



2021
Annual **INCOSE**
international workshop
Virtual Event
January 29 - 31, 2021

PLM/MBx Market Update

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Donald Tolle

Practice Director, Simulation-Driven Systems Development



- 40+ years of experience in the definition, development and implementation of simulation-driven engineering solutions
- Range of senior positions with PLM/CAE software & services providers (SDRC, UGS PLM/Siemens PLM, Comet Solutions)
 - Product Development Consulting Services
 - Software Product Management and Product Development
 - I-deas CAE & Test Business General Manager
 - Corporate Marketing, Business Development and Strategy/Mergers/Acquisitions
- Joined CIMdata in 2013 to help lead up the Simulation & Analysis Practice, Focus expanded to SDSD in 2015 to include S&A integration with SE (MBSE)
- Active participant in INCOSE, NAFEMS/INCOSE SMS WG, NAFEMS SDM WG, Aerospace & Defense Action Group, GPDIS, ASSESS Initiative Working Groups
- B.S in Mechanical Engineering and Masters in Business from Univ of Cincinnati

Our Mission...

Strategic management consulting for competitive advantage in global markets

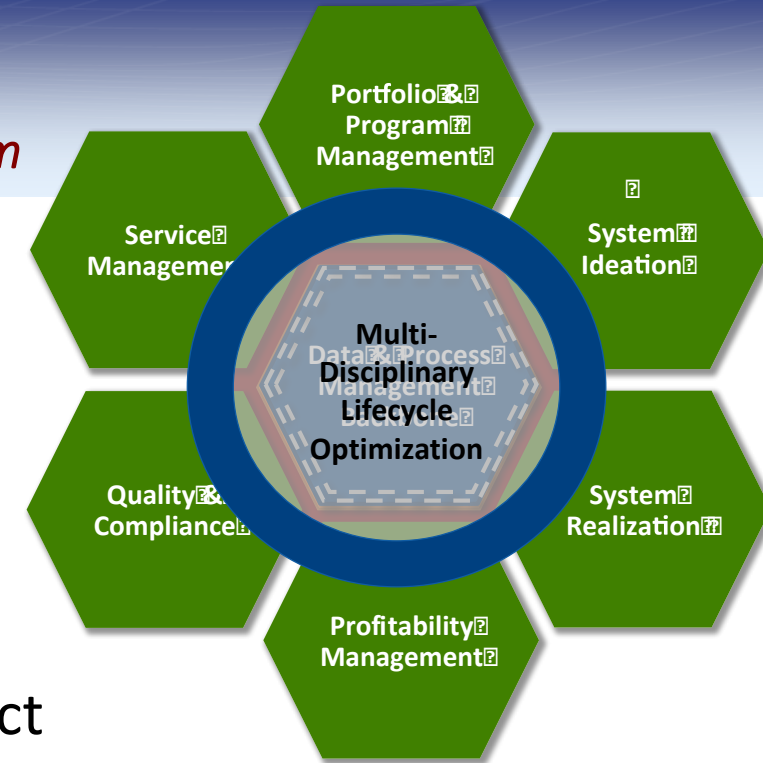
CIMdata is the leading independent global strategic management consulting and research authority focused exclusively on PLM and the digital transformation it enables.

We are dedicated to maximizing our clients' ability to design, deliver, and support innovative products and services through the application of PLM.

PLM – CIMdata's Definition

Digital transformation of the lifecycle—enabled by a product innovation platform

- Strategic business approach
 - **NOT** just technologies
 - Consistent set of business solutions
- Collaborative creation, use, management & dissemination of product related *intellectual assets*
 - All product/plant definition information – the virtual product
 - AEC, MCAD, EDA, ALM, SE, requirements, simulations, analytics, portfolio, formulas...
 - All product/plant process definitions – the virtual processes
 - Processes that plan, design, produce, operate, support, decommission, recycle...
- An innovation platform that supports the extended enterprise
- Spans the full lifecycle, from idea/concept through life



CIMdata Services...

Creating, disseminating, and applying our intellectual capital in support of your digital transformation



Research

- Market research & analysis
- Technology research & analysis
- Reports & publications across multiple domains
- Market news
- Member services...



Education

- Certificate Programs
- Executive seminars
- Technology seminars
- Educational webinars
- Int'l conferences & workshops
- Best practices training...



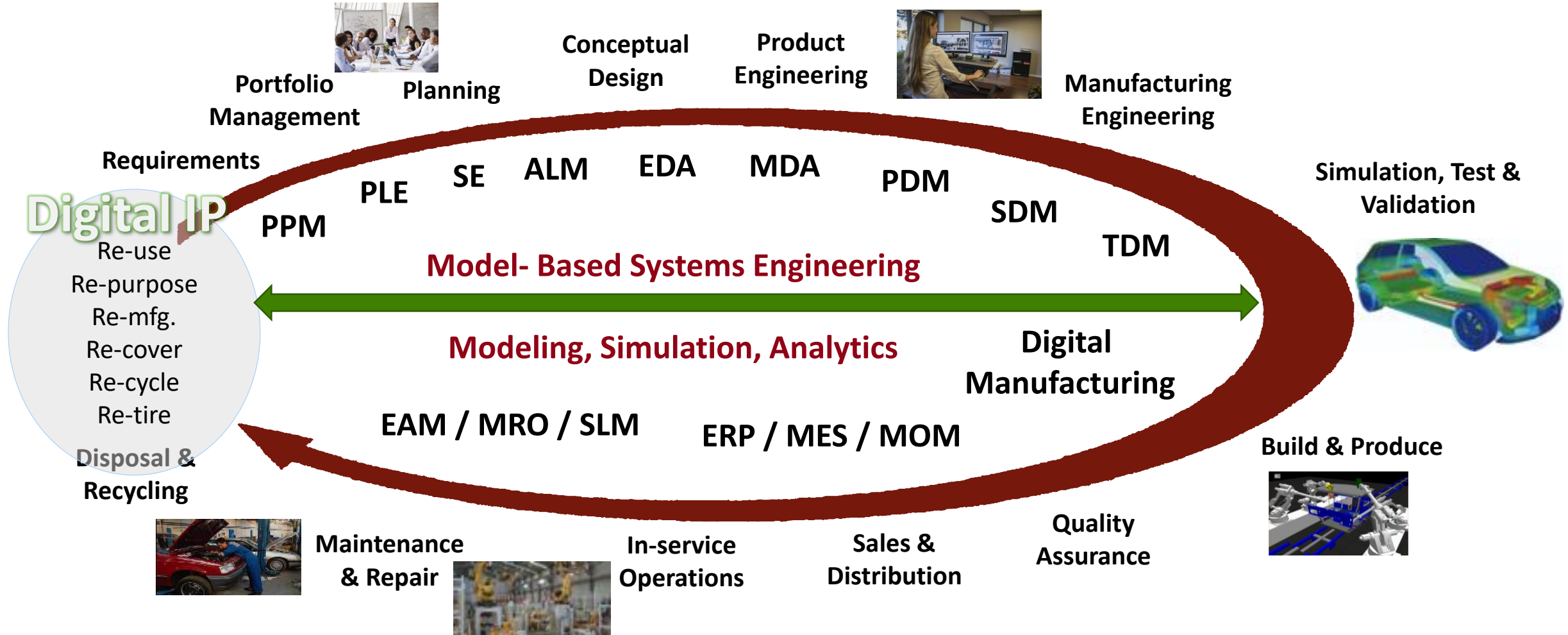
Consulting

- Strategy & vision
- Needs assessment
- Solution evaluation
- Best practices
- Quality assurance
- Program management
- Market planning...

Delivering strategic advice and counsel through a comprehensive, integrated set of research, education, and consulting services

PLM is a strategic business process - not software!

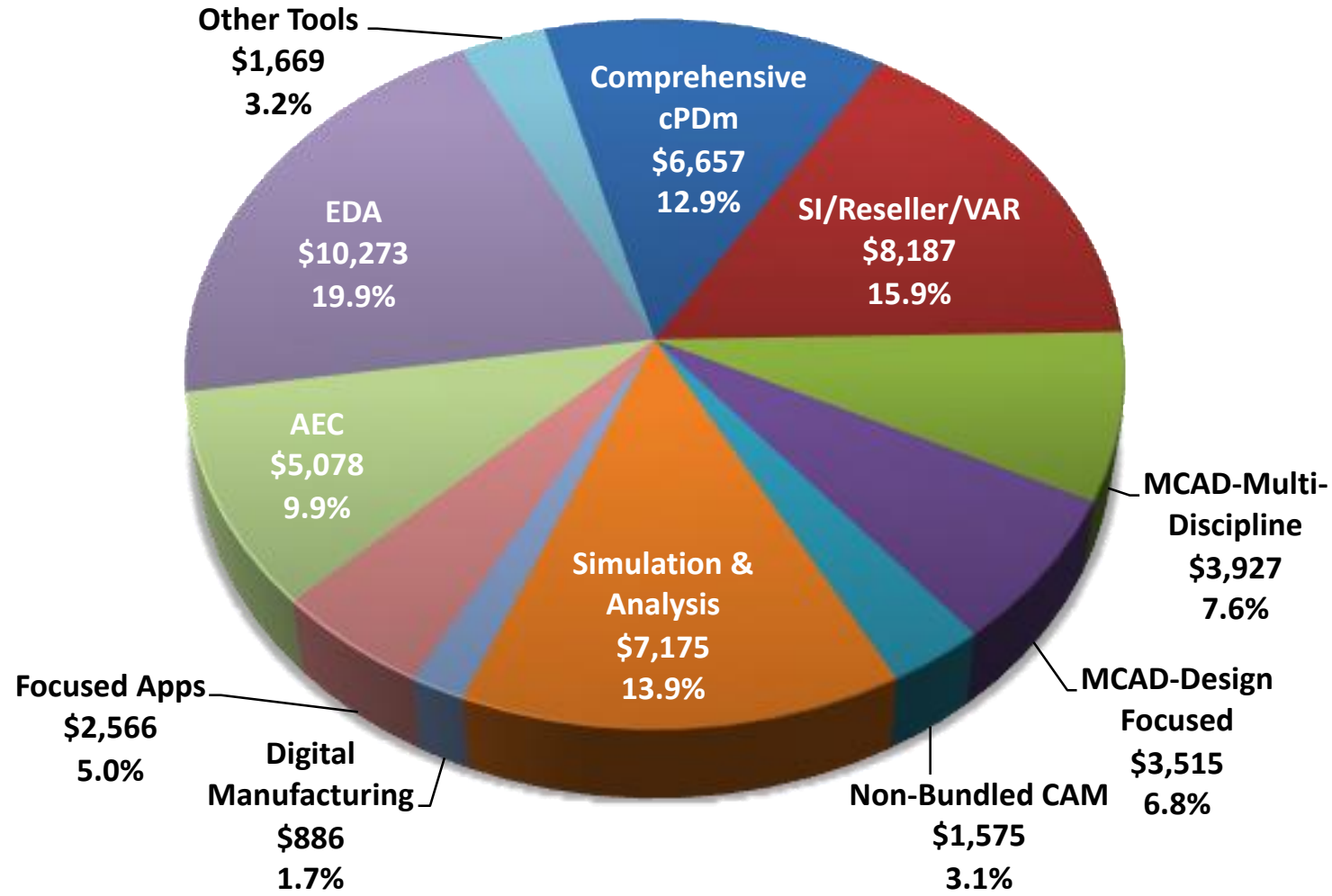
Digital Thread- Integration across many applications and data silos, each often focused on a part of the lifecycle



PLM Solutions—Information Management across Media, Process, Time, Geography, & Enterprise

PLM/Digital Engineering Investments by Segment

Market grew by 7.7% to US\$51.5 Billion in 2019



Additional SI/Reseller/VAR Revenue is included within each Tools sector

Revenues presented are CIMdata estimates

Estimates are US\$ (Millions)

