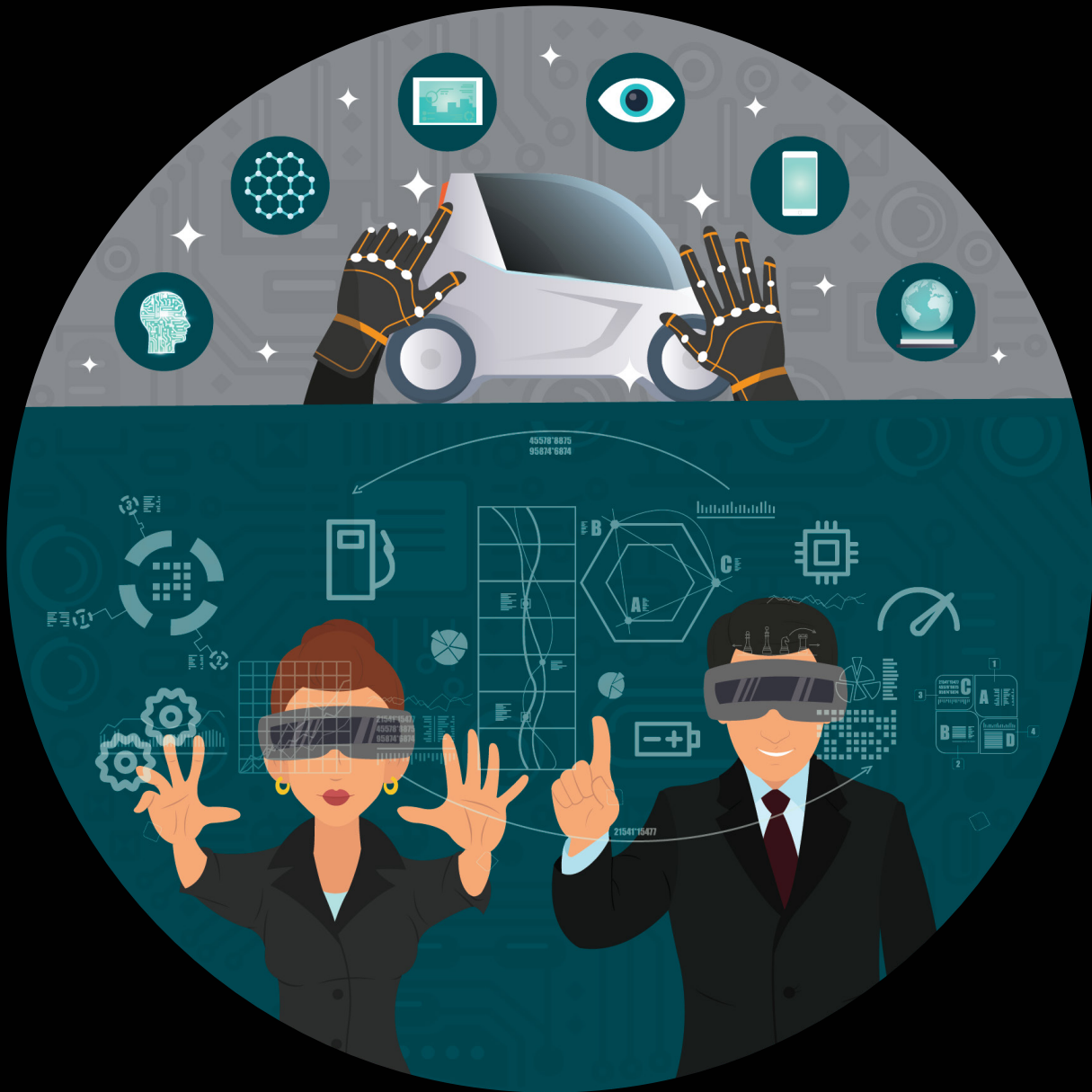


# Deloitte.



## Utilizing virtual reality to drive supply chain innovation

A series exploring Industry 4.0 technologies and their potential impact for enabling digital supply networks in manufacturing.

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## **Do you need virtual reality in your supply chain?**

Virtual reality can improve supply chain operations in four main areas: product and process design, data and process visualization, employee collaboration, and experience-based learning.

