

NAM WEBINAR: STATE OF INDUSTRIAL AUGMENTED REALITY

- **Title:** The State of Industrial Augmented Reality
- **Overview:** Moving beyond the hype, this webinar provides a data driven view into how manufacturers are using AR to create business value today. This research uncovers the industries that are leading AR deployments, how business functions are using AR, and the types of business value generated. This report also explores the degrees of success companies are experiencing in implementation, and where they are in transitioning pilots to production deployments.
- **Speakers:**
 - **Shawn Kelly**
 - **Vice President, Strategy, PTC**
 - **Rocky Jung**
 - **Senior Business Analyst, PTC**





Shawn Kelly, PTC Vice President of Corporate Strategy

- Responsible for leading projects focused on key strategic initiatives for PTC
- Inclusive of primary and secondary research to better understand markets, trends, technologies, end user needs, etc.
- Over 15 years of professional experience in Corporate Strategy and Finance for Technology, Life Sciences, and Financial Services companies
- MBA from the Tuck School of Business at Dartmouth College and a BS in Finance from The College of New Jersey



Rocky Jung, PTC Senior Business Analyst

- Responsible for providing analysis on emerging technologies to PTC's Thought Leadership group
- Accomplished market analyst, having held positions in Corporate Strategy, Corporate Development and Corporate Marketing
- BS in Business Management and Finance from Virginia Commonwealth University

 vuforia[®] thingworx[®]

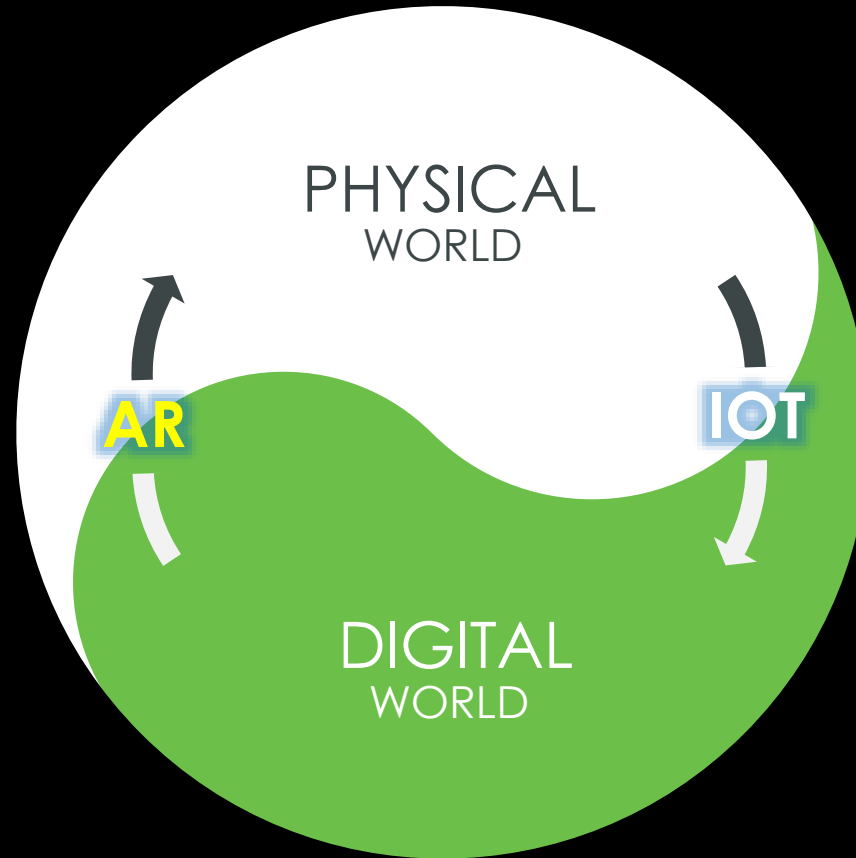
PHYSICAL
WORLD

\$1B Invested
to Build Leading
AR and IOT Brands

DIGITAL
WORLD

30 Years Pioneering
the Digital Twin

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STATE OF INDUSTRIAL AUGMENTED REALITY

- AR Market Overview
- Industrial AR Survey Findings
- Company Case Studies
- Wrap Up

AR MARKET OVERVIEW

WHAT IS AUGMENTED REALITY (AR)?

A human experience in which data or graphics are superimposed onto the user's physical environment or digital representation of a physical environment to deliver information in context.

PUNDITS IDENTIFY AR AS KEY TECHNOLOGY TREND

Forrester's Top Emerging Technologies To Watch: 2017-2022

Systems of engagement technologies

From customer-aware to customer-led

IoT software and solutions
Internet-of-things (IoT) platforms and packages, IoT management and security tools

Intelligent agents
Chatbots, digital assistants, robotic process automation

Personal identity and data management
Personal data lockers, authorization management tools

Real-time interaction management
Customer recognition, offer arbitration and delivery, measurement/optimization

Augmented and virtual reality
Image processing, 3D software, specialized chips, headsets, HUDs, mobile apps



Systems of...