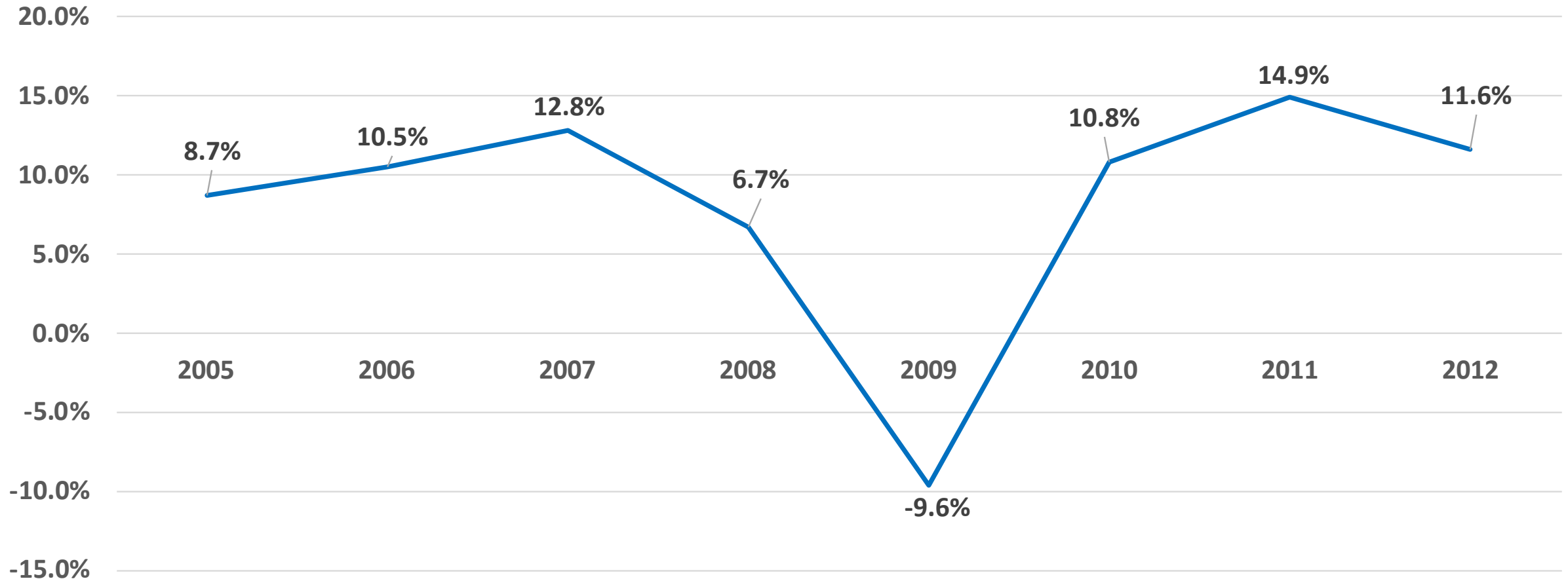
2019 Market Results

Results by segment (US\$ Millions) mostly positive

Segment	2019 Revenues	YoY Growth
cPDM Comprehensive Technology Providers	\$6,656.5	7.3%
cPDM-Focused Applications	\$2,566.3	6.8%
Digital Manufacturing	\$886.5	8.6%
SI/Reseller/VAR	\$8,186.6	7.2%
Tools		
MCAD Multi-Discipline	\$3,927.3	0.7%
MCAD Design-Focused	\$3,515.2	8.6%
Non-Bundled CAM	\$1,575.5	5.2%
Simulation & Analysis	\$7,175.1	11.0%
Other Tools (e.g., ALM, MBSE, Quality)	\$1,669.5	11.2%
EDA	\$10,272.5	4.0%
AEC	\$5,077.6	18.9%
Total	\$51,508.5	7.73%

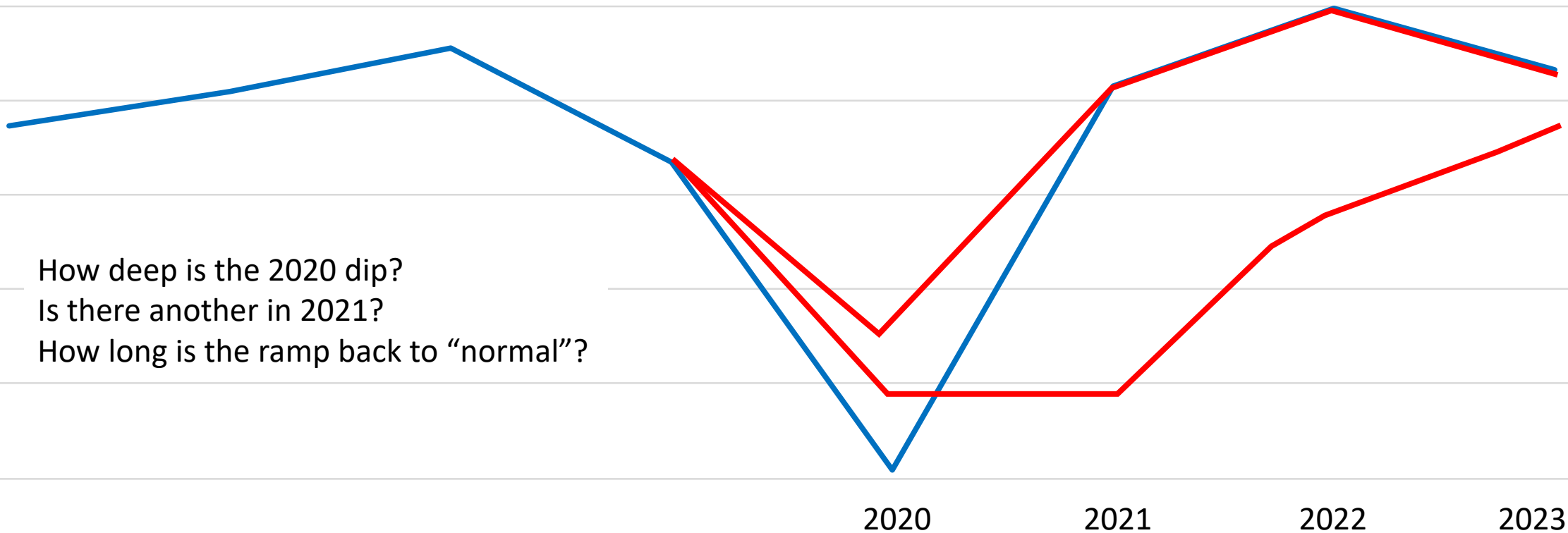
Impact of the Great Recession on PLM Revenues

Strong growth before and after 2009



Return from the COVID-19 Recession

Which scenario is more likely?



Revenues presented are CIMdata estimates

A COVID-19 Future

Will this be short-term or a long-term issue? (1 of 2)

- Globalization will take a hit, supply chain management and right-shoring will be revisited
- Travel will be slow to come back, particularly international travel
- More acceptance of remote working than today
 - Virtual collaboration tools relied on more, will they be increasing their integration with traditional PLM solutions?
- Individual financial distress will reduce buying power
- What is different this time?
 - This is a much more global phenomenon, impacting well beyond finance
 - World, value chains more interconnected than in 2009

A COVID-19 Future

Will this be short-term or a long-term issue? (2 of 2)

- The PLM Economy is different too
 - Higher levels of recurring revenue
 - Two key players rely on subscription, can help “stop the bleeding”
 - More cloud solutions available, more cloud adoption interest
 - More solutions bought online
- In some ways it is the same
 - Segments that rely on face-to-face sales, implementation will be more difficult, e.g., cPDm

Updated Market Forecasts (Q3, 2020)

For 2020 (US\$ Millions) and 5-year compound annual growth rate (CAGR)

Segment	2020 Estimate	YoY Growth	5 Year CAGR
cPDm Comprehensive Technology Providers	\$6,644.38	-0.2%	6.1%
cPDm-Focused Applications	\$2,510.89	-2.2%	4.9%
Digital Manufacturing	\$843.97	-4.8%	2.9%
SI/Reseller/VAR	\$7,724.85	-5.6%	3.0%
Tools			
MCAD Multi-Discipline	\$3,734.28	-4.9%	1.7%
MCAD Design-Focused	\$3,477.73	-1.1%	5.5%
Non-Bundled CAM	\$1,518.74	-3.6%	3.5%
Simulation & Analysis	\$7,217.23	0.6%	7.6%
Other Tools (e.g., ALM, MBSE, Quality)	\$1,622.40	-2.8%	4.6%
EDA	\$10,547.40	2.7%	7.1%
AEC	\$4,791.25	-5.6%	9.4%
Total	\$50,633.12	-1.7%	5.8%

Today's Major Trends & Potential Disruptors

A convergence of ideas, technologies, strategies, and associated complexities



Digitalization is Driving Major Engineering Trends

Investment in Simulation, Data Analytics and AI/ML to drive future Systems Development

- Product Innovation Platforms



Multi-physics S&A and cross-domain systems level simulation increasingly relevant throughout the product lifecycle to enable innovation, quality and profitability (Generative Design/Engineering)

- Modeling & Simulation Platforms



Open Platforms with 'best of breed' solutions based on standards is critical for delivering simulation value across the product lifecycle

- Model-Based Systems Engineering



Connecting VOC/requirements with systems level design, modeling and simulation across all engineering domains and thru the lifecycle

- Digital Thread & Digital Twins



IoT & data analytics technology creating new insights and use cases for simulation models in manufacturing and operations as well as design

- Smart Connected Products (IIoT, Analytics, AI/ML)



Technological advances enabling simulation and analytics use by more engineers throughout the product lifecycle into mfg and operations

