



# TECHNOLOGY CONVERGENCE FOR A **SMARTER**, MORE **CONNECTED** WORLD: MARKET TRENDS TO 2025

2020 Survey Report by CIMdata and Altair

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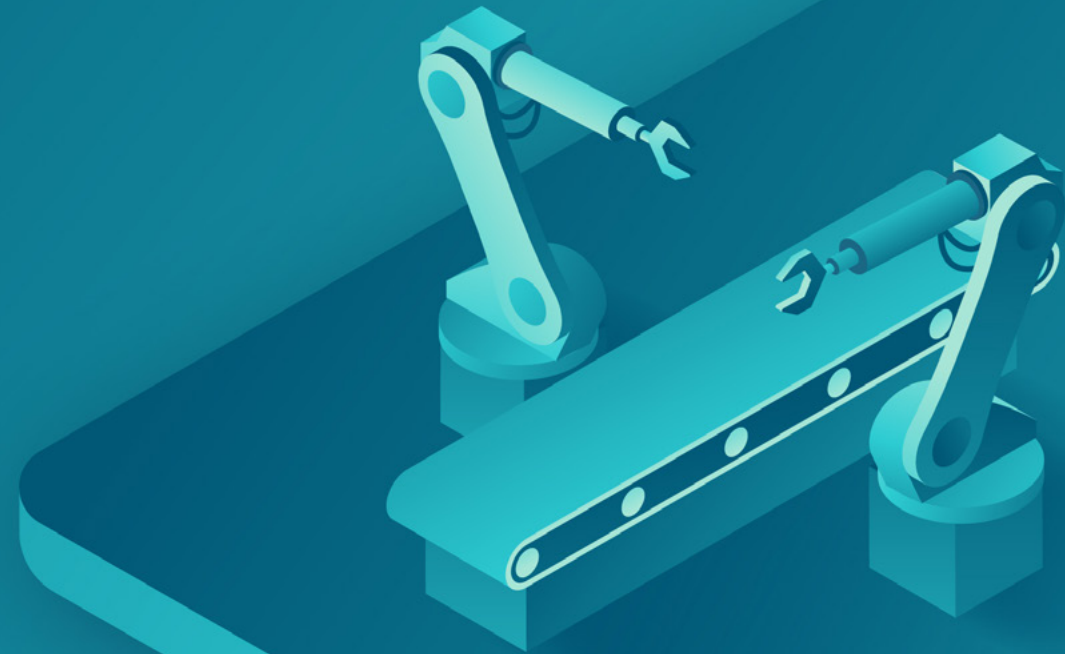
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# INTRODUCTION

Manufacturing enterprises are facing many new business and product development challenges that require changes in long-established business practices and engineering processes to remain competitive and viable in today's globally connected environment.

In conjunction with Altair, CIMdata developed and conducted a market research survey. Besides gathering background information on the respondents (title/role, industry, geography, size of company by revenues, number of employees, number of engineers), the survey posed questions covering the individual's perspective on the current and future adoption of key technologies across the engineering product lifecycle such as AI/ML, predictive analytics, physics-based simulation, and digital twins. The impact of the COVID-19 pandemic on business practices was also explored.

# INTRODUCTION

Approximately 400 survey responses were received and analyzed. 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%) vs. a technical end user role (55%). As anticipated, the background information responses were weighted towards the Americas (67%) and EMEA (20%) but the responses by industry segment and size of organization were in line with the overall engineering software industry profile based on CIMdata's experience with performing similar PLM market surveys for many years.

## Trends for the Next 25 Years

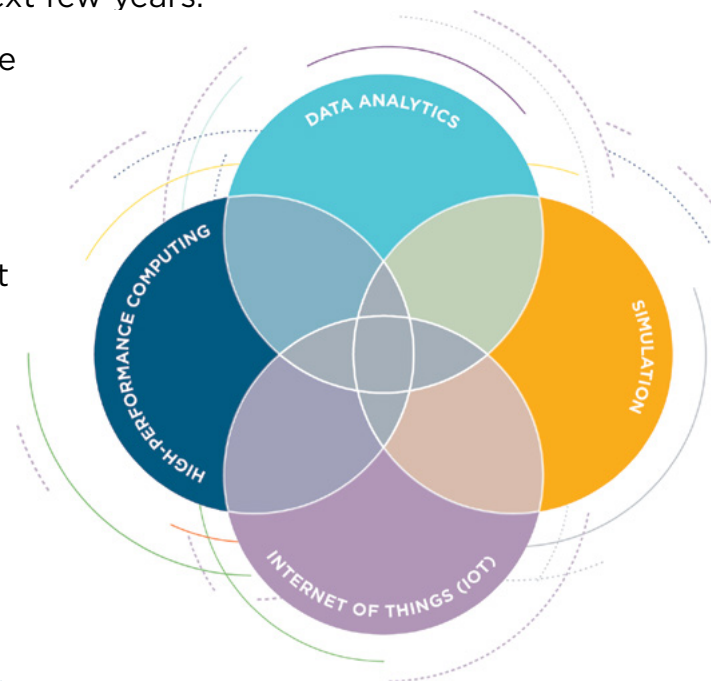
- ▶ Enterprise level digital transformation and digital thread business initiatives to enable new product innovation and product quality while also reducing time to revenues and total product lifecycle costs including in-service operations.
- ▶ New business challenges and revenue opportunities in the context of Industry 4.0 and the emergence of physics-based digital twins being applied to manufacturing, operator training, and in-service operations.
- ▶ New generative design approaches driven by the availability of advanced manufacturing processes (both additive and subtractive) and new hybrid materials enable the creation of innovative and highly cost-efficient products.
- ▶ The continued rapid expansion in the global availability of affordable and scalable computing resources and associated product development software solutions for the engineering desktop, in the cloud, and in HPC environments.
- ▶ Increasing product complexity of “smart connected” cyber-physical systems (hardware, electronics, software, sensors, controls, biological/chemical, etc.).
- ▶ The design and development of such complex “smart systems” requires integrated multi-disciplinary capabilities for cross-domain design, simulation, analysis, test, and optimization augmented by big data analytics and AI/ML.