From data-



Supporting technologies

From siloed to connected and from perfect to fa

Security automation and orchestration
Security analytics and workflow management, incident response, link analysis, threat intelligence

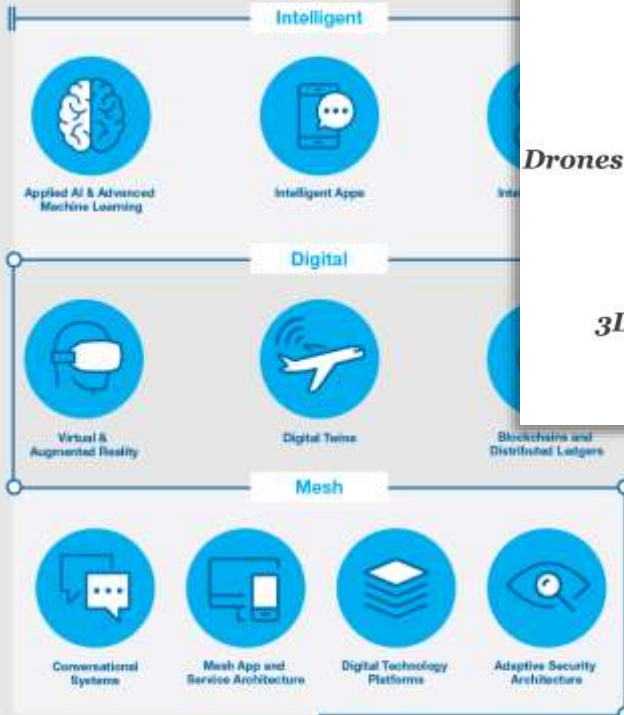
Containers and container management
Docker, CoreOS, Kubernetes, Mesos, cloud container management

Cloud native application platforms
Platform-as-a-service (PaaS), microservices tools, API management, CDCI tool chains

Hybrid wirel...
Chips and sof... translate betw... protocols on t...

Gartner.

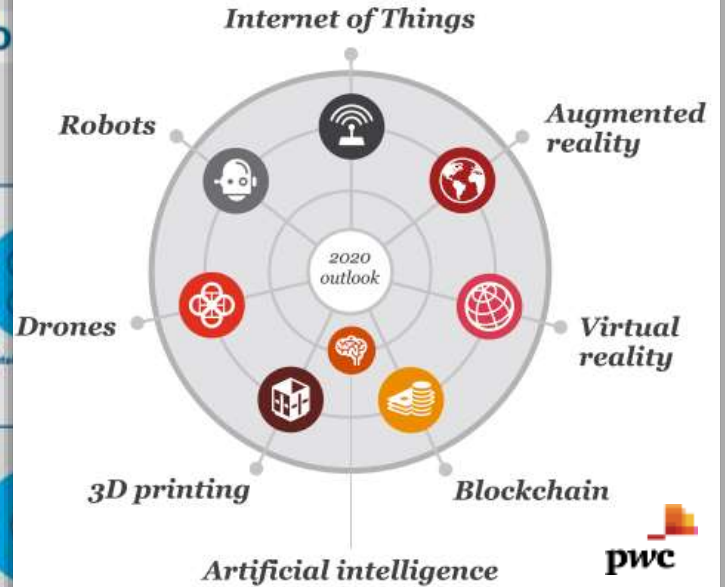
Top 10 Strategic Techno Trends 2017



gartner.com/SmarterWithGartner

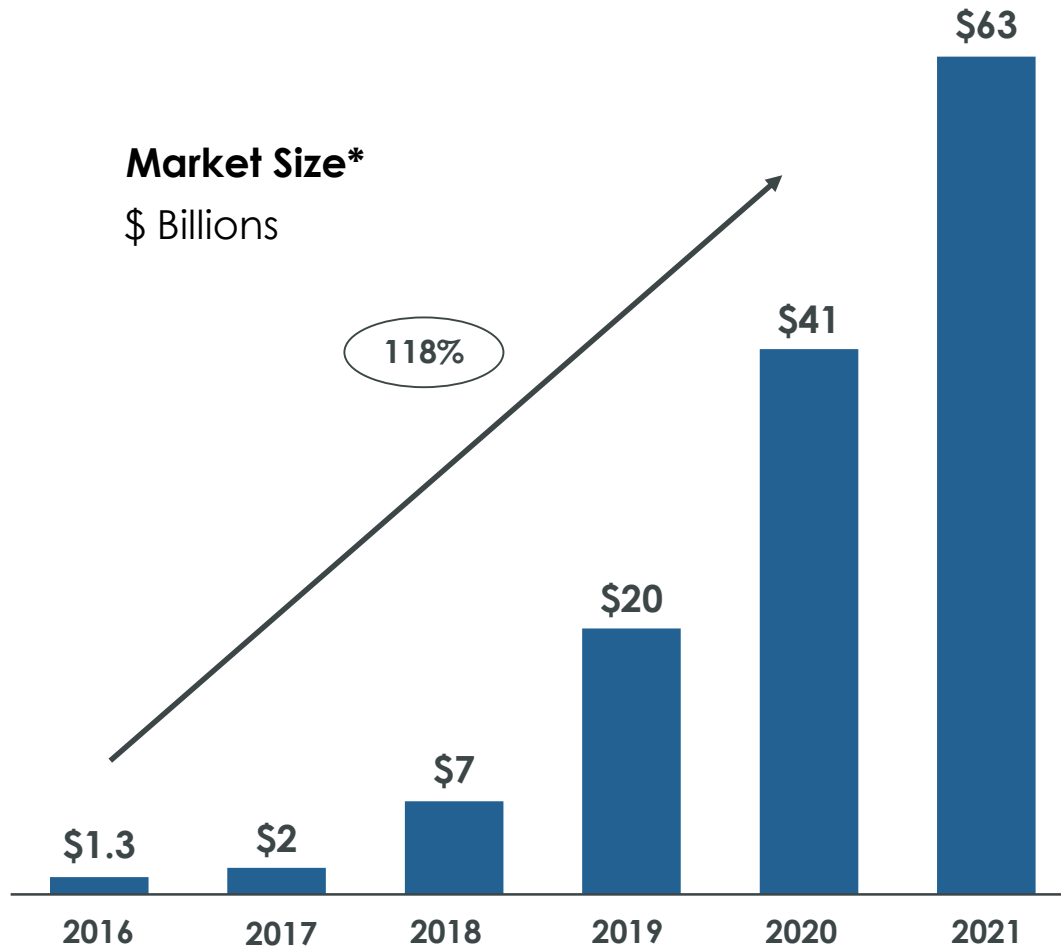
Source: Gartner
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The essential eight technologies