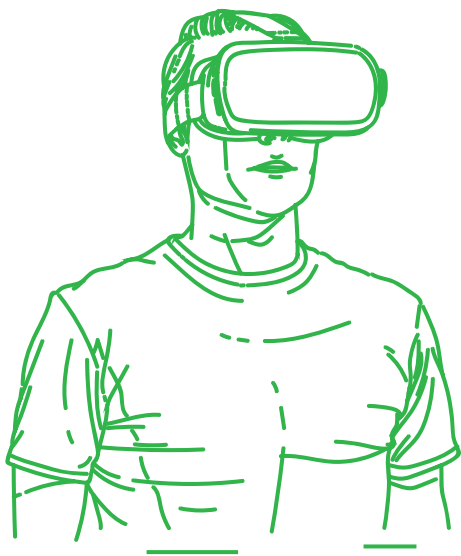
**Of interest because:** Companies with complex product development processes and a need for global collaboration are starting to pilot the technology. Hardware and software capabilities have improved greatly over the last few years, leading to easier adoption.

**Could improve your supply chain by:** Increasing design productivity; increasing proficiency; improving data visualization and supply chain planning; expanding workforce collaboration.

**Why not?** VR technology is still rapidly evolving and has not reached operational maturity or seen implementation at enterprise scale. Companies can face difficult development and adoption hurdles.

**Deloitte recommends:** Begin with small pilots to test and validate applications that could have immediate benefit and scalability.

# What is virtual reality?



## Overview

Virtual reality (VR) is an artificial, computer-generated, three-dimensional environment that a user can experience through sensory stimuli.<sup>1</sup> The user is able to interact with the environment in a seemingly real or physical way through specialized electronic equipment, including goggles, simple head-mounted displays, and 3-D images. The most cited use cases today are entertainment and gaming, but there are also significant enterprise applications. From an enterprise perspective, VR is being leveraged for product and process design, virtual collaboration, and experience-based learning.

## Recent developments and outlook

Virtual reality (VR) technology has evolved tremendously since its inception in the late 1950s.<sup>2</sup> The last five years, in particular, have seen an incredible uptick in both capabilities and use of VR devices; they have shifted from niche devices primarily for hard-core gamers to devices with more widespread adoption and applications for both consumers and enterprises. Forrester predicts that the adoption of mid- to high-end VR headsets will be 52.3 million by 2020, increasing substantially from today's market of approximately 11 million.<sup>3</sup>

The advancement of mobile computing power is eliminating the need to connect the headset to a centralized, powerful computer unit, making the application more mobile and affordable. Newer features also include "inside-out tracking" technology, which tracks the position of objects through a camera inside the VR headset. Barriers to mainstream adoption remain in the areas of computational power, pricing, security, and user perception. Today's hardware, however, has already solved some of the fundamental problems that plagued earlier generations of VR: the Oculus Rift, for instance, offers 1.3 million times the computing power at one-fiftieth the cost. In addition, it combines this performance with less than 20 milliseconds' latency, which is critical to mitigating nausea effects.<sup>3</sup>

Many large companies are pouring money into both hardware and software development, and it is only a matter of time before more barriers continue to fall and the full enterprise capabilities are realized. Traditional PCs and smartphones will continue to provide competition as they take on increased capabilities around augmented and mixed reality. However, as VR applications continue to expand and prices continuously decrease, the VR market alone could reach up to \$48.5 billion by 2025.<sup>4</sup>

### Virtual reality in the supply chain

Deloitte predicts that VR has the greatest potential to impact supply chains in four areas: product and process design, data and process visualization, employee collaboration, and experience-based learning. Global teams can streamline process and product design through immersive VR applications by collaborating simultaneously, irrespective of physical location. Using VR to design a factory line, for instance, engineers can both collaborate on design and learn how to operate in the new environment. At the same time, studying how workers and robots interact

within the virtual environment can give better insight on how to optimize the factory line. Leveraging 3D capabilities for visualizing complex data sets in new ways will have an impact on supply chain planning functions, as companies will use novel tools to process customer data. Finally, immersive virtual environments are providing a useful tool throughout operations for coaching decision-making best practices and learning procedures through low-risk trial and error. Research has already shown that learning with the help of VR technology can increase information retaining rates.<sup>5</sup>

### Overview

Value drivers	<ul style="list-style-type: none"> <li>• Increased productivity and efficiency</li> <li>• Improved data visualization</li> <li>• Enhanced product and process design</li> <li>• Ability to separate presence from physical location</li> <li>• Greater employee collaboration and communication</li> <li>• Improved employee training effectiveness</li> </ul>
Scope	Enhance design and communication across the supply chain
Technology substitutes	Smartphones, tablets, PCs, augmented/mixed reality devices

### Five key developments in virtual reality



Improvements in hardware and electronics performance



Reduced equipment costs (hardware and software)