# KEY FINDINGS

Altair is leading the way to address the convergence of Data Analytics, Simulation, HPC & Cloud, and IoT. Enabling organizations in nearly every industry to compete more effectively in a connected world, while creating a more sustainable future.

- ▶ Hybrid cloud - a combination of private cloud and public cloud services - will be the predominant platform for data analytics and simulation in five years.
- ▶ Management expects the use of AI/ML for decision making to triple throughout organizations in five years.
- ▶ The number of digital twins in production will almost double in five years.
- ▶ Information Technology (IT) and Operational Technology (OT) infrastructures will see a massive increase in alignment over the next few years.
- ▶ The #1 anticipated benefit of digital twins is to more consistently applying product knowledge during development, the #1 roadblock is lack of necessary skills in simulation.
- ▶ Within five years three-quarters of manufacturing companies will offer IoT services as a very important part of their mainstream product offering.
- ▶ Half of manufacturing organizations increased IT projects during the COVID-19 pandemic
- ▶ Two-thirds of organizations intend for the majority of their company to be back in the office again, but foresee a significant increase in working from home(WFH).



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# SURVEY RESULTS

A summary analysis of the technology trend results and selected charts are provided in the following pages. We have highlighted those areas where the results were significantly different between the management level and technical end user groups.

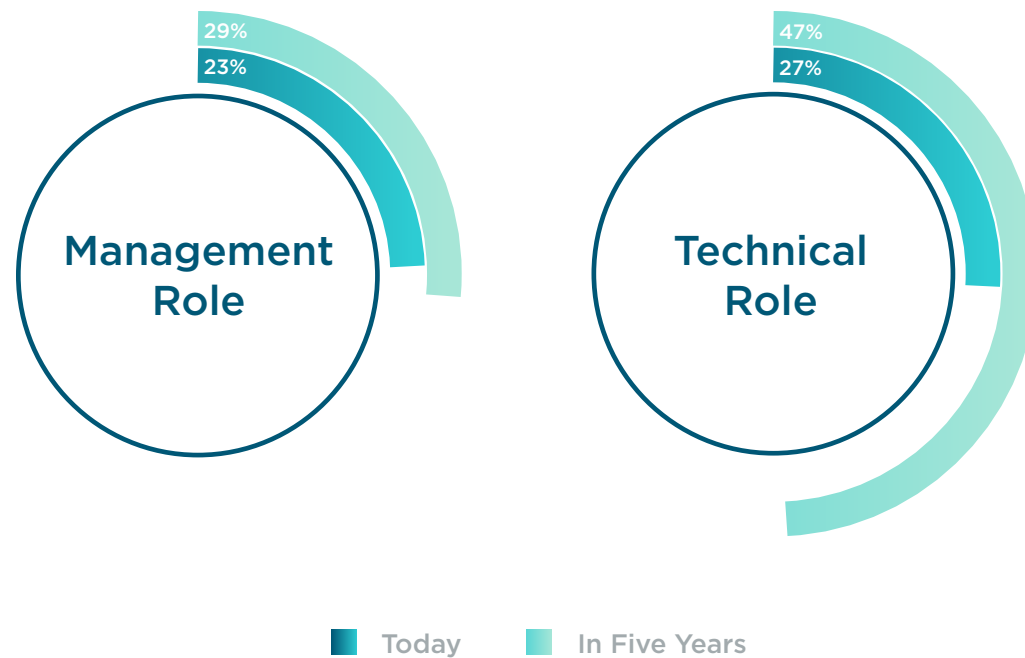
Since the global pandemic has profoundly impacted our world during 2020, we'll address those results as well. While there were some differences in opinion between management and technical staff, 50% of the respondents in both groups believed that the COVID-19 pandemic will lead to an overall increase in IT projects and budgets. Two-thirds of both groups felt that when the pandemic subsides, the majority of their company will work in the office again, albeit with a significant increase in the percentage of effort WFH.

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# Hybrid Cloud - a combination of private cloud and public cloud services – will be the predominant platform for data analytics and simulation in five years.

29% of management believes that a hybrid environment will be the predominant platform. While 47% of technical roles believe that a hybrid environment will be the predominant platform. That is a **75% increase** in adoption predicted by those in a technical role.

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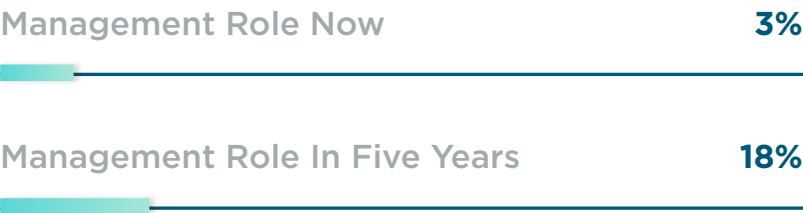
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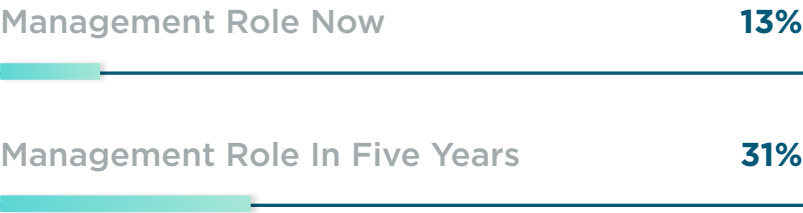
# Management expects the use of AI/ML for decision making to triple throughout organizations in five years.