pwc

AR IS A \$1B MARKET GROWING AT 100%+



Augmented Reality Trends

AR revenue will be driven by industrial (energy, logistics, manufacturing, etc.), healthcare, and government/military verticals

Enterprise usage will be a stronger driving force for AR than for VR, and could make AR the more lucrative market

The technical aspects of AR and VR will merge into a mixed reality feature set, with AR maintaining a larger market share due to its business applications

Current investment in the sector is prioritizing advances in relevant underlying technologies such as depth-sensing camera lenses and physical environment mapping systems

*Spend inclusive of: hardware, software, eCommerce, games, and advertising

Sources: PTC Market Research & Analytics, Digi-Capital, ABI Research, Markets and Markets

RECENT NEWS AROUND INDUSTRIAL AR

2017

February



Tim Cook declares AR as core to the future of Apple

April



UILabs & Augmented Reality for the Enterprise Alliance release functional requirements standards designed to help industrial deployments

Osterhout Design Group releases ruggedized smart glasses for industrial use

July



Google Glass Enterprise Edition Officially Announced with 30+ lighthouse customers

August



ARkit and ARcore bring augmented reality development to 100s of millions of devices

- **How would you characterize your company's adoption of Augmented Reality?**
 - Currently adopting
 - Plan to adopt in the next year
 - Plan to adopt in the next two years
 - Not yet adopted
 - No plans to adopt