Parallel advancements in augmented and mixed reality devices



Development of "inside-out" tracking systems



Digitization of development

# Benefits of virtual reality in the supply chain

## Virtual reality value drivers

### Primary potential benefits



## Value drivers for virtual reality

Virtual reality has evolved significantly in the last five years due to technology innovations such as the development of low-cost, high-quality mobile components and electronics, improvements in frame-rates, and the ability to synchronize the human processing system with the virtual one. Given these significant improvements, supply chain organizations should move to test the applicability of VR in specific areas. Deloitte believes that the successful adoption of VR in the supply chain depends on the alignment of technology value drivers with a company's use cases, operational needs, and organizational readiness, not just a broad-based approach built on the current popularity of the topic.

A primary value driver for organizations is VR's interactive visualization capability. Companies are starting to leverage the technology within their design organizations to enhance CAD functionality and engineer employee engagement. The VR-enhanced designs allow for visualization capabilities previously unavailable; this allows product engineers, architects, and designers to rapidly shift through multiple designs and evaluate them on the spot. Automotive OEMs and large construction firms are partnering with design software companies and VR hardware manufacturers to create these immersive experiences. Creating virtual prototypes is delaying—and in some cases, minimizing—the need for physical prototyping and costly early-stage experimentation, ultimately reducing costs for these organizations.

In addition, a second truly unique attribute is the ability to separate presence from physical location. Utilizing VR's audio and video capabilities with different field of view points, workers can collaborate with other colleagues around a shared visualization or interact through virtual avatars. Access to a platform is achieved in various parts of the world instantly, leading to enhanced virtual collaboration through real-time simulations and immersive "games." These interactions not only drive down costs, but also give manufacturers and suppliers further insight earlier in product and process development, especially important across distributed supply networks. The efficiency gains across the supply chain are evident.

### Secondary potential benefits

- Encourage unique problem-solving perspectives with improved visualization
- Reduce company travel expenses through increasingly engaging virtual meetings
- Collect better customer data to improve responsiveness of the supply chain
- Improve employee engagement through new, immersive technology
- Improve product quality through improved early-stage designs

The data capture and visualization capabilities of VR are transforming the supply chain from product development all the way to the end customer. Leveraging interactive 3D data visualization not possible on 2D screens will assist with complex decision making and help companies see the interdependencies and impact of certain decisions on operations. Using VR devices to facilitate analysis and rapid decision making will address serious pain points within and across organizations.

Finally, VR's ability to create *high-fidelity virtual environments* will have a great impact on human resources within supply chain organizations. Many industries, including industrial products and services, energy, and manufacturing, have difficulty preparing employees for high-risk environments. VR can help employees quickly make the best decisions possible in safety-critical environments: developing the ability, for example, to identify, prioritize, and analyze situational variables indicating an oil well is about to enter a dangerous condition or that a machine is about to fail. In many of these industries, an aging and retiring workforce has created a looming experience gap that will likely create risk in these rare situations and operations. With virtual reality, companies can simulate these high-risk scenarios, giving new workers real-life experiences that create significant value in reducing risk in the supply chain.

### Case study

A large logistics organization was looking to reduce logistical and operational costs (travel, housing, lost time, etc.) associated with a centralized learning facility where employees are sent to train on equipment maintenance, repair, and troubleshooting.

They invested in developing a highly immersive 3D equipment simulator, which provides learners with a flexible training platform emphasizing just-in-time training and performance support. The simulator also provides a consistent and trackable learning solution that can be accessed anywhere and anytime by equipment maintenance workers.

Observed benefits in the supply chain:

- The company is incorporating the VR learning platform into their overall maintenance and training solution, aimed at maintenance cost reduction and repair effectiveness