Management believes their organization will increase the use of AI/ML for decision making by 33% between early and mature applications in the next five years. Shifting from mainly using mostly Excel and BI/Data analytics tools.

## Mature AI/ML Apps



## Early AI/ML Apps



3x

as many AI/ML applications in the next five years.



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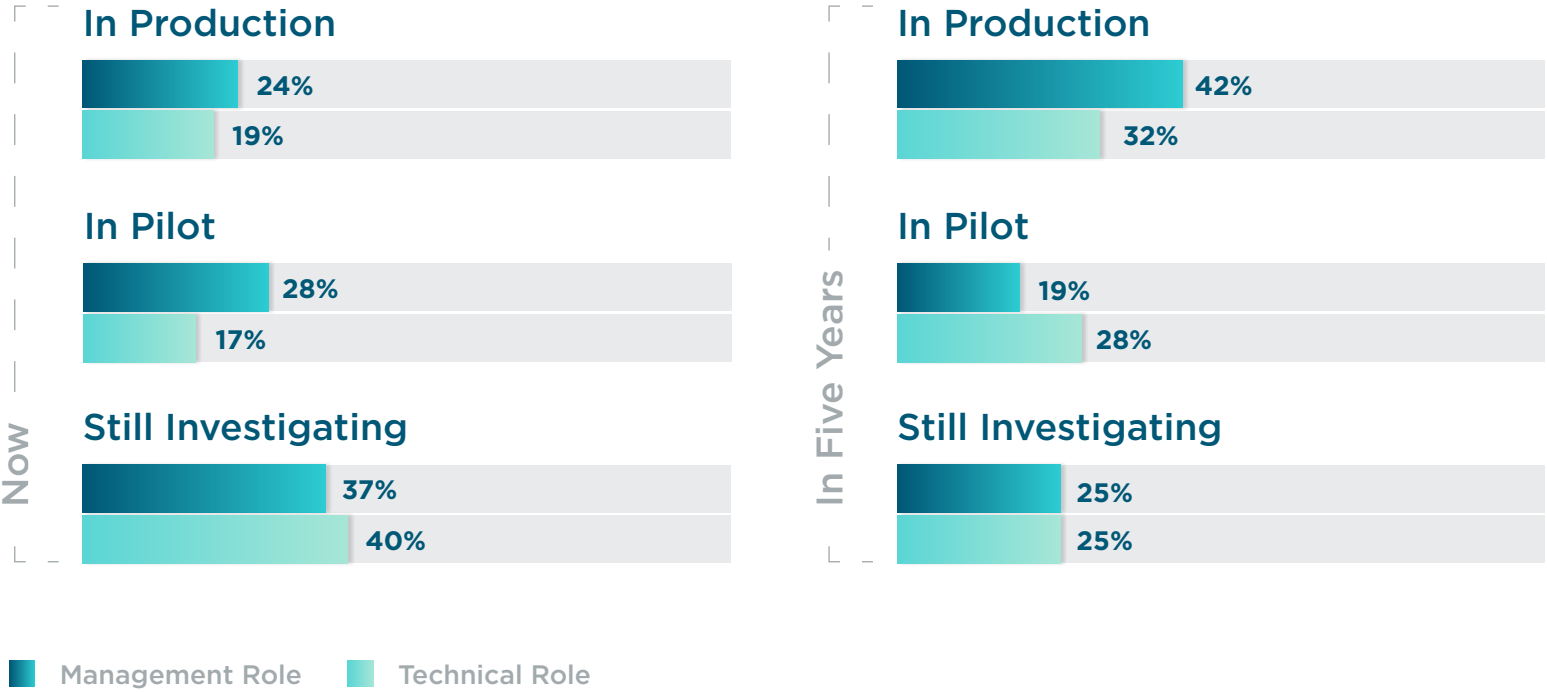
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# The number of digital twins in production will almost double in five years.

Digital twins have applications across the product lifecycle, from helping companies understand product behavior early in the lifecycle to understanding product behavior in the field. Overall management and the technical role predict an increase of “in production” digital twins.