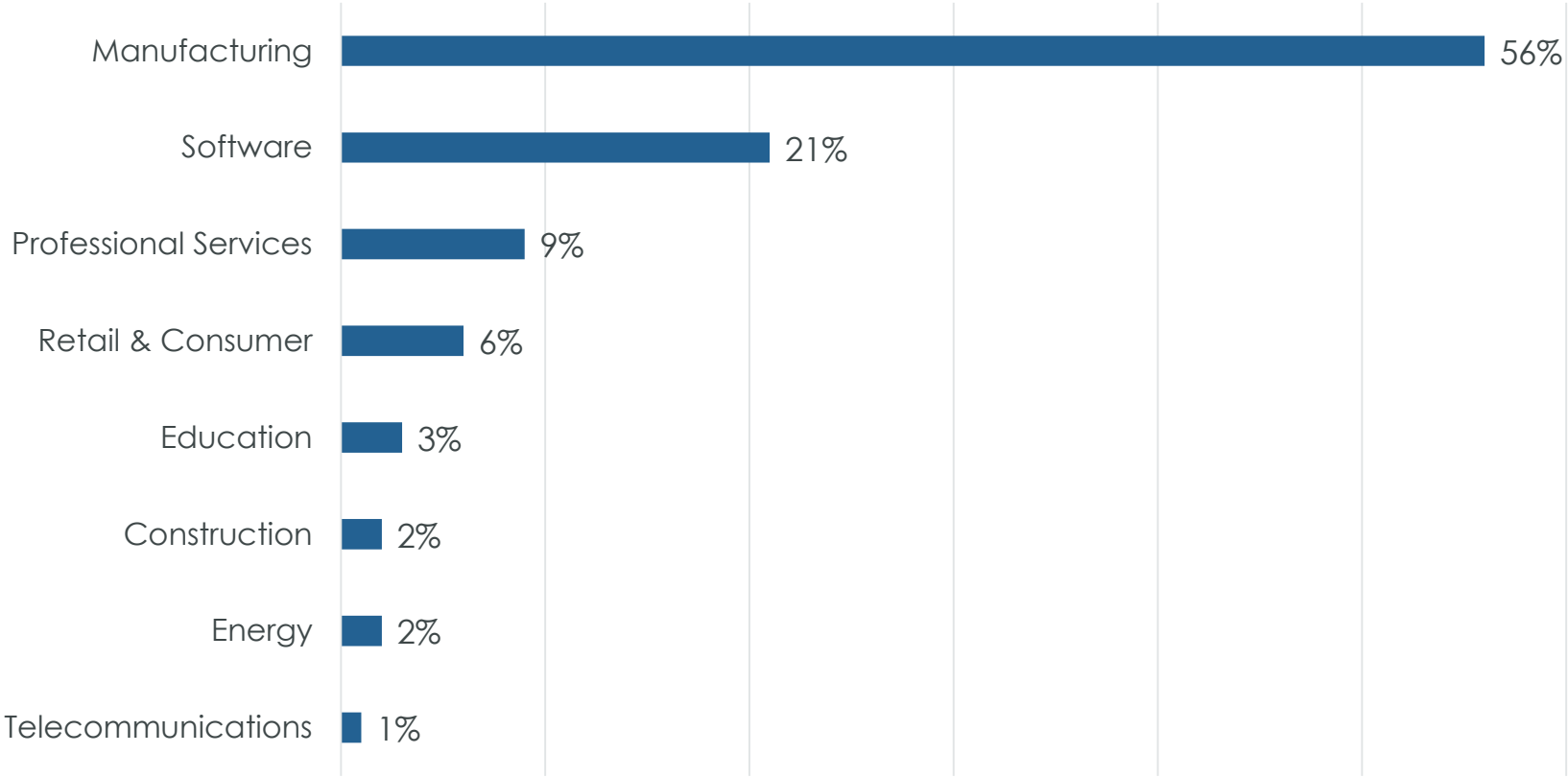
INDUSTRIAL AR SURVEY FINDINGS

- PTC acquired the Vuforia augmented reality platform in 2015
- PTC has integrated Vuforia's codeless authoring and publishing capabilities into PTC's ThingWorx platform (ThingWorx Studio)
- PTC has a ThingWorx Studio pilot program with several thousand users of its technology
- In the Spring of 2017, PTC conducted a survey of ThingWorx Studio users to gain visibility into the rapidly evolving augmented reality space

Industry Distribution

% of AR experiences developed across industries

N = 107



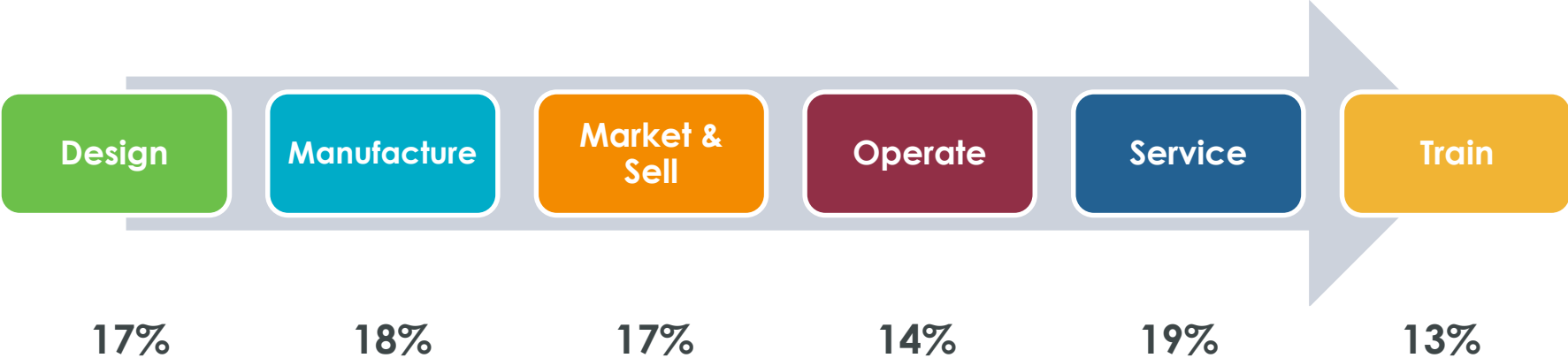
Question: What is your company's industry segment?

Note: Manufacturing includes Industrial Products, Automotive, Aerospace & Defense, Electronics & High Tech, Medical Devices

Widespread AR Adoption Across the Enterprise

% of Respondents designing AR experiences for each functional area

N = 107



Question: Which use case category [function] are you building AR experience(s) around? Select all that apply.