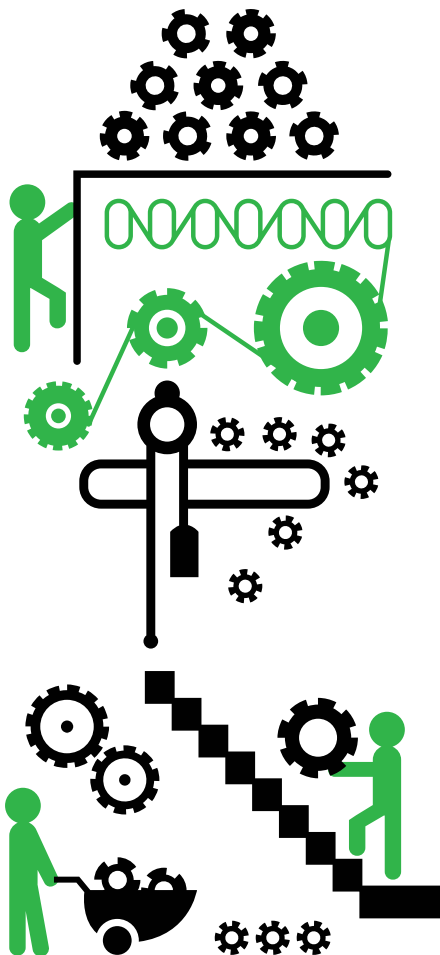
- The globalized, remote training offered by the simulator standardizes knowledge across geographic locations, allowing the company to repair and troubleshoot around the clock without the need of an expert in a specific geographic location
- The increased traceability of the VR solution creates a data platform on which analytics can be used to improve personalization and effectiveness
- With the success of the solution, the organization is considering expanding into serious games and augmented reality



# Criteria for evaluation and adoption

## Operational considerations

To adopt virtual reality in your supply chain, start by understanding where you will use the technology and how it will connect to your existing systems. Each organization has a unique operating model and the adoption of VR should match strategic objectives. The following five attributes can help shape your decisions and determine the potential overall return on your investment.



## Functional deployment

Applications that benefit from enhanced visualization, collaboration, and training will gain the greatest initial improvements from virtual reality technology. Understanding which functions, facilities, and individuals should start with the technology will be critical to successful rollout.

Key considerations in this category:

- Which functions offer the best use case and rapid value capture for initial rollout?
- Do software and unique applications exist for your desired use cases? If not, do you have the capabilities in your organization to build them?
- Do existing workflows need re-engineering to incorporate virtual reality?
- What type and how many devices do you need to achieve expected benefits? Is it possible to utilize existing corporate mobile devices for VR applications?

## Technology infrastructure

Virtual reality very much depends on a comprehensive IT ecosystem to support creation and consumption of content. It is important that these devices connect to existing enterprise systems, design software, communication networks, security systems, and possibly more if the intent is to leverage full capabilities as part of existing workflows.

Key questions to consider:

- What are the required changes in the existing technology stack to facilitate the integration of VR?
- How digital is your supply chain or supply network?
- Is your preferred VR hardware and software able to integrate with your systems?

## Security

Security is an important consideration for the adoption of virtual reality: cybersecurity, in particular, is often ranked as one of the top three risks for companies, as indicated by a Deloitte survey.<sup>6</sup> As connected devices increase in the workplace, companies are incorporating operational technology privacy and security into their traditional information technology considerations.

- Given increased device-enabled workflows, what are your mitigation strategies for a network disruption?
- Do you have a comprehensive security network for operational technology?
- Do you know which pieces of hardware and software are able to operate on private networks?

## Regulations

New regulations remain in flux for things like heat generation and device use time, augmenting standard OSHA, ANSI, and other traditional industry requirements. There is also great uncertainty around future regulations in a virtual world: whether real-world laws will be applicable in virtual reality platforms or new laws written and tailored to the virtual environment.<sup>7</sup>

Intellectual property and trademarks are at the forefront of the discussions among regulators, both for developers and for the new products, processes, and services created within VR.

Additional considerations within this category:

- Which countries do you operate in and how do regulations differ across each?
- What are the industry requirements for wearables in your workplace?



- Do you have a plan to handle IP created globally through these devices?
- Do you know how IP for VR content is being addressed in your industry?

**Operating environments and perception**

Because of its immersive nature, VR poses a hazard to both users and bystanders if the surroundings are not reasonably controlled. Cyber sickness is a real issue for VR users, which results from the mismatch of virtual and physical realities: dizziness and headaches may occur when the refresh rate is not fast enough for the human vision processing system. We do not fully understand the neurological impacts from VR and the field requires further research to ensure there is no neurological harm from prolonged VR use.<sup>8</sup> Incorporating VR can be a drastic change for some employees’ everyday tasks. Implementing the appropriate trainings and change management processes to help ease the transition and drive adoption are requisite initiatives.

