify the expert, or team of experts, that has extensive knowledge of how to service the product or machine in question, and understand how this new type of support solution will impact their availability. Consider these experts part of your core AR team and make sure they understand what is expected of them in their new role, since they will be key contributors who are critical to success.

Identifying the right hardware

You also need to think about how users will access and navigate your AR experience—including hardware. Wearable headsets like the Microsoft HoloLens 2 provide an immersive hands-free experience, but may not really be necessary for a simple pilot program (depending on the work environment). On the other hand, tablets and mobile devices offer a more affordable and accessible option for workers, but may not be as effective if the environment requires on hands-free work. Making the right hardware decisions before creating AR content will minimize unnecessary development cycles on platforms that may be inappropriate for the use case or operating environment.

Once you've identified the business challenge your AR program will solve, you'll have a better idea of the hardware you will need to provide to your fleet of workers. Lower cost AR viewing devices can bring back a higher ROI and are easier to distribute across a global organization. To create successful experiences that your company can quickly and easily scale, it's important to keep everything from your hardware to the experience itself simple and goal-oriented. Because pilots often influence full-scale deployments, you should factor in long-term requirements when examining hardware and software compatibility.

3. IDC. How Augmented Reality Drives Real-World Gains in Services, Training, Sales and Marketing, and Manufacturing

Step Four:

Gather AR Knowledge

Sharing online AR trainings and tutorials with your team members can accelerate your use case definition, ideation, and experience development. You can also build up internal AR expertise with face-to-face classroom style training or remote virtual trainings. PTC has many of these resources available, including free online Vuforia Studio training paths, an online help community, and multiple tutorials and sample projects that are free and accessible to anyone.

AR solution providers that have experience with enterprise transformation will know exactly where and how AR can reduce costs, increase productivity, and improve training and skill adoption for new and existing workers. Read their blogs, watch their videos, and talk to their experts to understand how their solutions align with your business needs. When needed, technology providers such as PTC have dedicated customer success teams that can provide additional guidance and support.

Find and form strategic partnerships

Successfully implementing industrial AR at the enterprise level requires a mix of hardware, software, and services. For holistic out-of-the-box solutions with fast time to value, look for AR suppliers that have strong, well-established strategic partnerships with industry-leading technology companies.

For example, the partnership of PTC and Microsoft combines Vuforia's low-code AR authoring software with built-in support for Microsoft HoloLens and HoloLens 2, in addition to the Microsoft Azure IoT cloud platform—offering a complete end-to-end enterprise AR solution.

Choosing the right partners can also help you fill gaps in expertise and get in-depth guidance. Beyond AR pilots, consider how potential partners fit into your business strategy and future digital transformation plans as a whole.

Arm yourself with success stories

Knowing what makes other companies' AR programs successful can better prepare you to run a winning AR pilot in your own organization. Electric-hybrid bus manufacturer BAE Systems uses guided step-by-step work instructions created with Vuforia Studio to help line workers reduce [battery cell assembly time](#) by 50%. Industrial equipment manufacturer GSI uses Vuforia-powered AR experiences to reduce training time for large complex product installations by 60%, in addition to [resolving service issues faster](#) and more effectively. And Howden, a manufacturer of oil and gas handling equipment, is using [IoT-driven mixed reality](#) to prevent unplanned downtime by enabling customers to self-service products. Read [case studies](#) such as these to understand the before and after states for companies that have implemented AR and learn how they overcame any roadblocks.

“With Vuforia Studio we can provide customers with [virtual] products that have yet to be manufactured without having to send a unit to location, but still have to-scale examples that you can walk around and see the information.”

-Sandra Humphrey, Sr. Application Architect IV, [Fujitsu](#)

Step Five:

Prioritize the User Experience

User experience (UX) is paramount for AR inside and outside of the industrial setting. In addition to helping workers complete tasks more efficiently, the AR user experience should be intuitive, instructional, and easily reproducible. AR UX will vary depending on the use case and who the target user is, but it's important to design experiences that reflect user intent, and to involve them early and often in the testing and development phases.

Development courses from [PTC University](#) and AR style guides from leading tech companies like Microsoft, Apple, and Google can give you a head start with proven UX designs that accelerate time-to-value.

Considering the hardware impact on experience

Designing an AR experience for a wearable headset, mobile device, or tablet can change what it looks like and how simple it is to use, as well as how accessible it is to people within your organization. The human brain accesses eighty to ninety percent of the information it gets through vision⁴. Augmented reality, assisted reality, mixed reality, and virtual reality are vision based and immersive, so consider the user's field of view needs to ensure an optimal experience. Each device has differences in cost, usability, product roadmap, and ubiquity, all of which are factors that could impede or drive progress of implementation at your company.