Average ~2.3 functional areas chosen per respondent

AUGMENTED REALITY USE CASE DEFINITIONS



- Collaborative Design Review
- Digital Design Review

- Maintenance Work Instructions
- Operator & Assembly Work Instructions
- Quality Assurance
- Safety & Security Alerts
- Virtual Layout Planning
- Performance Dashboards

- Virtual Product Companion
- Augmented Brand Experience
- Retail Space Optimization

- Augmented Operator Manual
- Head-up Display
- Augmented Interface
- Digital Product Extension

- Service Manual & Instructions
- Service Inspection & Verification
- Remote Expertise
- Customer Self Service

- Job-specific Training
- Safety & Security Training
- Expert Coaching

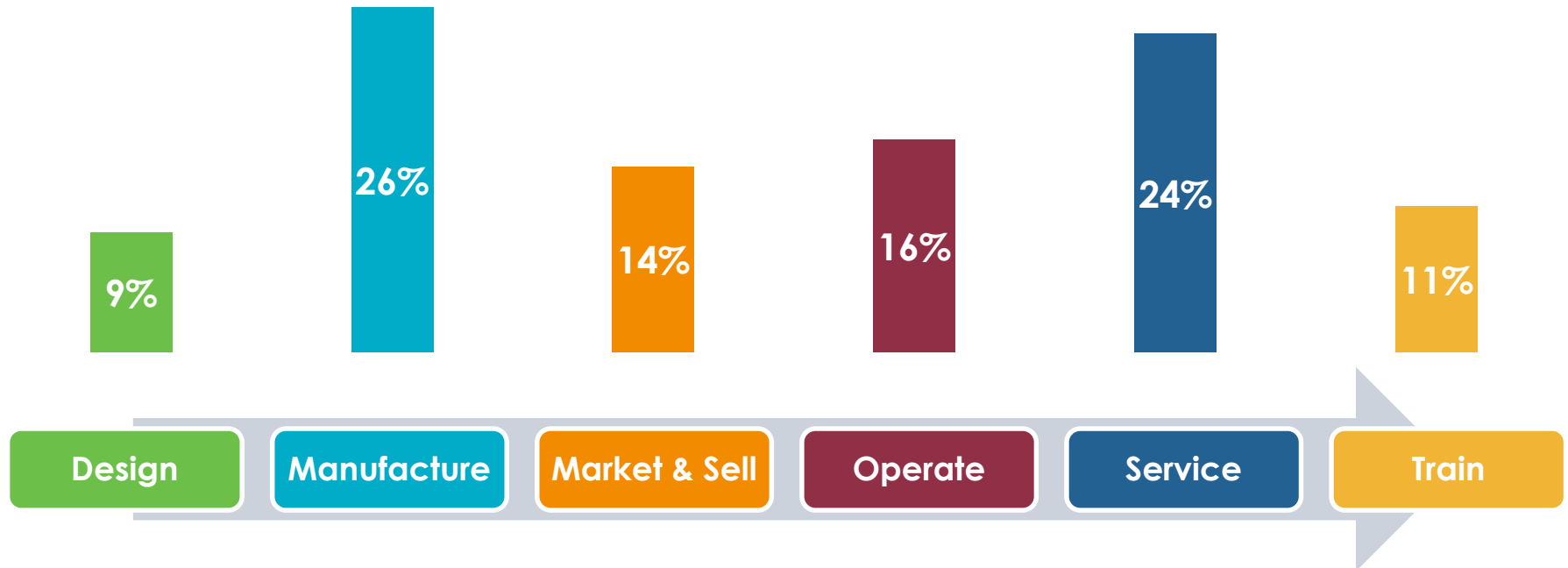
AUGMENTED REALITY USE CASE ADOPTION



Manufacture and Service are the leading Use Case Categories

% of AR experiences developed for each functional area

N = 494 identified Use Cases (Avg. of 4.7 use cases per respondent)



Question: For each category selected, which specific use cases are you trying to solve for? Select all that apply.