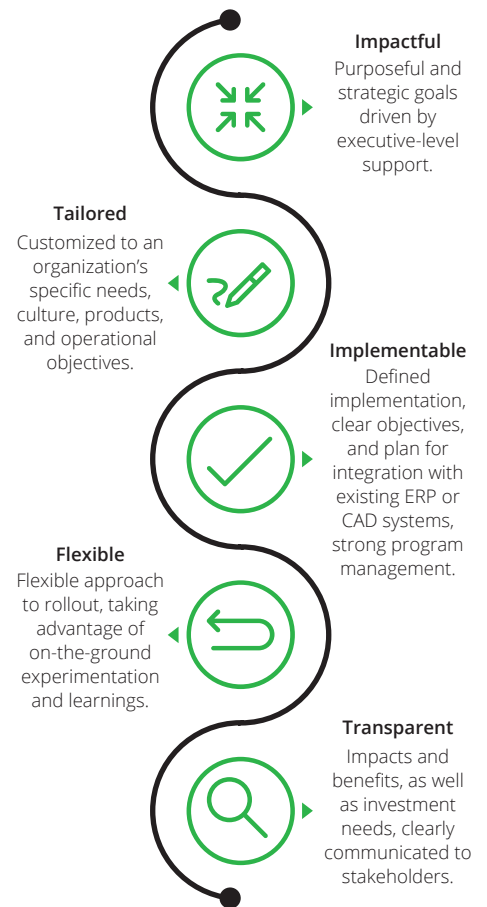
Basic considerations in this category:

- How do you expect the current workforce to respond to working with VR?
- Does your proposed physical environment satisfy the necessary requirements?
- Are you expecting employees to share the VR devices with each other?
- How much training is required to familiarize employees with the new technology?
- Do you need to establish insurance policies to accommodate for VR-caused sickness?

**Framework for decision making**

**Virtual reality success factors**

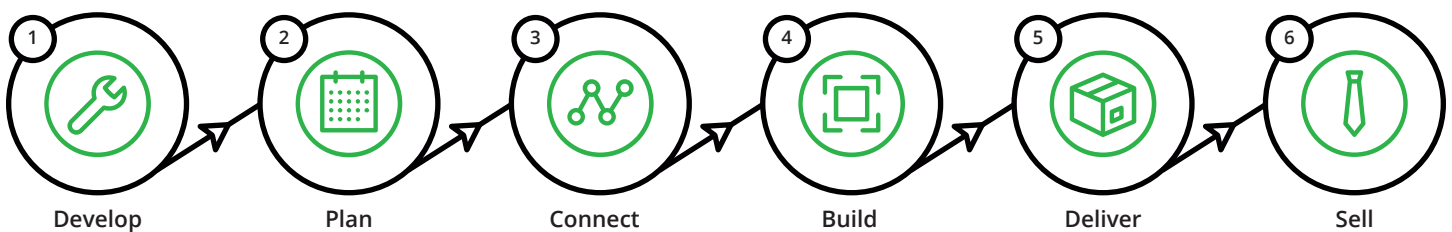
Leveraging industry-leading practices can help you define an implementation strategy for virtual reality in your organization. As with any new strategy, your goals for incorporating virtual reality into your supply chain should match your organization’s overall vision, goals, culture, and strategy.



# Key levers for virtual reality in your supply chain

## Supply chain applications

Significant opportunities for virtual reality exist at each stage of the supply chain.



### Examples

01. Develop: VR enhances the ability to rapidly test design iterations to reduce costs in the product development process. Virtual prototypes can test engineering issues, quality, and fit of CAD designs before physical prototypes. VR training requires up-front investment but has the potential to increase collaboration and significantly drive down new product introduction costs.
02. Plan: Successful supply chain plans incorporate multiple supply chain levels and an investment in human capital. As industries increase the use of “big data” in planning, working with complex data sets in VR, users can interpret the data across many more dimensions intuitively and collaboratively.
03. Connect: Virtual reality allows teams to grow and connect globally with fidelity and scale not previously experienced. The enhanced communication aspects connect engineers with their suppliers and reduce barriers for collaboration across supply chain planning teams.
04. Build: VR allows organizations to safely and efficiently train in a highly immersive, simulated environment before operating on the costly and sometimes dangerous capital equipment in heavy manufacturing,

advanced electronics, and other highly regulated supply chains. New visualization capabilities help workers see step-by-step assembly procedures or visualize their impact on line operations in ways not previously possible.

05. Deliver: Remote assistance in large capital industries like energy, high-tech manufacturing, and heavy manufacturing can be delivered effectively with VR applications. Like other augmented reality devices, VR speeds up flow of information during repair response to ensure equipment uptime, and can also be used to improve communication for high-risk supply chain delivery, such as medical supply.
06. Sell: Virtual reality’s ability to enhance the customer sales experience also provides unprecedented insight into customer preferences. If used correctly, this can feed back into product design to create better products and more responsive supply chains.