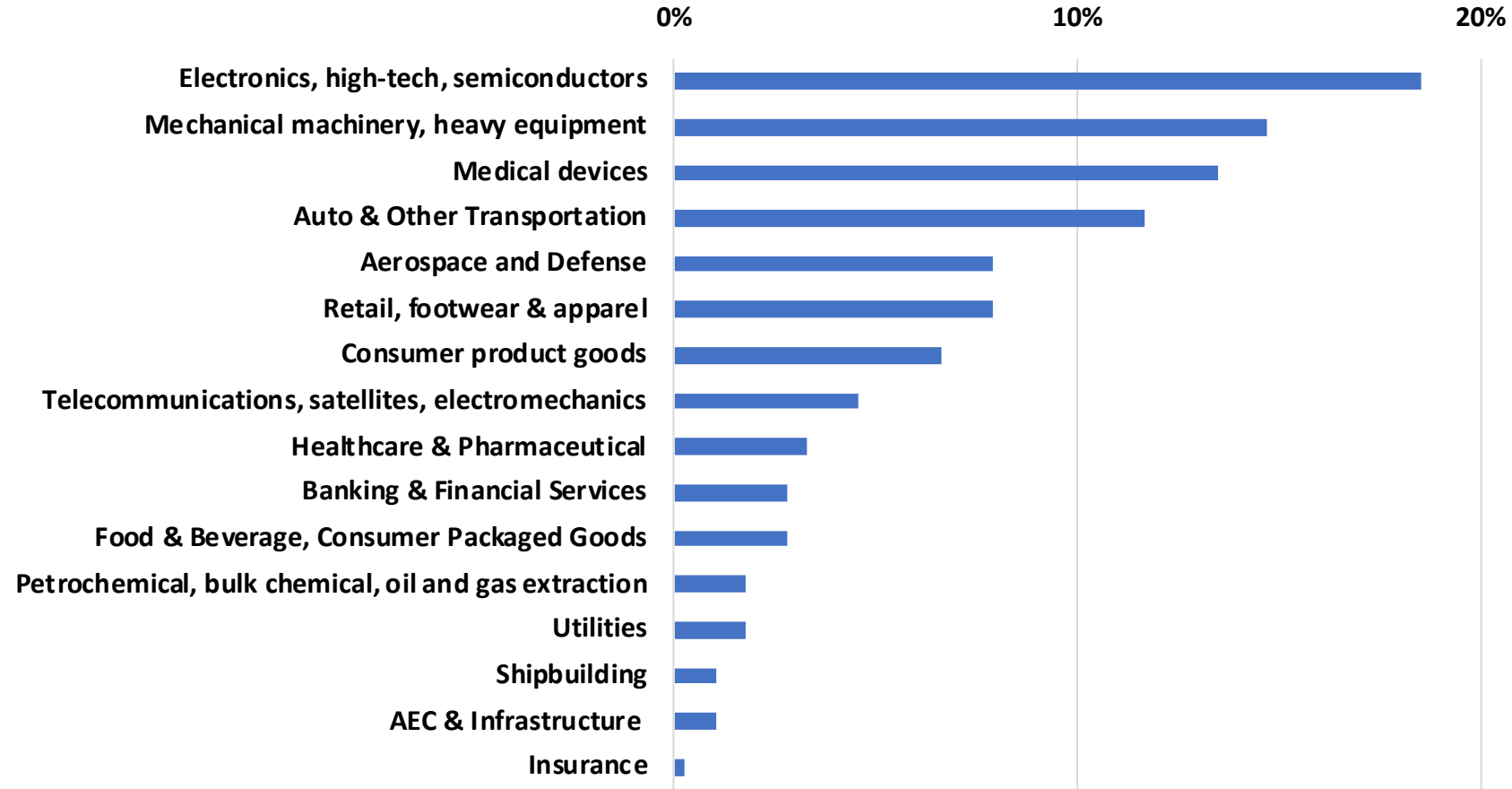
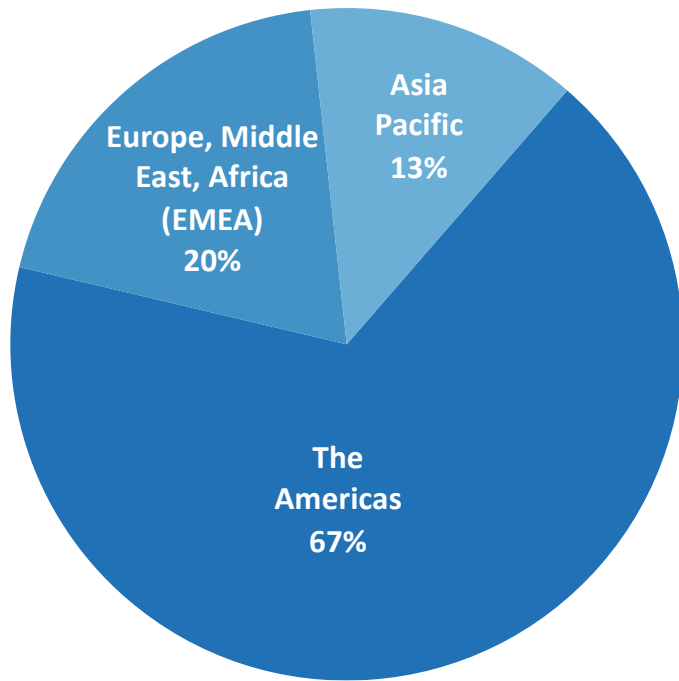
CIMdata & Altair Joint Market Survey

Conducted in the fall of 2020 to in conjunction with Altair's Global Technology event

- In the fall of 2020, CIMdata and Altair collaborated on a survey in conjunction with Altair's Technology Conference (ATC)
 - Theme of virtual event- *Technology Convergence for a Smarter, More Connected World*
- Each organization solicited respondents to a common survey on trends
- Altair solicited responses from the ATC attendees
- CIMdata used its industrial contacts and promoted the survey using traditional means (e.g., press release, social media)
- Working together the two organizations obtained over 400 usable responses from a cross section of industry, geography, company size and titles/roles

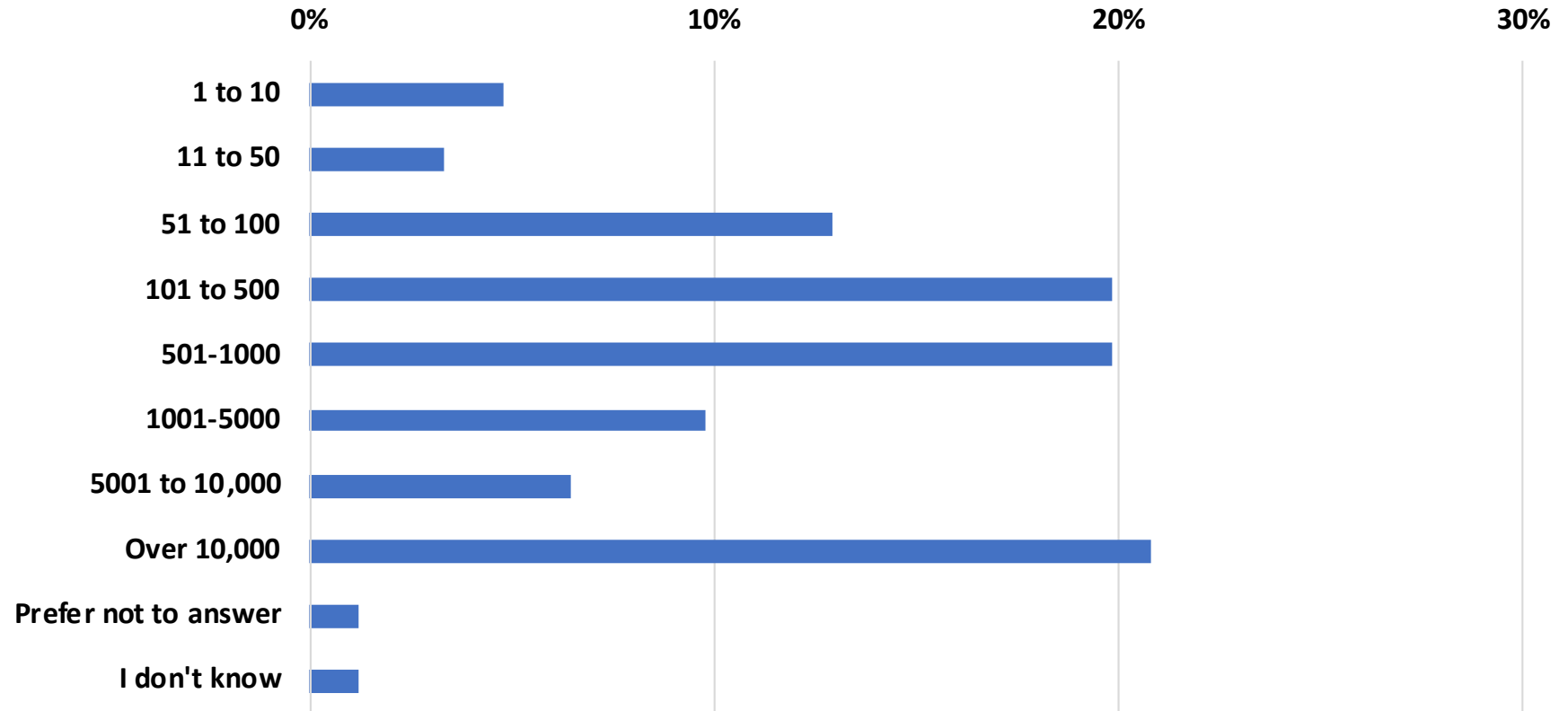
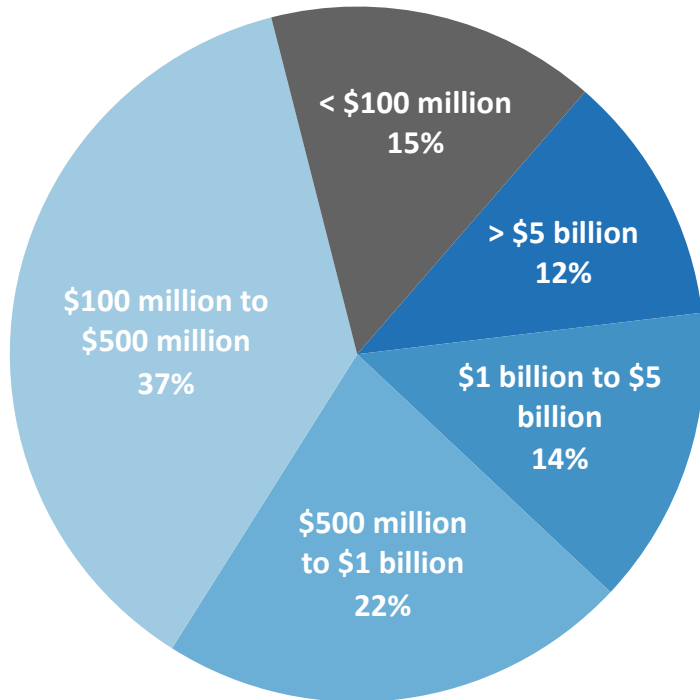
Respondent Demographics – By Geo & Industry

2020 CIMdata-Altair ATC Survey



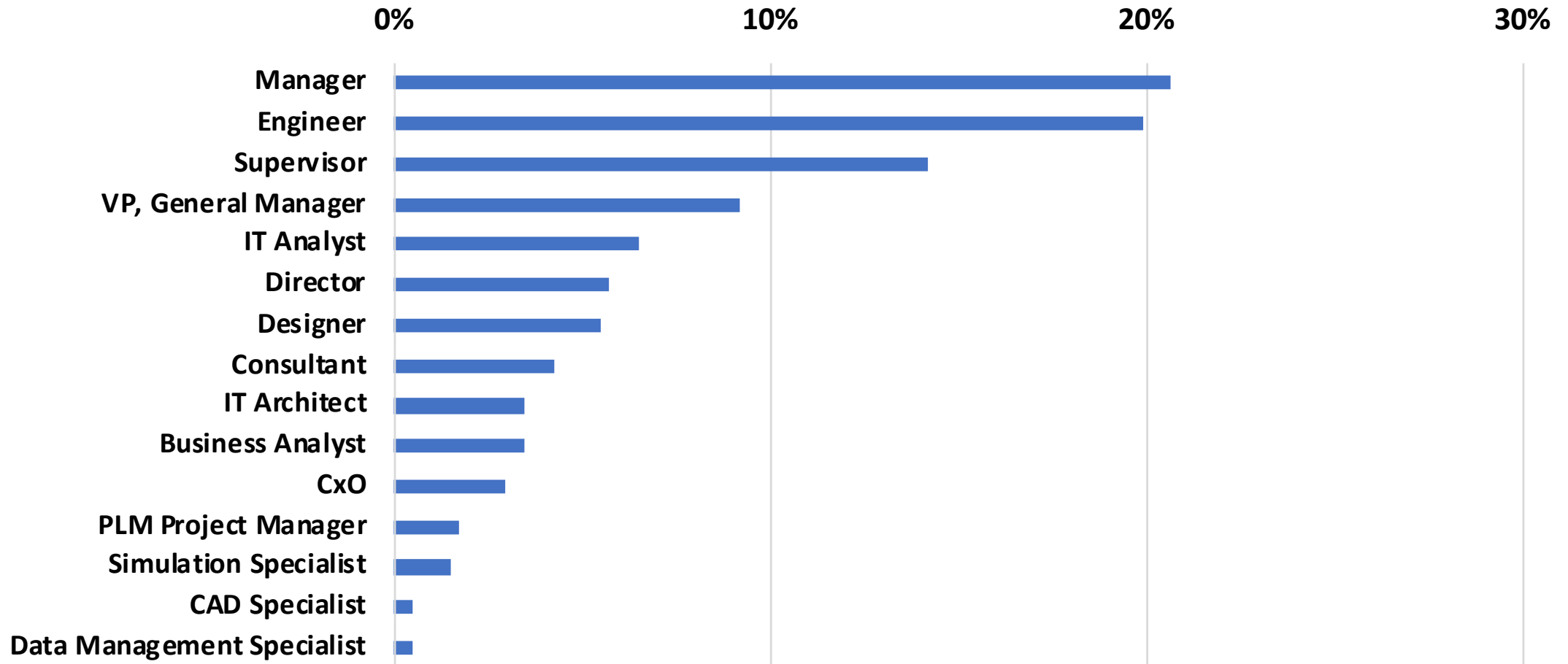
Respondent Demographics – Revenues & Employees