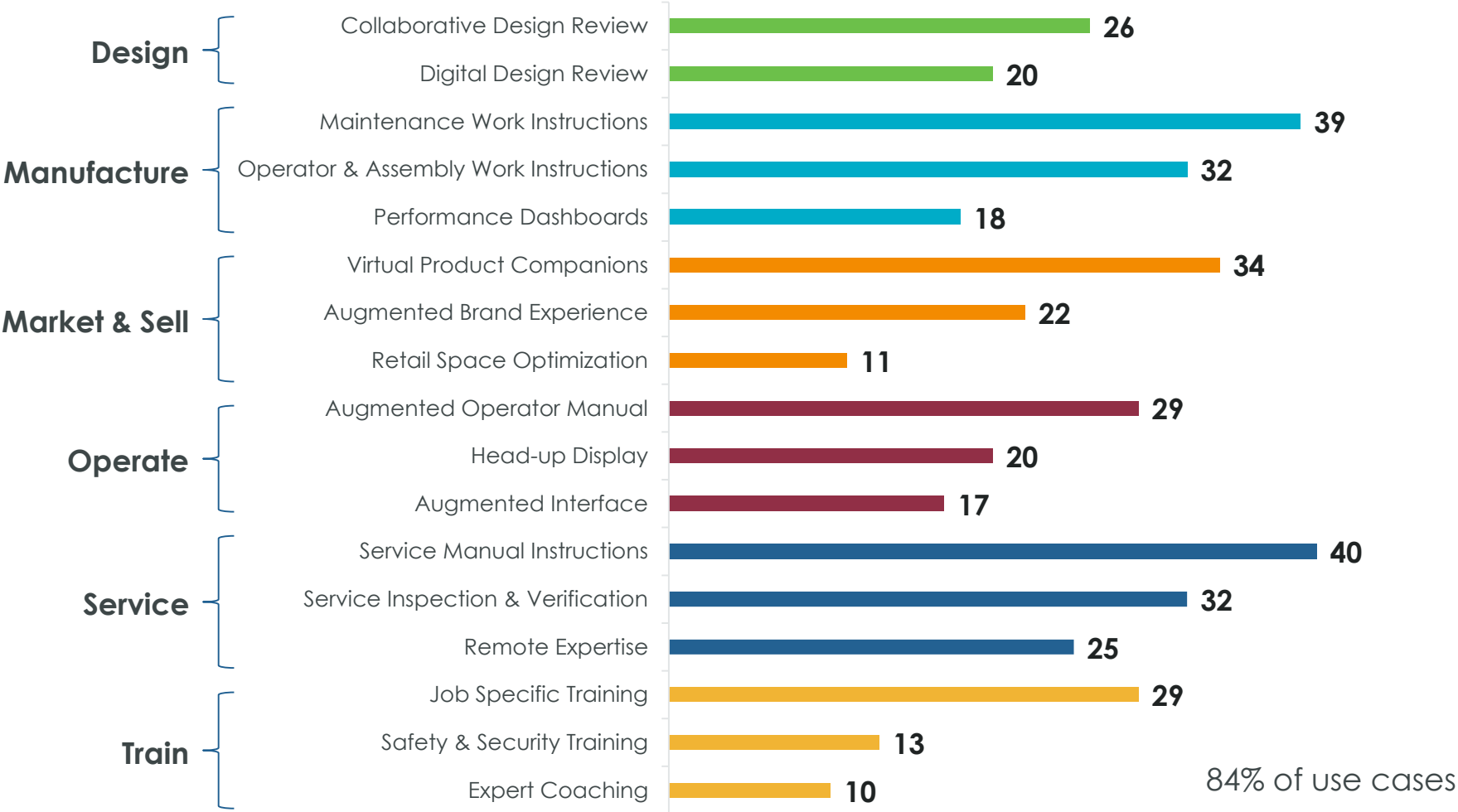
Other (2%) not shown includes: Surgical guidance in operating rooms, Operations management (Dashboard design and usage for team leads, Production/operations managers), QA for Buildings, For Management and Attracting new graduates, Technology Insight to Leadership

AUGMENTED REALITY USE CASE ADOPTION



Top AR Use Cases in the Enterprise

Count of AR experiences developed for each use case type



Question: For each category selected, which specific use cases are you trying to solve for? Select all that apply.

BUSINESS PROBLEMS BEING ADDRESSED



Business Drivers

N = 100



Select Responses

“Manufacturing efficiency, increasing quality and lowering cost.”

- Tier 1 Automotive Parts Supplier

“It’s part of Lean Manufacturing. Improving quality by showing visually damaged data on the product greatly enhances the value proposition of the quality control procedures.”

- Appliances Manufacturer

“These use cases address how we can increase the sales revenue of our organization or how we can accelerate the buying habits of our potential customers.”

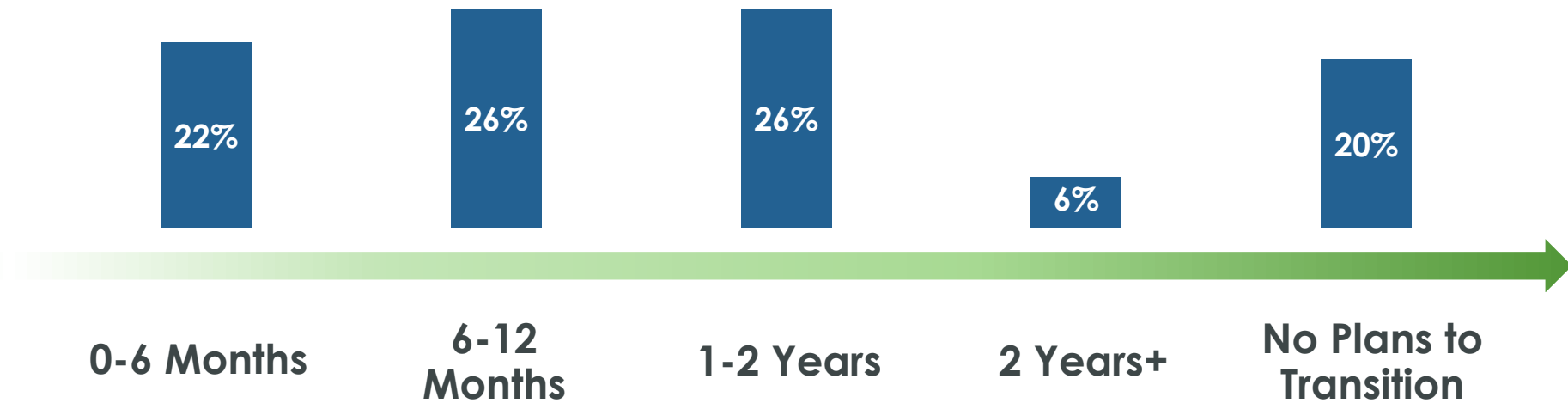
- Global Communications & IT Services Company

Question: What business problem are these use cases addressing?