### Motivation for action

The time for companies to start assessing virtual reality in their supply chains is now. The VR market could reach nearly \$50 billion by 2025,<sup>9</sup> and leading companies continue to invest in VR’s space—improving features and overall costs. Enterprises across industries

are starting to experiment with use in design and training so that they are familiar with the technology as use cases expand.

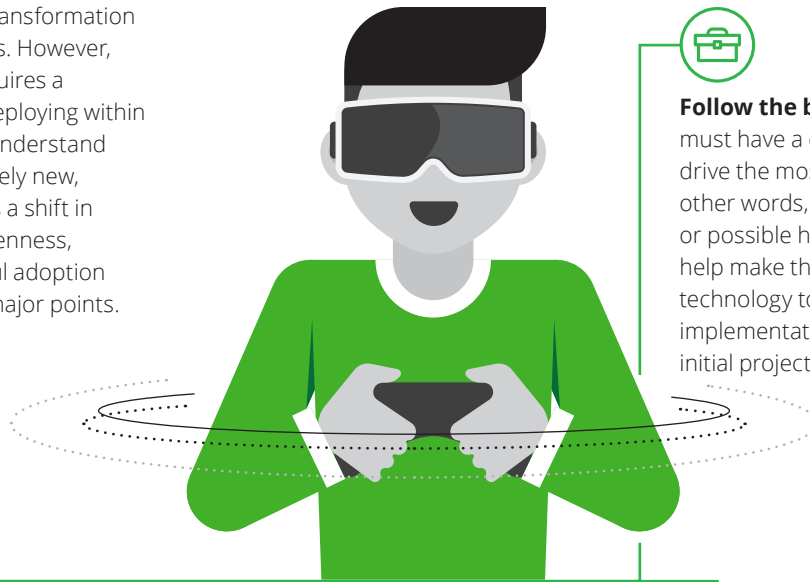
Companies with large global teams that stand to benefit from design collaboration or highly immersive learning experiences will soon find themselves playing catch-up if they are not experimenting with virtual reality. As the technology continues to mature, new uses will emerge and the business case will become even clearer. But, as is the case with other technological shifts in the supply chain, simply placing it in the organization is not transformative; the real value comes from the process to select, design, apply, and integrate the technology. The approach to deploying VR will be discussed in the final section.

### Virtual reality adds value throughout the supply chain:

- Increased productivity and efficiency
- Improved data visualization
- Enhanced product and process design
- Ability to separate presence from physical location
- Greater employee collaboration and communication
- Improved employee training effectiveness

# Getting started with VR technology

Virtual reality can drive true transformation in supply chain and operations. However, like every major change, it requires a strategic approach to begin deploying within a company. Leaders need to understand that shifting toward a completely new, virtual environment mandates a shift in culture toward innovation, openness, and collaboration. A successful adoption strategy should include four major points.



**Follow the business case.** First, leaders must have a clear view of where VR will drive the most value in the supply chain—in other words, identify the optimal use case or possible high-value use cases. This will help make the business case and allow the technology to pay for itself in successive implementations if successful in initial projects.



**Clearly communicate the strategic goals.** Second, supply chain leaders should communicate a VR strategy clearly. Virtual reality will radically shift employee workflows and processes; these shifts may face difficult adoption in some areas of the workforce. Clear communication about the vision and benefits from leaders is critical and will ensure confidence as implementation and other operational risks arise. This will help early adopters apply bold ideas and view each failure as a learning opportunity toward future success.



**Target and pilot.** Third, companies should pilot the technology in an area of the organization where the risk of VR to operations is low. Often, this may be the R&D organization, but for other use cases, it may simply be a small experimental team in the field. Piloting the technology may mean choices about outsourcing aspects of the technology rather than developing it in-house. Organizational leaders must also be quick to address unforeseen barriers to success: monitoring how the technology changes workplace layouts, modifying standardized workflows, and responding to cultural issues of using headsets. Careful design and execution on a pilot scale will help prove the technology for greater investment and adoption later.



**Pick the “champions.”** Finally, companies must find a small group of employee super-users who can help tailor VR to the company’s needs and will ultimately champion its future rollout. Identify employees who can influence the rest of the workforce and help them serve as “champions” of VR. These people will be eager to find out about the technology and, in this way, be in a position to advocate about the benefits of VR and urge their coworkers to participate in training seminars and implement the technology in their work.

# Key Deloitte contacts in virtual reality and supply chain management



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## Endnotes

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