2020 CIMdata-Altair ATC Survey



Respondent Demographics – By Job Title

2020 CIMdata-Altair ATC Survey



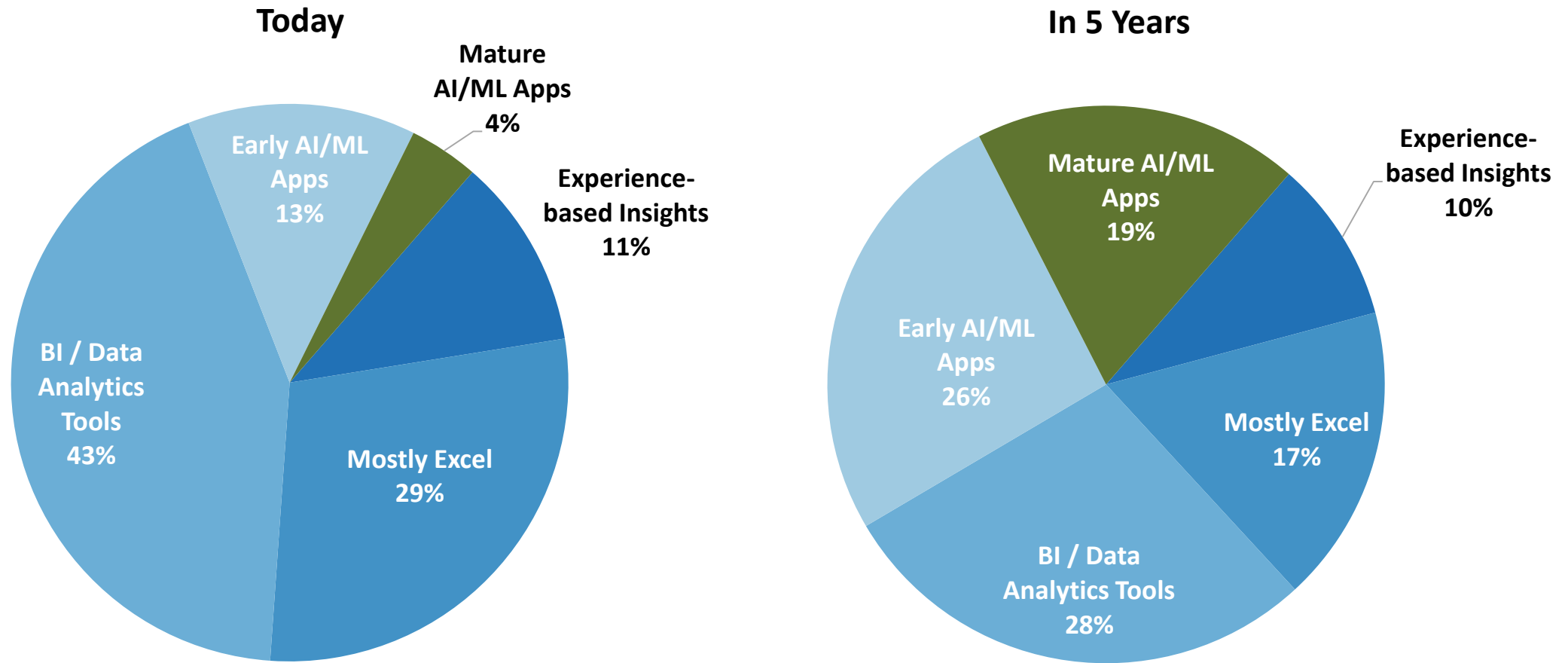
Market Trends Survey Results: Summary

2020 CIMdata-Altair ATC Survey

- The survey results were analyzed for the entire data set as well as by the title of the participants grouped into a management role (45% of total) vs. a technical end user role (55% of total).
- A summary of the market survey results is broken down into 5 major areas:
 - Impact of Data Analytics, AI and Machine Learning
 - Cloud Utilization
 - Adoption of Digital Twins
 - Impact of Smart, Connected Products and IoT on Product Development
 - Impact of the COVID-19 pandemic
- Overall results were analyzed separately for both groups to identify any significant differences in each of the 5 major areas

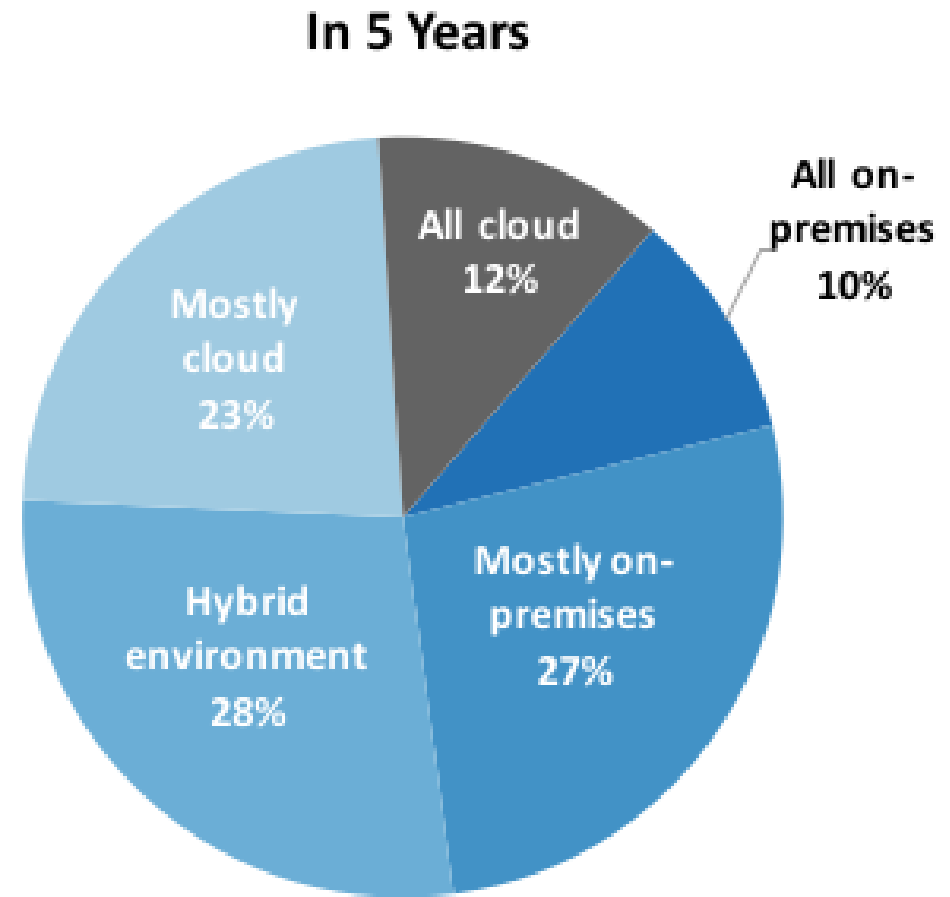
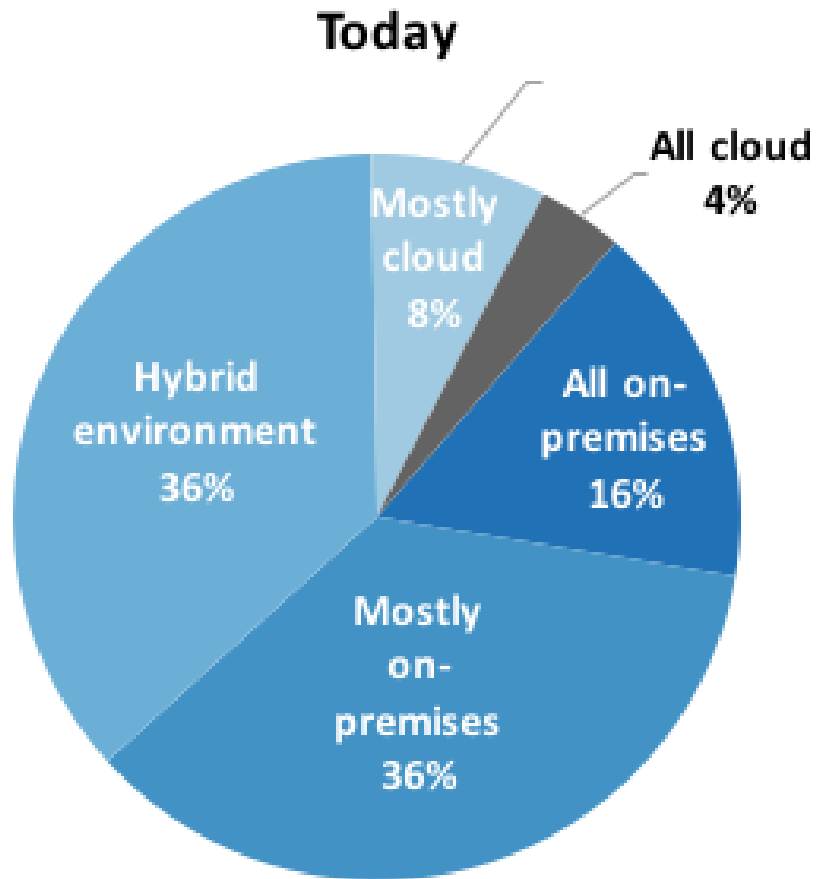
What will be key drivers to impact decision making?

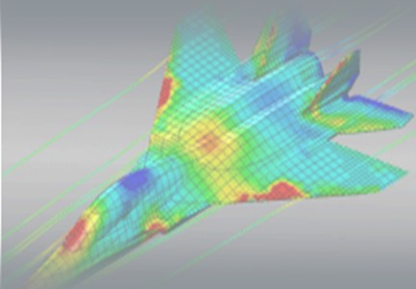
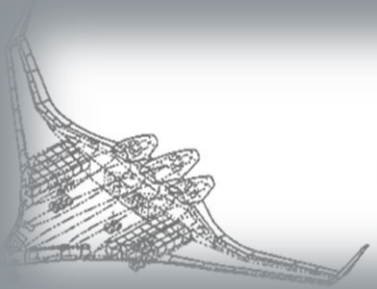
BI/Data Analytics, AI /Machine Learning, Experience, Excel



Cloud Utilization

Where is your company in the use of Cloud applications for engineering?