PLANS TO TRANSITION TO PRODUCTION

Companies are aggressively moving to Production (sum of % for each AR experience)

N = 92

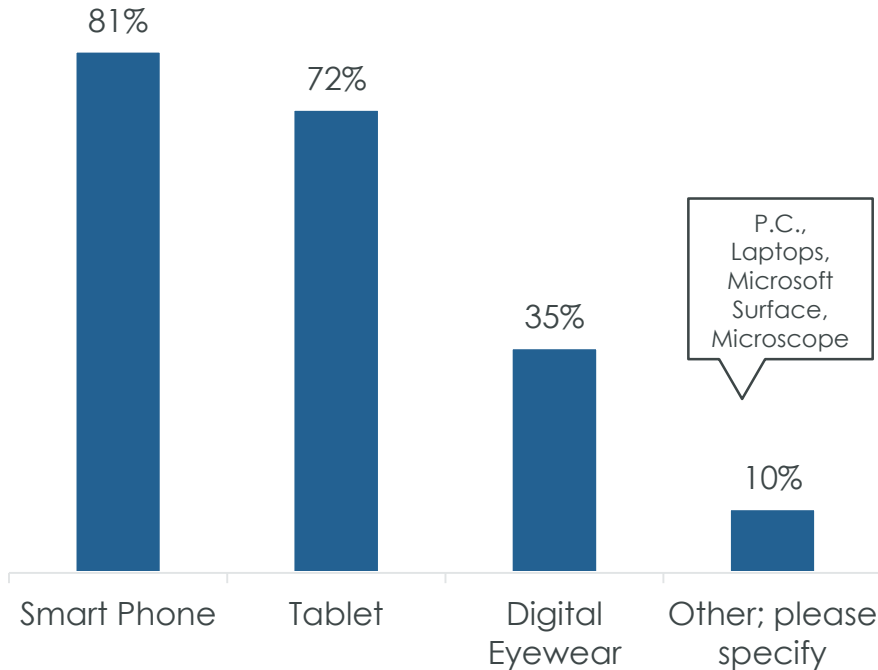


Question: What is the likely timeframe for transitioning each AR experience to a production environment?

DEPLOYMENT OPTIONS FOR AR EXPERIENCE

Hardware Tool for AR Experience

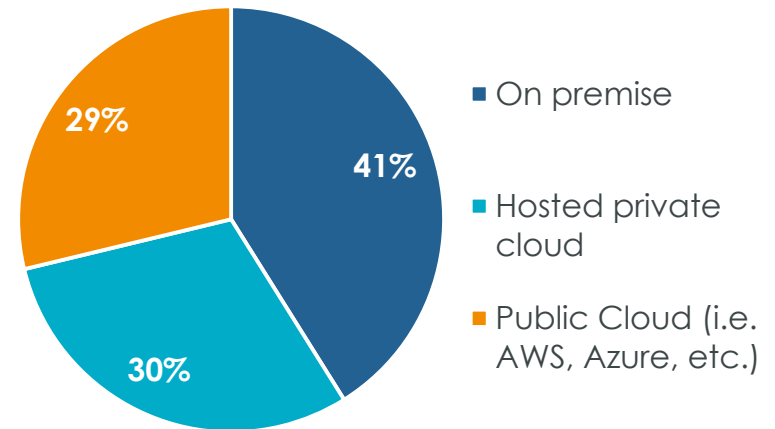
N = 100



What hardware tool are you using to deploy your AR experience(s)? Select all that apply.

Primary Hosting Environment

N = 73



What is the primary hosting environment you are planning to deploy the AR experience in?

Note: Question was asked to a subset of respondents based on answers to other questions

AUDIENCE POLL



- What business drivers are you interested in solving for via an augmented reality experience? (Select all that apply)
 - Shortened development cycle
 - Improved operational effectiveness
 - Higher manufacturing quality
 - Greater sales revenue
 - Improved end user experience
 - Other

COMPANY CASE STUDIES

COMPANY CASE STUDIES



Case Studies*:

Digital Design Review



Operator & Assembly Work Instructions



Augmented Brand Experience



Head-up Display



Remote Expertise



Expert Coaching



* Case Studies were generated from publically available sources and used to illustrate how companies are applying AR into their work environments

VOLKSWAGEN – DIGITAL DESIGN REVIEW



Design

Manufacture

Market & Sell

Operate

Service

Train

VW is using AR for **Digital Design Review** during the engineering process. VW projects design change and internal component data directly onto existing and prototype cars, ensuring the physical prototype matches the digital design and allowing them to visualize proposed changes.



Value Metrics

- Reduced Scrap from Prototyping
- Higher Quality Design
- Faster Time to Market



Design

Manufacture

Market & Sell

Operate

Service

Train

An engineer at **Boeing** performed a wing **assembly** study to prove Augmented Reality (AR) **Operator & Assembly Work Instructions** can increase productivity in Assembly. The study had three control groups assemble a wing with 30 parts in over 50 steps (desktop computer instructions vs. mobile tablet with pdf instructions vs. AR instructions on a mobile tablet).