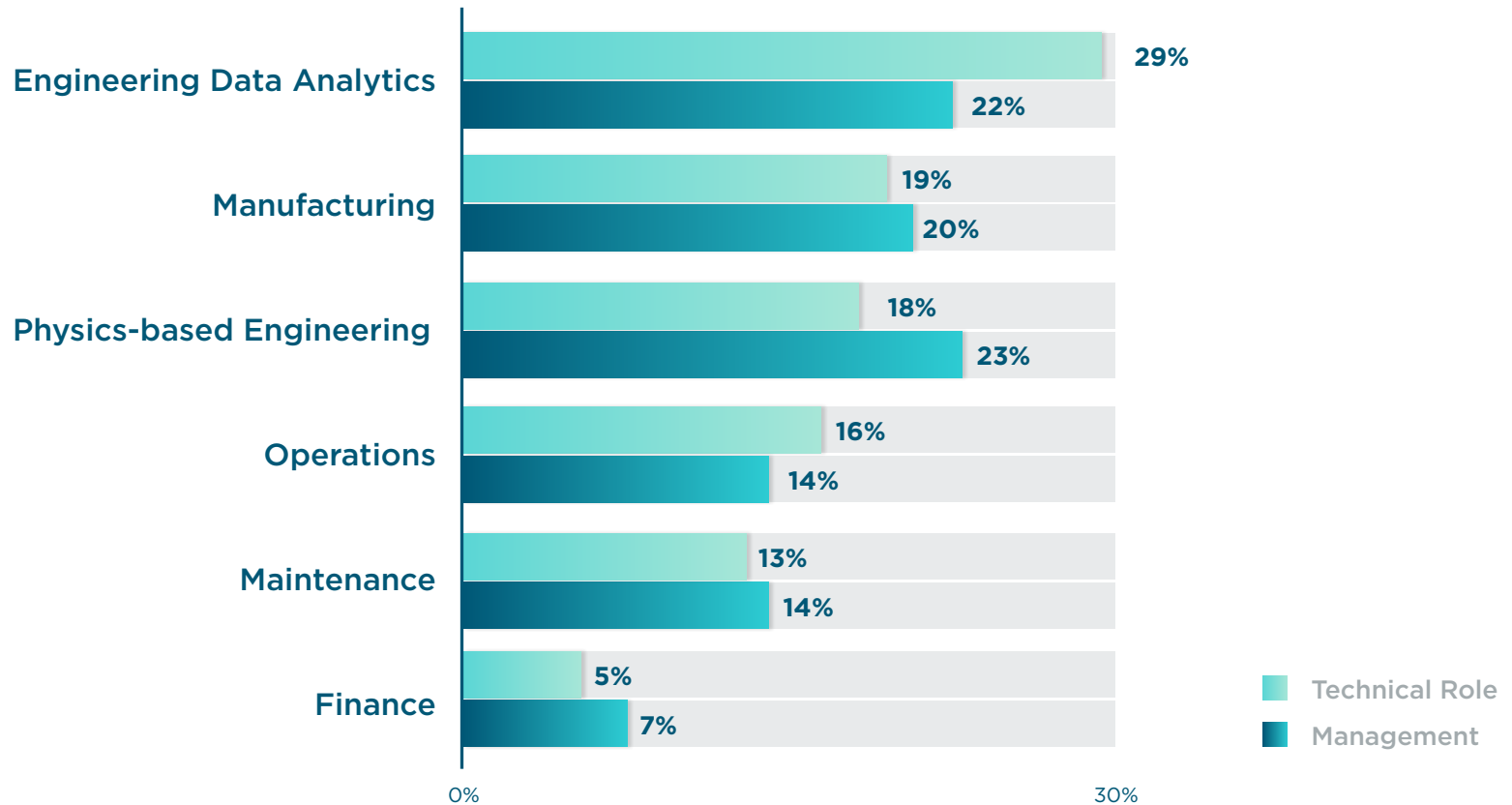
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# Types of digital twins that management and technical roles believe organizations will be pursuing in the next five years.

Technical roles are more optimistic of the implementation of digital twins within engineering data analytics, **7% more** than management expects.

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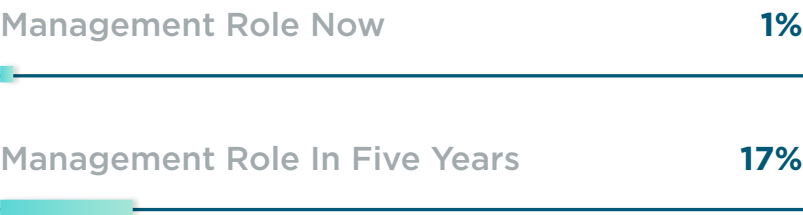
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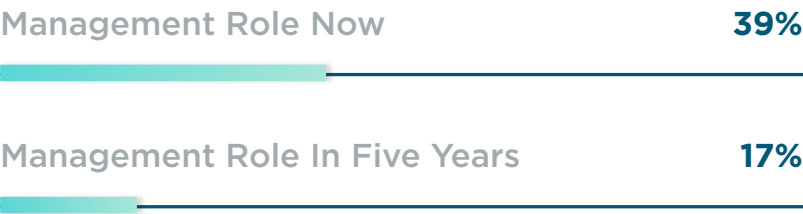
# Information Technology (IT) and Operational Technology (OT) infrastructures will see a massive increase in alignment over the next few years.

In order to drive digital twin initiatives forward management predicts a 17x increase in alignment between their IT and OT systems to be fully in sync.

## Fully in Sync



## Early Initiatives



17x

increases in alignment between IT and OT infrastructures.

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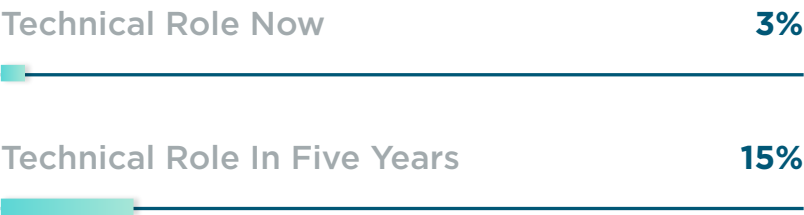
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# Technical roles perspective for the next few years on how Information Technology (IT) and Operational Technology (OT) infrastructures will shift.

5x

increase in a fully in sync IT and OT system for digital twin initiatives.