Concept

Design

Manufacturing

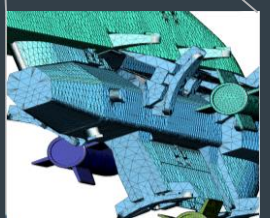
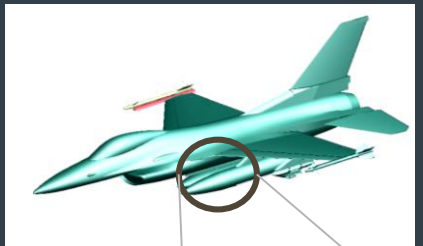
Operation

Post Life

Retirement

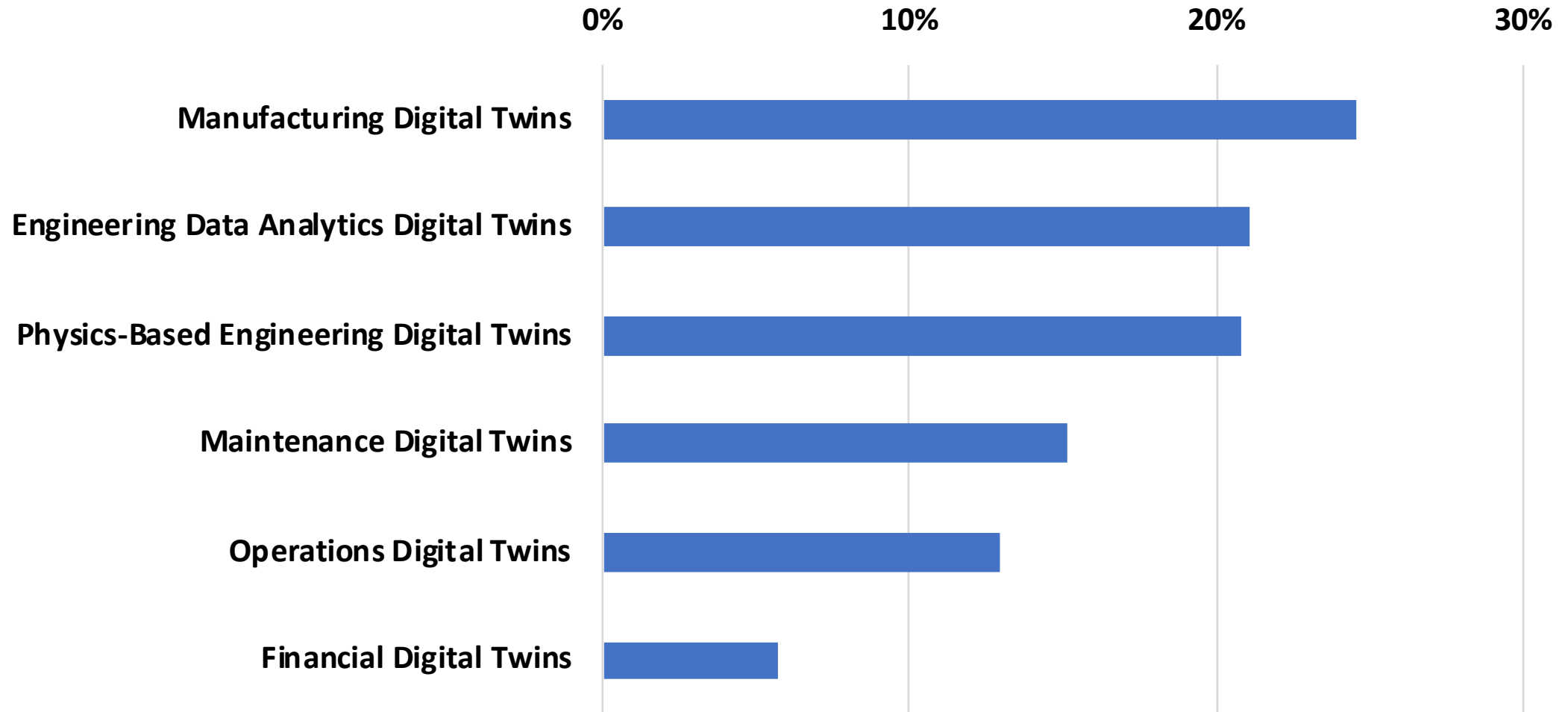
“A Digital Twin is a set of **virtual information constructs** that **mimics the structure, context, and behavior** of an **individual/unique physical asset**, is **dynamically updated** with data from its physical twin **throughout its lifecycle**, and **informs decisions that realize value**”

- AIAA Digital Twin Subcommittee, SciTech 2020



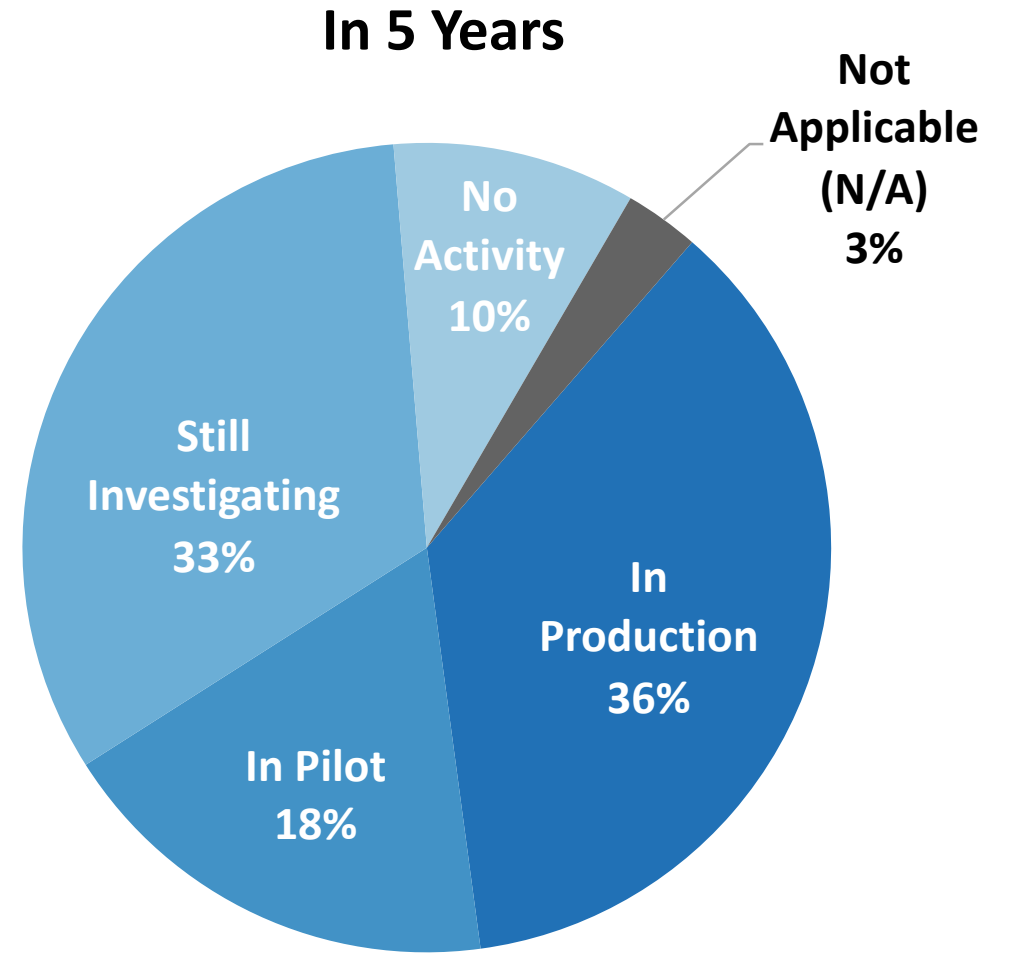
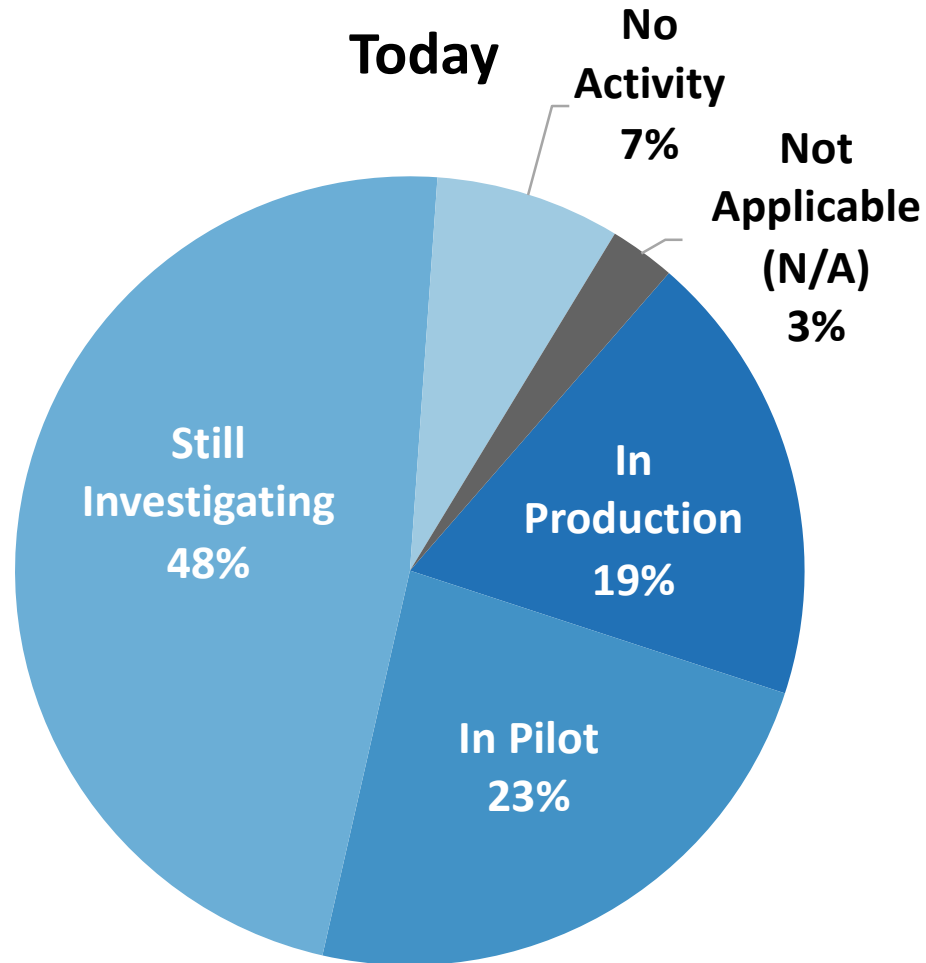
Adoption of Digital Twins

Expected areas for application for digital twin technologies - Next 5 years (All participants)



Adoption of Digital Twins

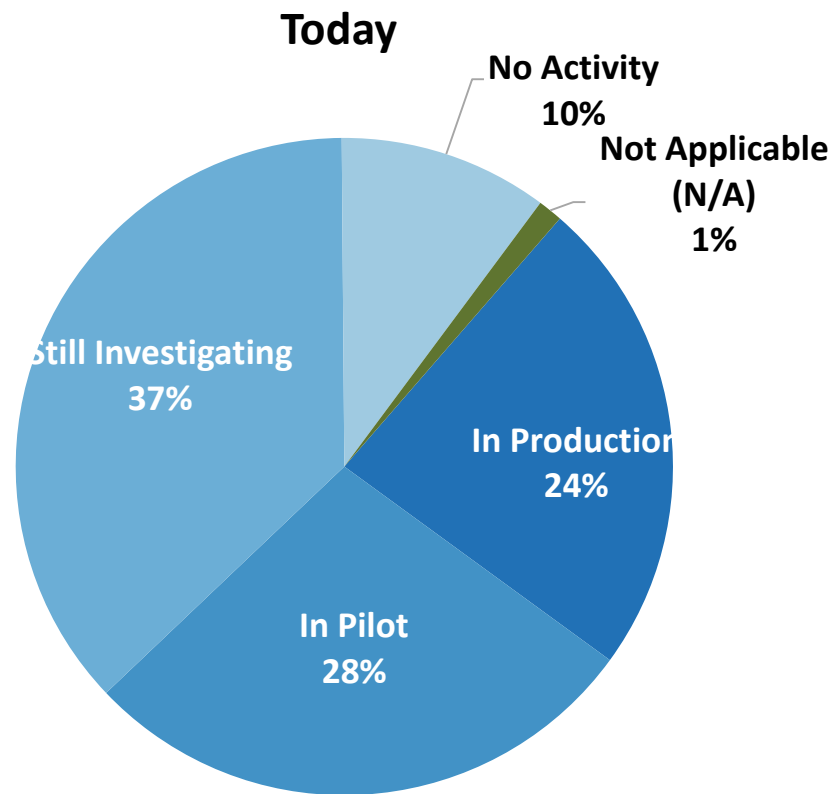
Where is your company in the implementation of digital twin technology?