Value Metrics:

- Quality Increase (90% improvement in first-time quality between desktop and AR modes)
- Heightened Productivity (AR reduced time to build the wing by around 30%)



DISNEY – AUGMENTED BRAND EXPERIENCE

Design

Manufacture

Market & Sell

Operate

Service

Train

Disney World hosts Star Wars-themed weekends every Spring. Last year, Disney added exclusive 3D content, videos and animations to their Star Wars Weekend's merchandise for an **augmented brand experience**. The customer can scan the merchandise to trigger the 3D content improving the value and longevity of the products.

Value Metrics:

- Sales increase (25% increase in merchandise sales of AR-enabled products)



BMW - HEAD-UP DISPLAY

Design

Manufacture

Market & Sell

Operate

Service

Train

Some **BMW** models come equipped with a **head-up display** (HUD) that enables the operator to access real-time SCP data, safety alerts, maps, and other dynamic content. The HUD projects onto the car's windshield above the steering wheel. This makes it easier to consume this operational data because the driver does not need to shift focus from road to the instruments and back. This display shows vehicle performance, surrounding environment, and supplemental information such as maps or location-based alerts.



Value Metrics:

- Process information 50% faster
- Safety and risk



CATERPILLAR – REMOTE EXPERTISE



Design

Manufacture

Market & Sell

Operate

Service

Train

CAT is Leveraging AR for Remote Expertise. CAT is using AR to deliver live video streaming, voice, live annotation, screen sharing and white-boarding to simulate the effectiveness of having the expert looking over your shoulder guiding you on what to do step-by-step.

Value Metrics:

- Reduce Service Event Time
- Improve Quality of Service
- Increase First-Time Fix Rate



JAPAN AIRLINES – JOB SPECIFIC TRAINING



Design

Manufacture

Market & Sell

Operate

Service

Train

Japan Airlines (JAL) partnered with **Microsoft HoloLens** to create a prototype for **job-specific training** for flight crew and mechanics. The device enables the user to experience a realistic cockpit environment irrespective of location or time of day as a supplementary training tool for flight crew trainees seeking promotion to copilot status.

Value Metrics:

- Employee satisfaction
- Time to completion



COMPANY CASE STUDIES



Case Studies*:

Digital Design Review



Operator & Assembly Work Instructions



Augmented Brand Experience



Head-up Display



Remote Expertise



Expert Coaching



* Case Studies were generated from publically available sources and used to illustrate how companies are applying AR into their work environments

AUDIENCE POLL



- Which of the use case categories presented most resonate with you and your company's objectives around augmented reality? (Select all that apply)
 - Design
 - Manufacture
 - Market & Sales
 - Operate
 - Service
 - Train
 - Other

WRAP UP

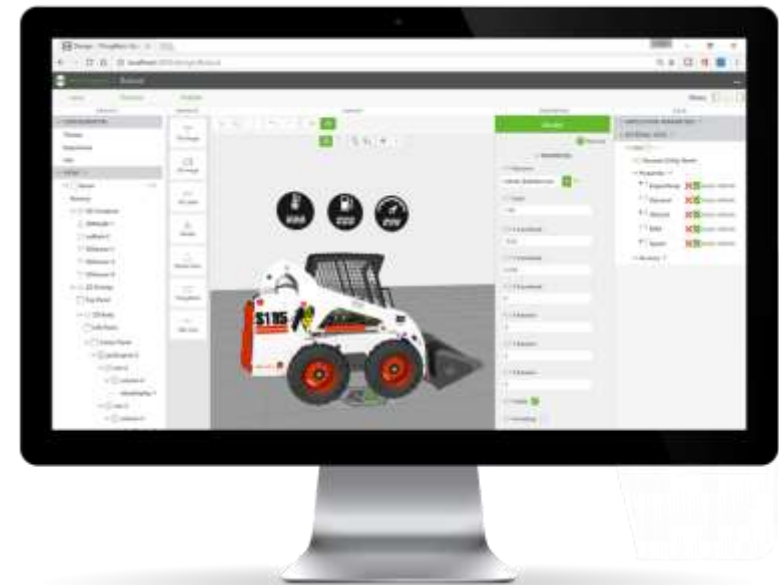
SUMMARY

- Heavy industries are leading industrial AR adoption
- AR has broad applicability to all functions of the value chain, and especially for use cases in Service and Manufacturing.
- The application of AR to serve as a powerful instruction and guidance tool is providing an entry point for many organizations
- AR adoption is reaching a critical tipping point and companies are aggressively pursuing ways to leverage the technology

Explore the Possibilities

Ready to get started? Sign up for a ThingWorx Studio Trial to:

- Gain first mover advantage with early access to tools that are specifically built to make AR authoring fast, simple and scalable
- Develop use cases and pilot studies complete with proof points specific to your organization using the easiest and most powerful AR solution designed specifically for the enterprise
- [REQUEST ACCESS TO THE FREE THINGWORX STUDIO TRIAL](#)



<https://studio.thingworx.com/login/>



Questions?

A black marker is shown in the bottom right corner, having just finished writing the word "Questions?" in a cursive, handwritten style on a sheet of white lined paper. A long, thin, curved line is drawn below the word. The paper has vertical blue lines.



ptc