## Fully in Sync



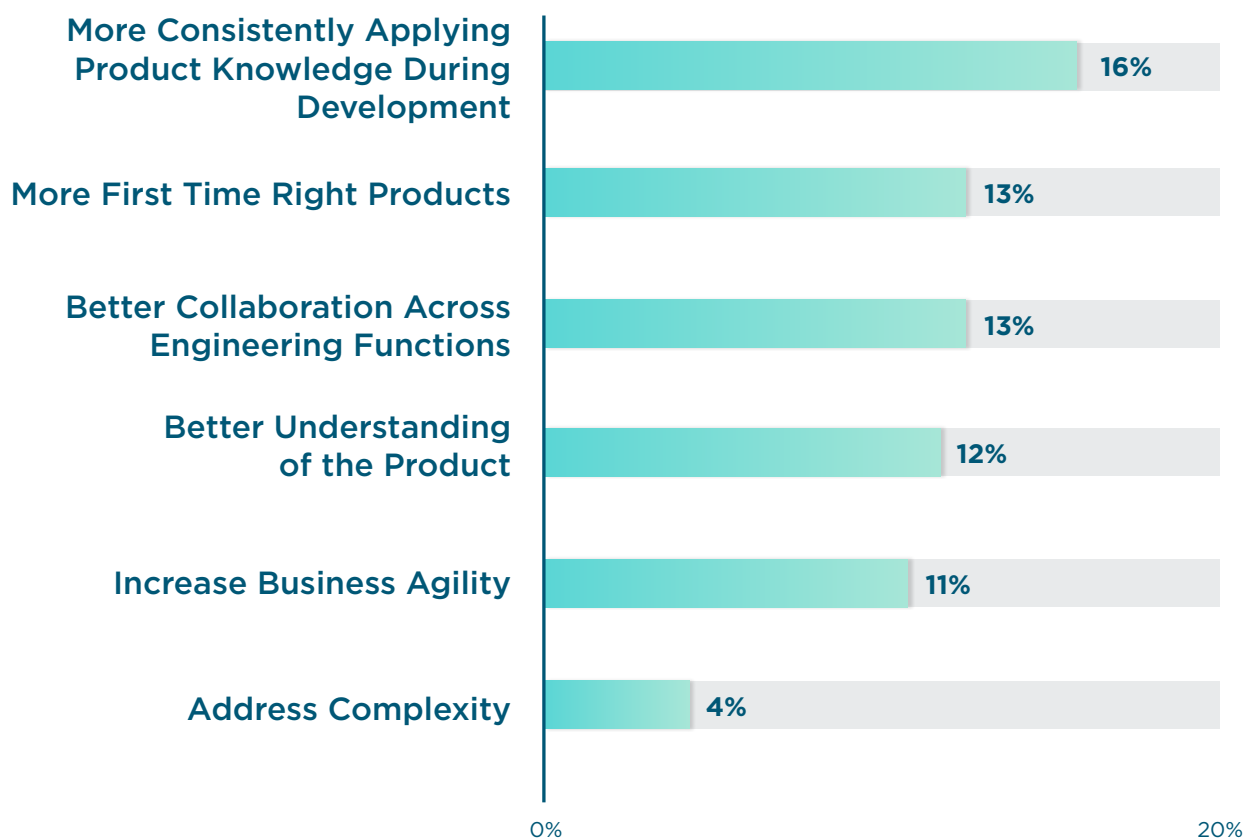
## Early Initiatives



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# The #1 anticipated benefit of digital twins is to more consistently apply product knowledge during development.



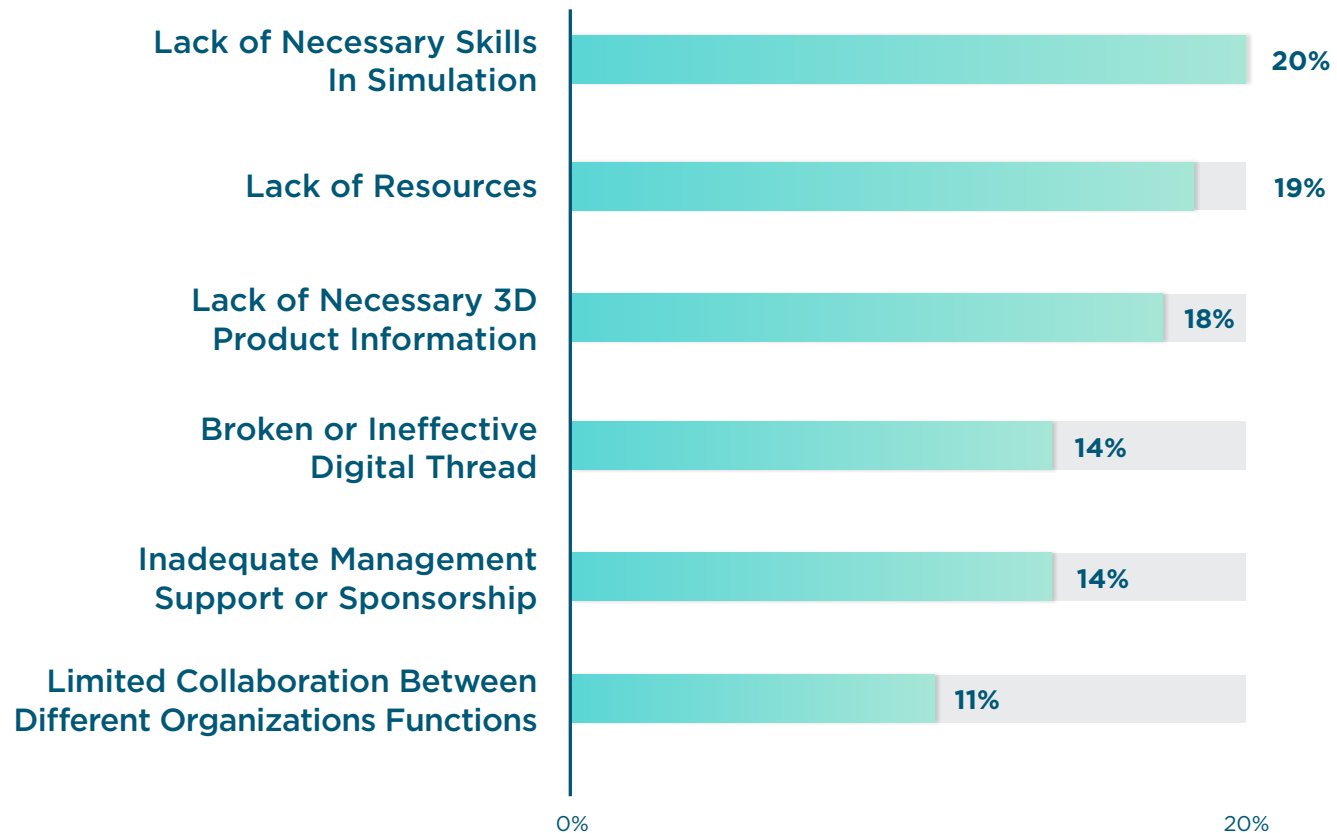
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# The #1 roadblock is the lack of necessary skills in simulation.