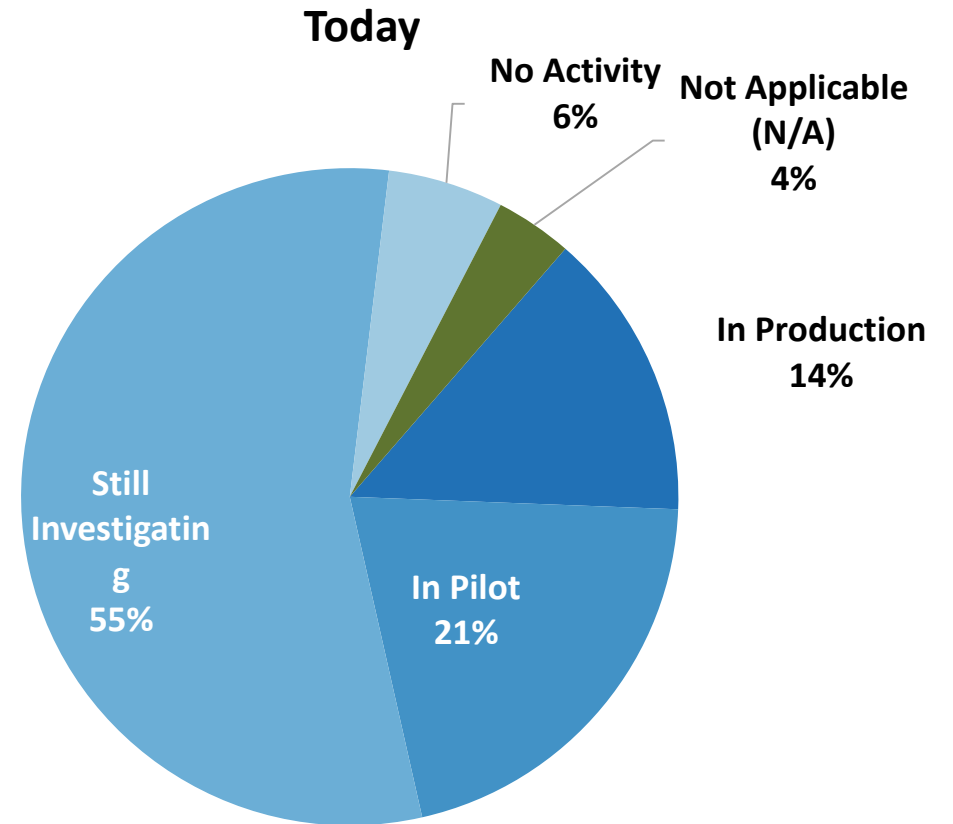
Adoption of Digital Twins

Management more optimistic than users

Management Assessment



Technical Specialist/ User Assessment

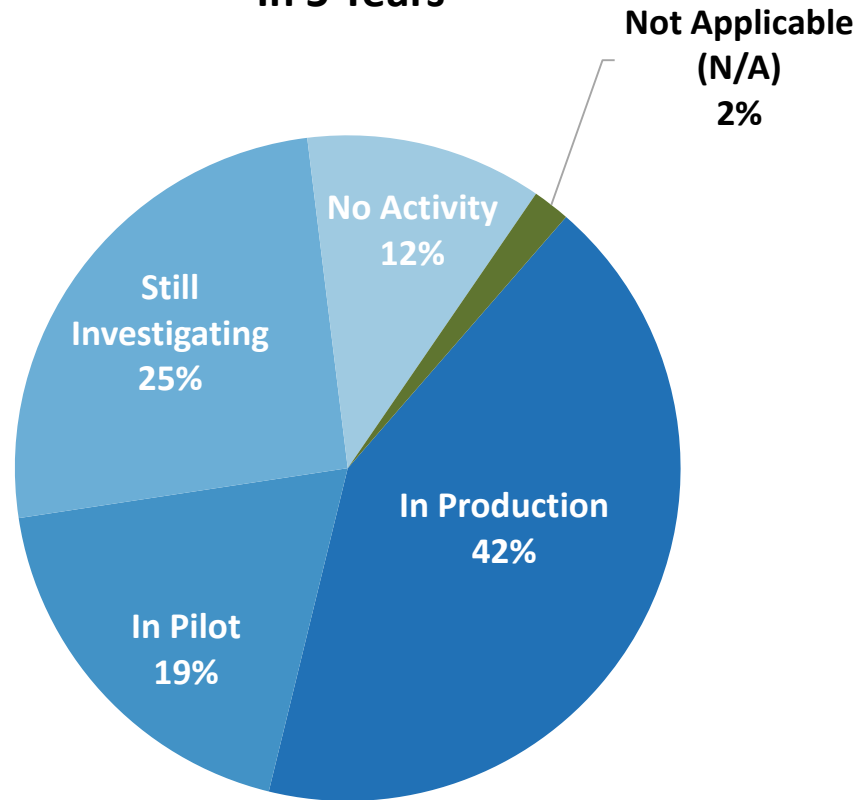


Adoption of Digital Twins

Management more optimistic than users

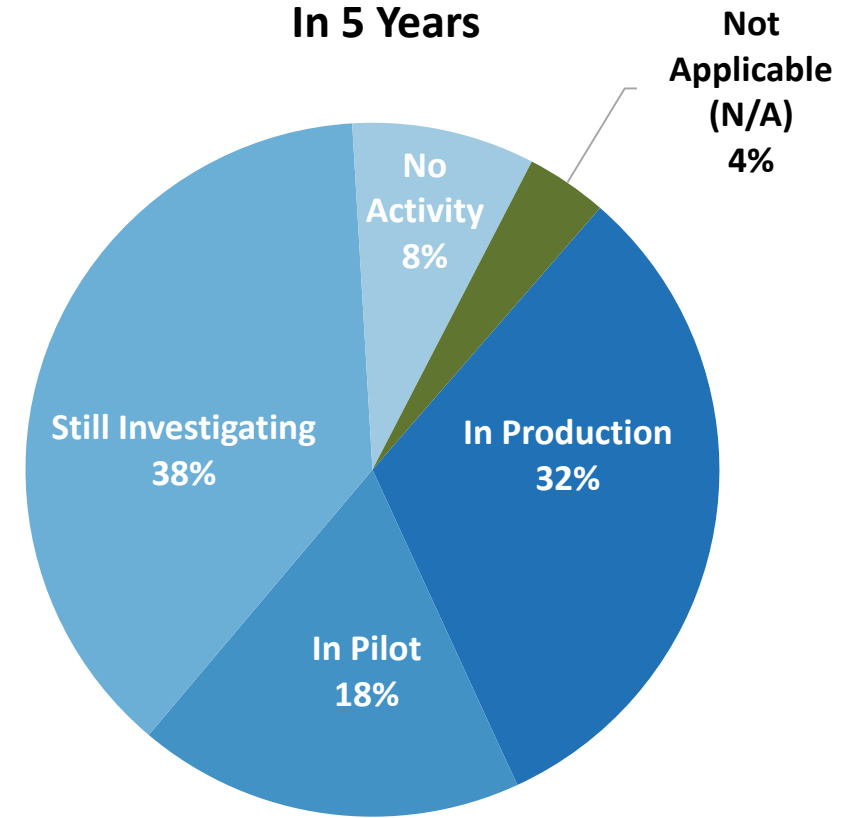
Management Forecast

In 5 Years



Technical Specialist/ User Forecast

In 5 Years

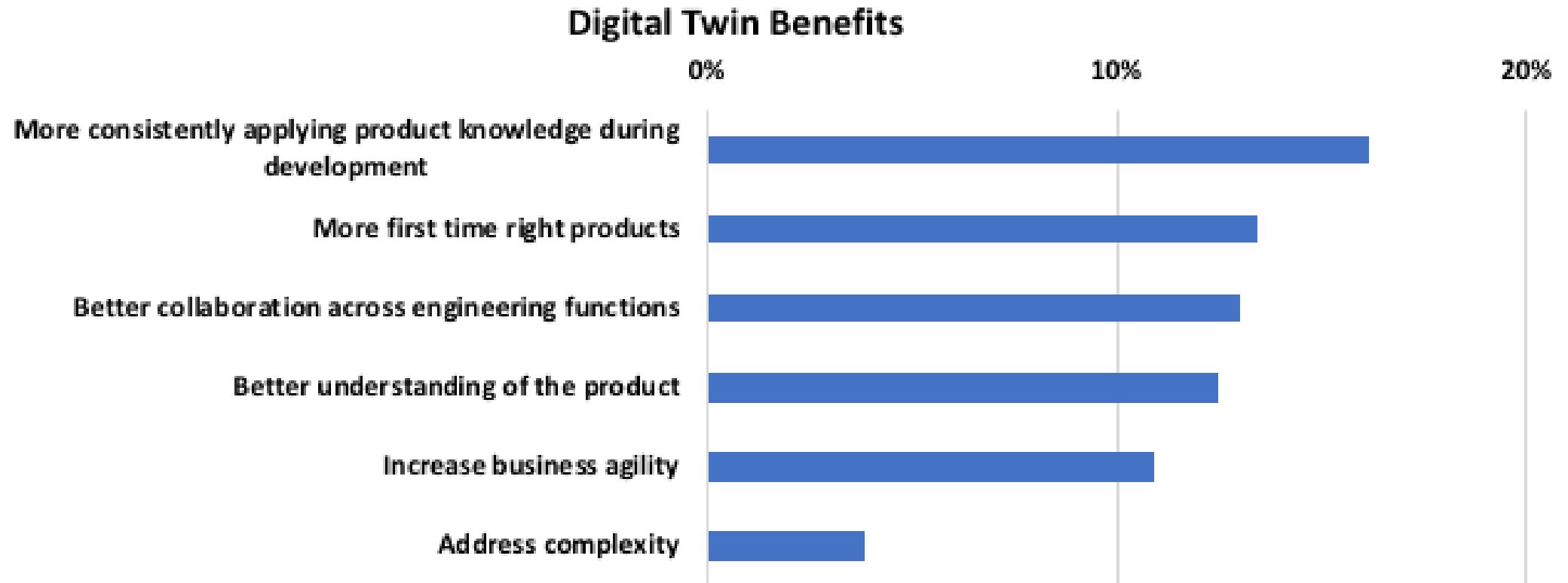


Adoption of Digital Twins

Expected benefits from digital twins - Next 5 years (All participants)