For a successful AR experience that saves your organization time and costs, you should have a solid understanding of how and when the target user will access it, as well as what kind of tasks they will perform during the experience. The hardware and content authoring software you use should be compatible, so you can leverage any unique device features and capabilities, such as voice command and eye tracking. AR content creation solutions like Vuforia Studio and Vuforia Engine support a wide array of operating system and device options, providing more flexibility with regards to hardware choices.

Implement a user-centric design

With the frontline user in mind, your AR experience should clearly convey what you want them to do and precisely how you want them to do it. Invest the time up-front to properly document your use case with detailed story boards, and iterate based on the feedback you receive from testing the experience with your target user community.

“Consider the end-user experience first. Keep it simple; keep it clean; keep it relevant.”

-Michael Campbell, EVP, Augmented Reality Products, PTC

Make content the focus of your AR projects

If you leverage the right people with the right expertise, then creating the right AR content will come naturally. Utilize your most knowledgeable subject matter experts as content authors—look at your process engineering, technical documentation, training, product development, and R&D teams to start. Pairing these product and workflow experts with low-code AR authoring tools reduces the need to hire programmers and provides a faster time to value.

AR solutions like Vuforia Studio enable organizations to leverage existing CAD, 2D and 3D models, and engineering data, so content authors don't have to start from scratch when creating a new experience. If the intention for your AR pilot is to visualize the digital twin of a physical product, then think about the product information you will need to create that experience and where in your organization you can find it. Product designs and their corresponding AR experiences will evolve over time, so consider incorporating any foreseeable product updates into today's experience.

If your organization has implemented IoT solutions that can connect and monitor equipment status and performance data, it's worth regarding that data as a potential AR content resource—particularly if the data is easily accessible through an industrial IoT solution like PTC ThingWorx. If that data is accessible and can help a user navigate equipment to better perform assembly, operations, or maintenance tasks—then you should strongly consider its impact in a subsequent production solution, if not the pilot itself.

4. Why Every Organization Needs an Augmented Reality Strategy. Michael E. Porter and James E. Heppelmann. <https://hbr.org/2017/11/a-managers-guide-to-augmented-reality>

Step Six: Measure the Results

Once you've done the legwork and completed the planning and development stages for your AR program, it's time to deploy it and start measuring results—as soon as possible. Gathering a pre-AR baseline with the key metrics you've identified will help you connect your results to immediate business value and allow you to better track progress over time.

Companies with AR success stories all have one thing in common: quantifiable results. Follow their footsteps and set short term checkpoints to prove you're continually making progress. This can boost morale for your team and stakeholders while holding critics at bay.

Share success with stakeholders

Publicizing the positive results you've had by sharing progress with others in your organization is often the most rewarding part of getting started with AR. Quantifiable results that prove value are impossible to argue with, so share them frequently with sponsors and stakeholders. Use KPIs that demonstrate clear value for any high-visibility updates and as a launching pad to talk to executives. When it's time to scale, they will be the ones to evangelize your AR program to the rest of the company.

“Before you get building, measure your current state; produce metrics before the project, so you can build an ROI case.”

-Mark Sage, Executive Director, AR for Enterprise Alliance (AREA)

Get Started Now

Today's AR solutions are affordable to implement and scale, but new technology and innovative ways of doing things can sometimes be met with opposition. If you build your AR pilot with the above guidelines in mind, you will be well-equipped to turn skeptics into believers, while saving significant time and costs for your organization.

Companies like yours are already testing AR to drive digital transformation. If your workforce is challenged by high turnover, expert worker scarcity, error prone processes, or competitive advantage, it's time to get started with AR now.

PTC Success Resources

If you're interested in getting started with augmented reality for the enterprise, learn how you can rapidly author and publish scalable AR content with [Vuforia Studio](#), quickly and easily create AR procedural guidance in-situ with [Vuforia Expert Capture](#), or see how [Vuforia Chalk](#) can help you scale up your expertise today.

You can also learn how to author engaging AR experiences with the [Vuforia Studio Author learning path](#) at PTC University.

Want to take the next step towards ensuring success? PTC's [Success Management program](#) can provide you with the dedicated support you need to get the most out of your investments, including access to training, subject matter experts, and innovative services that drive greater business results.