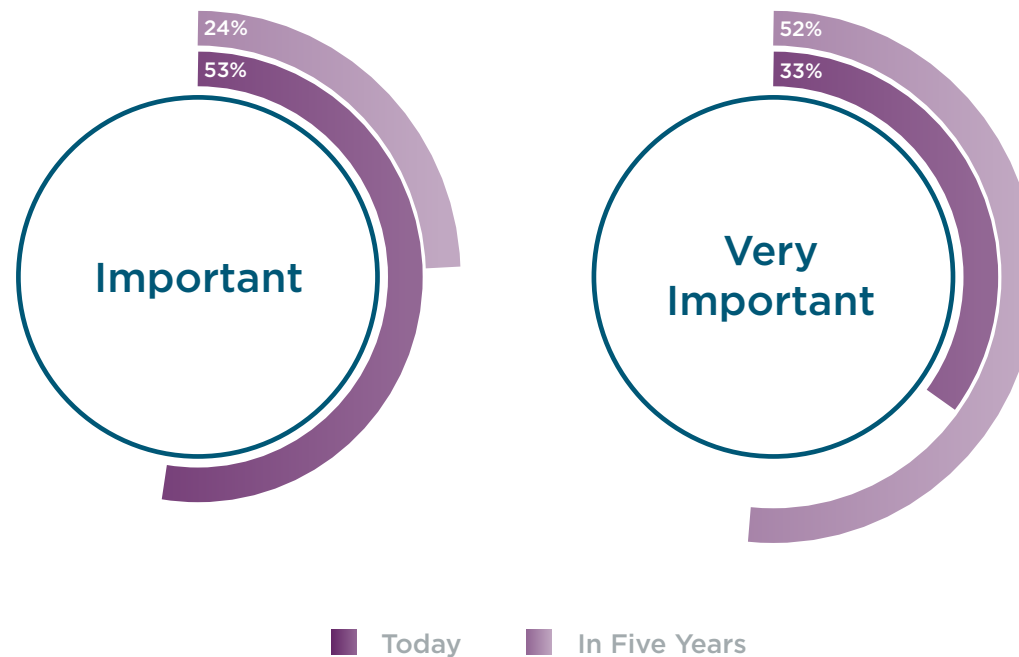
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# Within five years three quarters of manufacturing companies will offer IoT services as an important part of their mainstream product offering.

Within the next five years there will be an increase of almost **20% in the importance of IoT** in helping companies take products from being potentially smart to being smart and connected with the help of IoT.