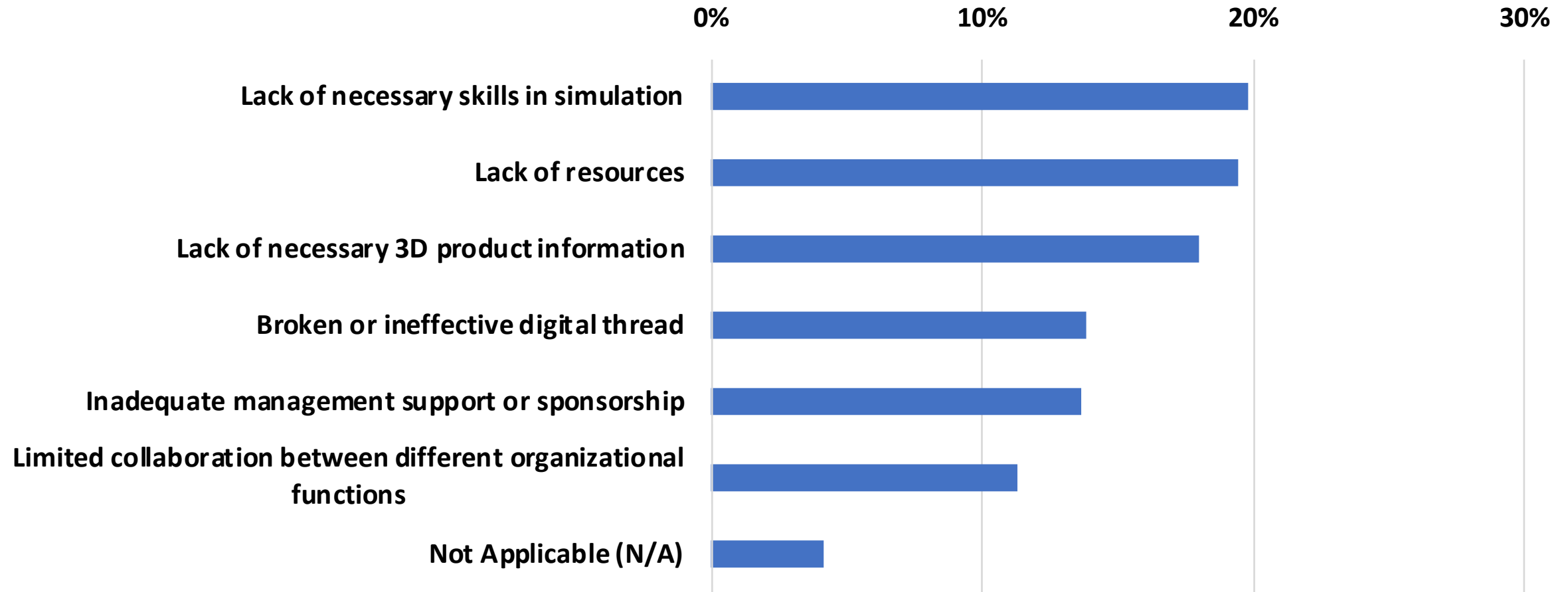
Benefits from utilizing Digital Twins

Applying product knowledge and product team collaboration helps yield more “first time right” products



Adoption of Digital Twins

Expected roadblocks to digital twin adoption - Next 5 years (All participants)

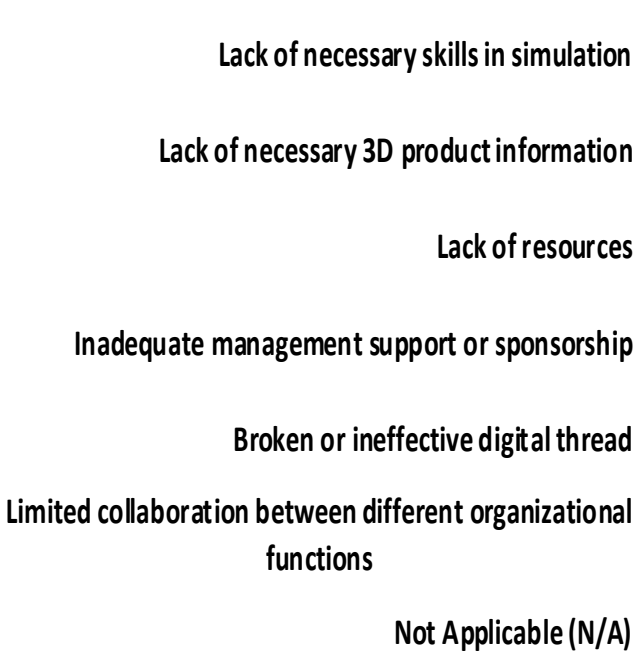


Expected Digital Twin Roadblocks

Again, management view a bit different than end users

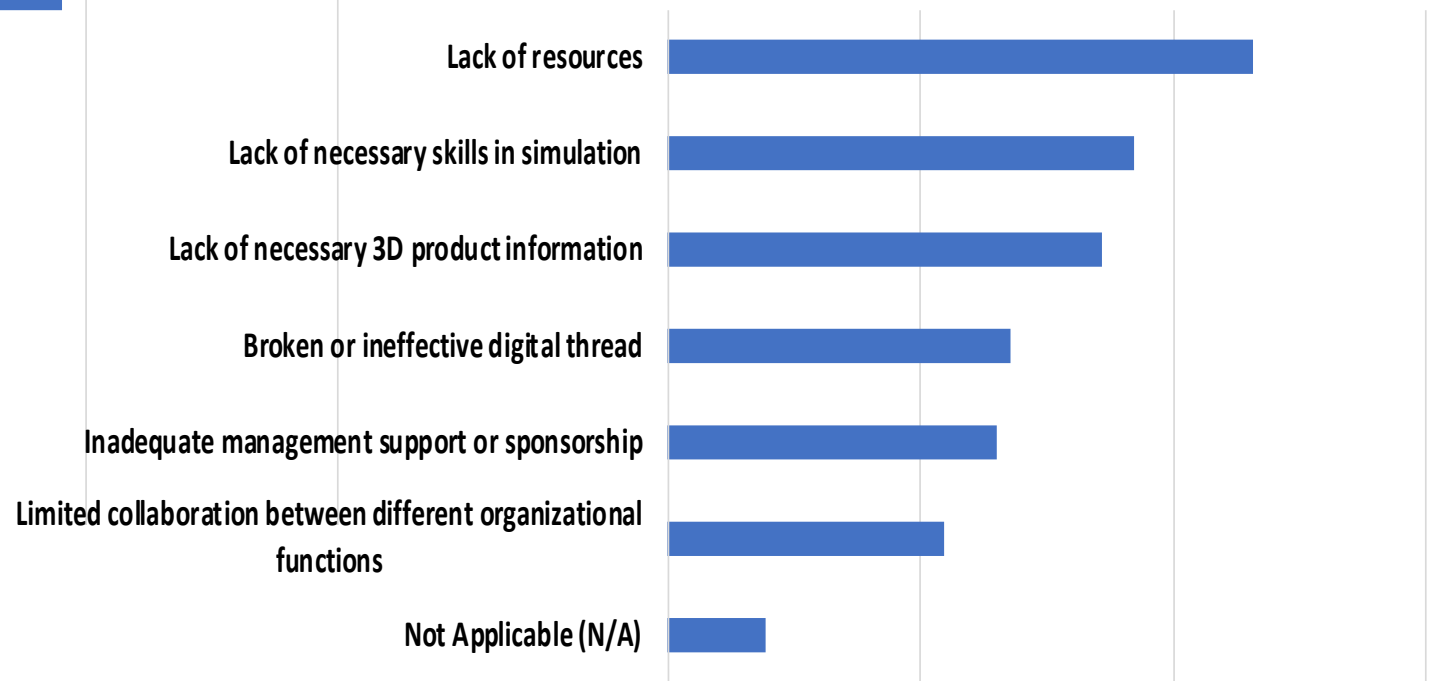
Digital Twin Roadblocks - Management

0% 10% 20% 30%



Digital Twin Roadblocks - End Users

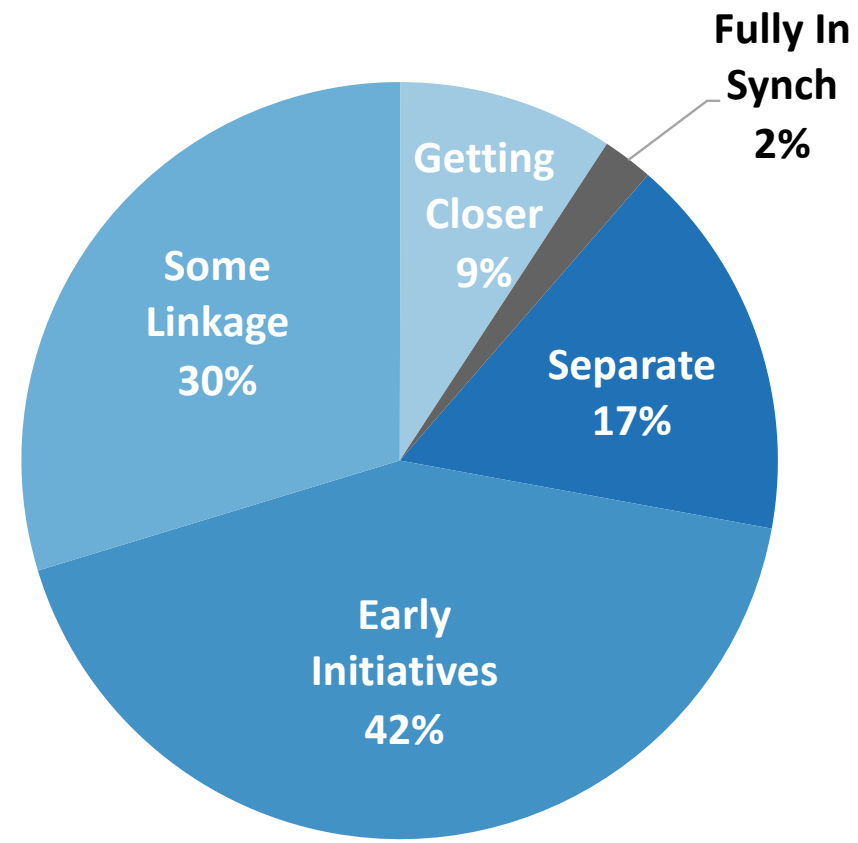
0% 10% 20% 30%



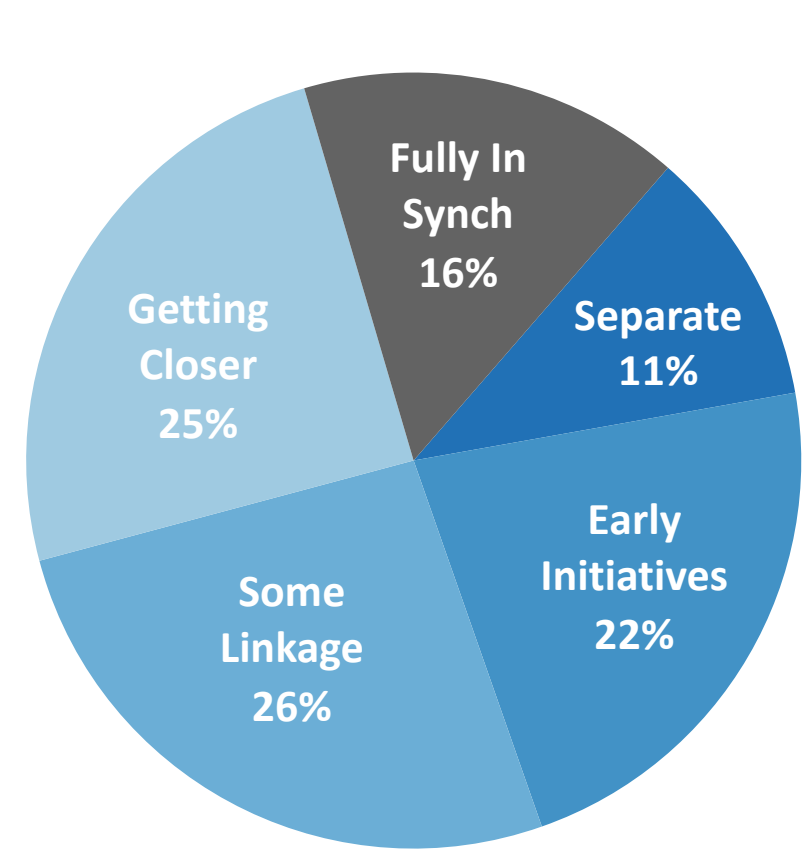
Linkage Between IT and Operations Technologies

How well aligned are your IT & OT systems to enable digital twin initiatives?