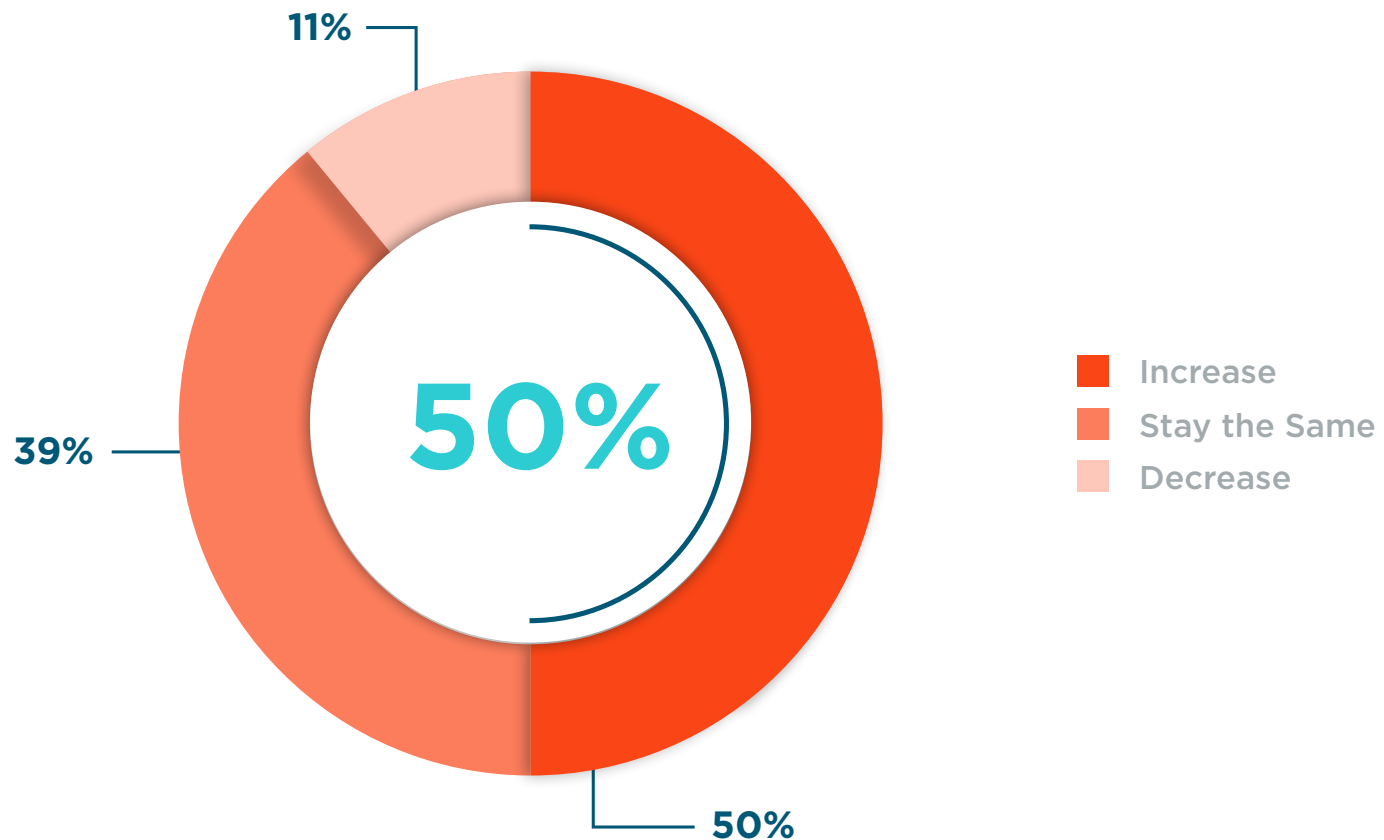


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# Half of manufacturing organizations increased IT projects during the COVID-19 pandemic.

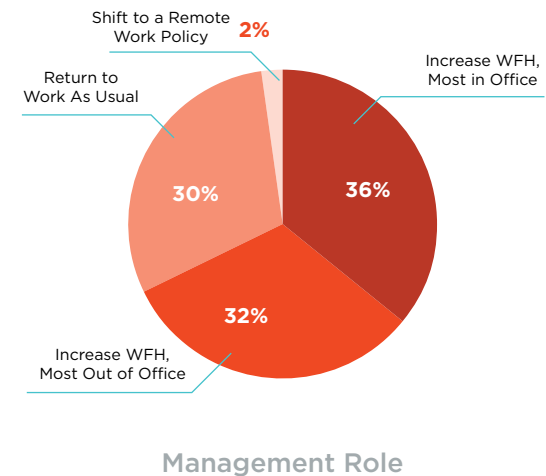
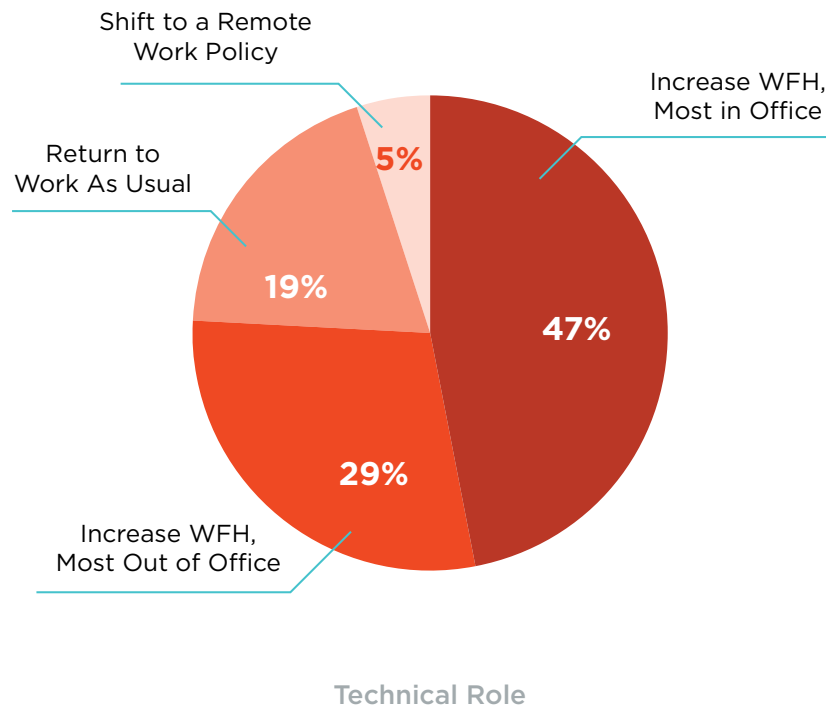
The COVID-19 pandemic has accelerated investment or necessitated a shift in new, and sometimes unplanned, Information Technology (IT) projects during a time of aggressive expense management for many companies. Overall **50% increased their IT budgets**.

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# Two-thirds of organizations intend for the majority of their company to be back in the office again, but foresee a significant increase in working from home (WFH).



# 76%

of technical roles believe WFH will become normal routine.

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# ABOUT

## About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at [www.CIMdata.com](http://www.CIMdata.com).

## About Altair (Nasdaq: ALTR)

Altair is a global technology company that provides software and cloud solutions in the areas of data analytics, simulation, and high-performance computing (HPC). Altair enables organizations across broad industry segments to compete more effectively in a connected world while creating a more sustainable future. To learn more, please visit [www.altair.com](http://www.altair.com).

Software provider conferences typically focus on customer applications of their software offerings combined with technical sessions on software features and future product plans. Altair broke away from this norm to explore "Future of" macro trends and technologies during their annual Global Altair Technology Conference (GATC). Together with industry and academic thought-leaders, the conference highlighted the growing convergence of data analytics, computational science, and cloud HPC technologies and their relevance to product and process innovation, academic instruction, tomorrow's innovators, and society.



CIMdata's commentary on Technology Convergence for a Smarter, More Connected World: Market Trends is available [here](#).



Global Altair Technology Conference (GATC) presentations and panel discussions, are available to view [here](#).



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# APPENDIX

Approximately 400 survey responses were received and analyzed. 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%) vs. a technical end user role (55%). As anticipated, the background information responses were weighted towards the Americas (67%) and EMEA (20%) but the responses by industry segment and size of organization were in line with the overall engineering software industry profile based on CIMdata's experience with performing similar PLM market surveys for many years.