Today

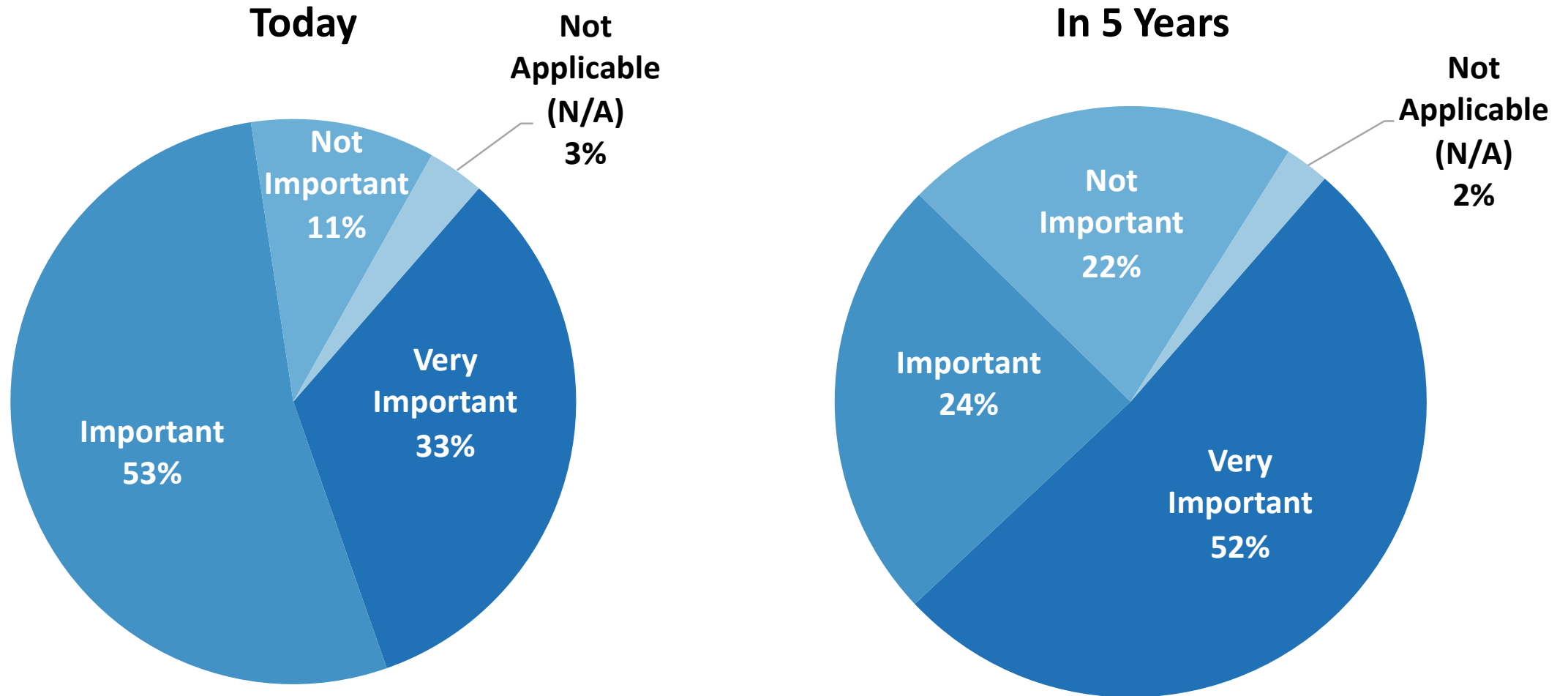


In 5 Years



Linkage Between Product and IoT Strategy

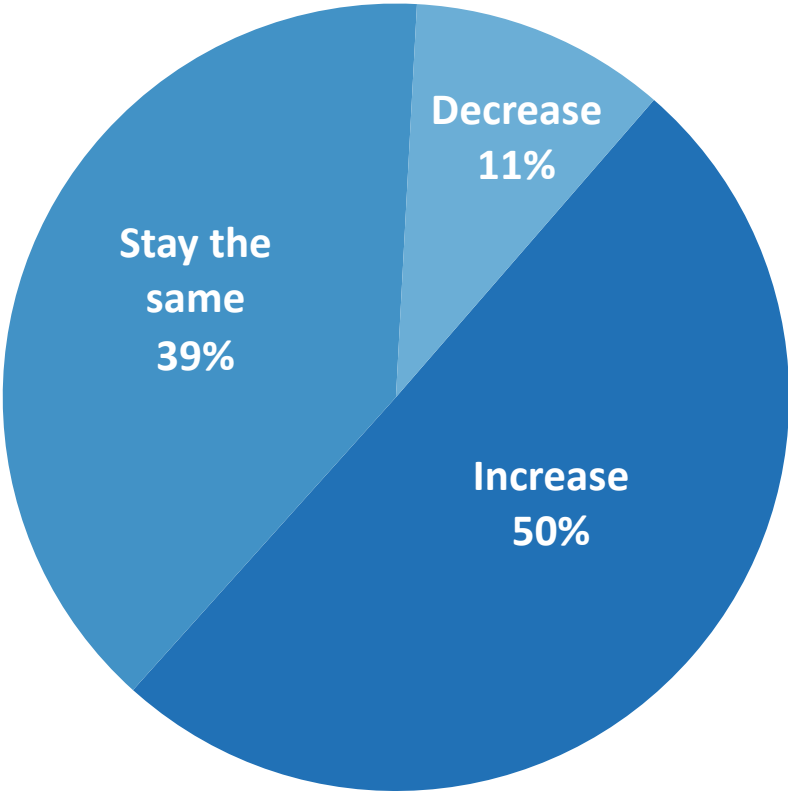
How well aligned are your product development activities to company IoT strategy?



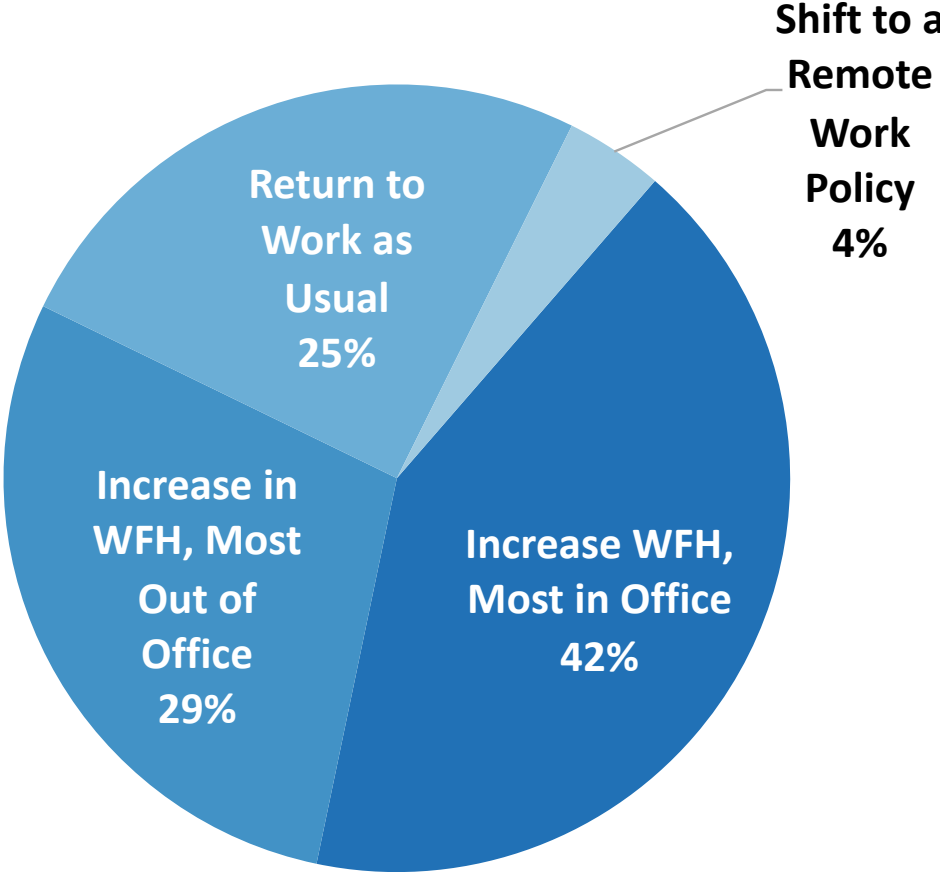
Impact of the COVID-19 Pandemic

IT budgets & WFH expected to increase after pandemic subsides

COVID-19 and IT Budgets

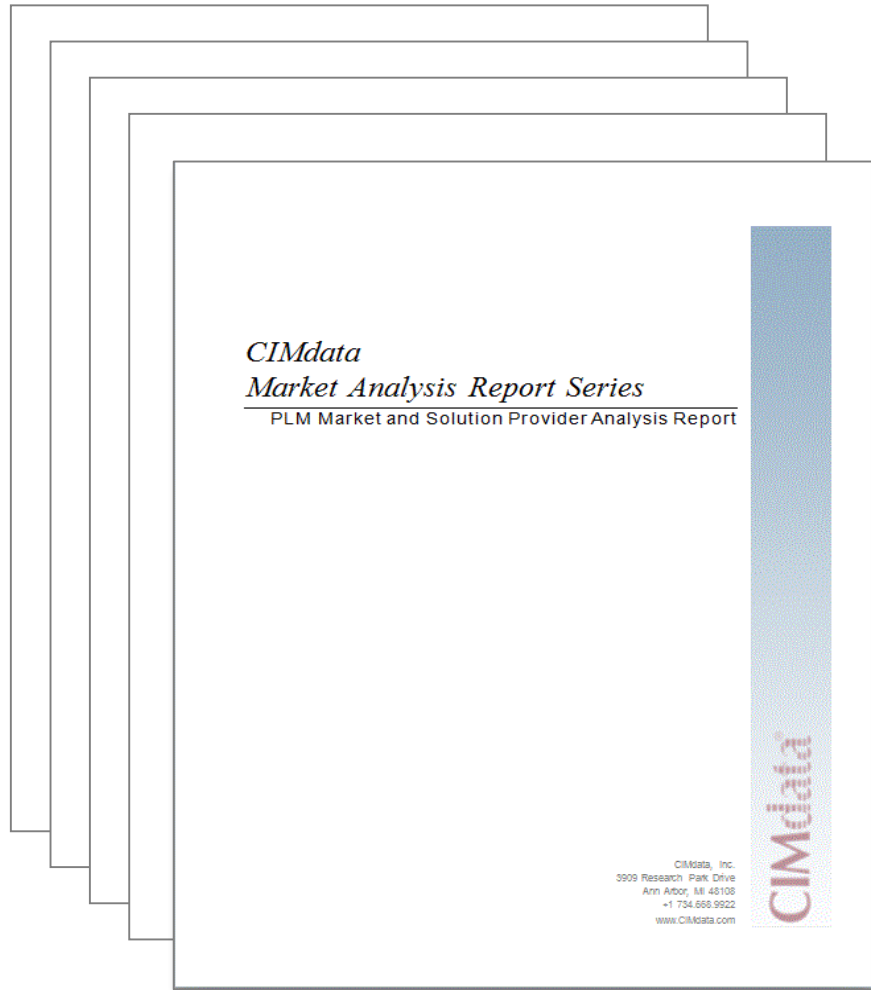


Future Work Locations



The CIMdata PLM Market Analysis Reports

Major PLM Foresight deliverables, a growing MAR series



- CIMdata PLM Market Analysis Report
 - CIMdata Executive PLM Market Report
 - CIMdata PLM Industry Review and Trends Report
 - CIMdata PLM Market and Solution Provider Analysis Report
 - CIMdata PLM Market Geographic Analysis Report
 - CIMdata PLM Market Industry Analysis Report
- Country reports for the Brazil, China, Germany, India, Japan, Russia, South Korea, Italy, United Kingdom, France, and the United States
- CAM MAR (28th year)
- Simulation & Analysis (S&A) MAR

CIMdata

Strategic consulting for competitive advantage in global markets

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