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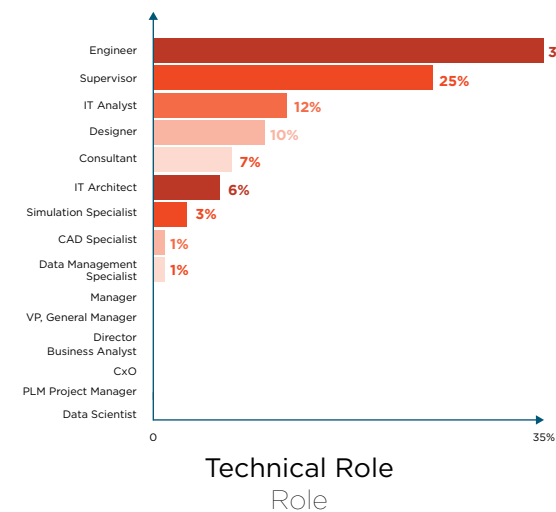
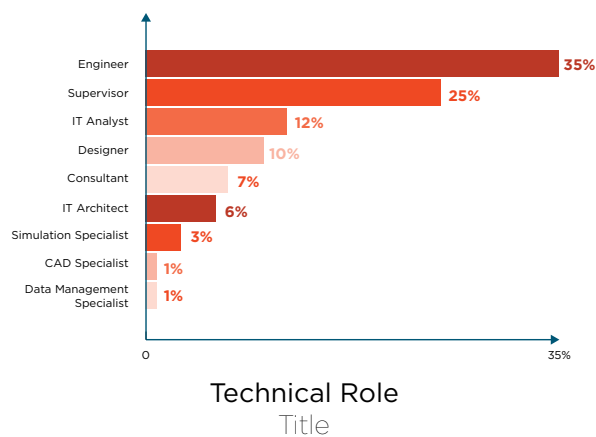
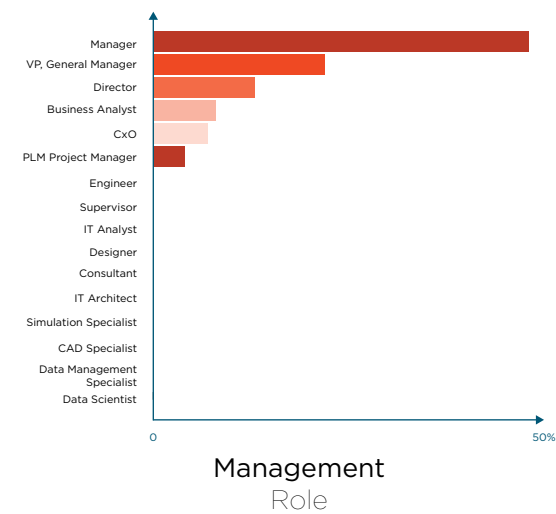
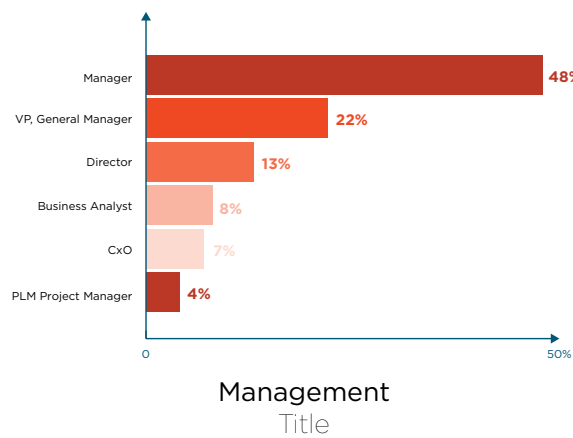
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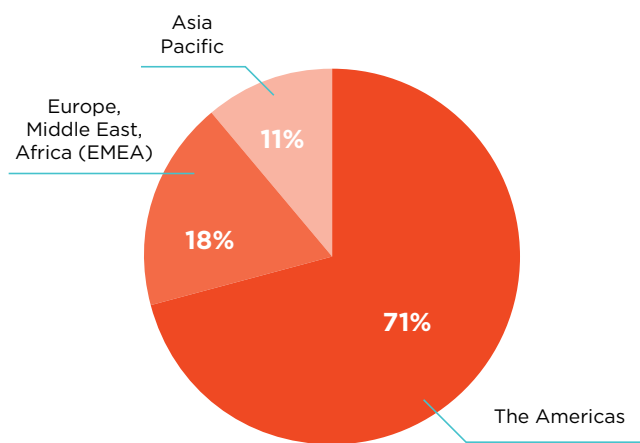
Overview - What is your title/role?



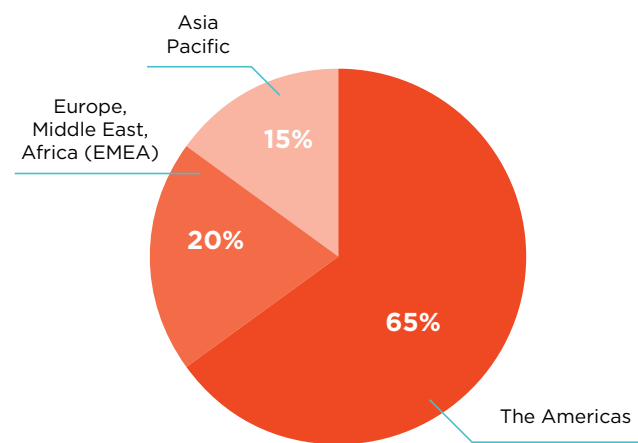
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### Overview - In which geographic region do you currently work?



Management



Technical Role

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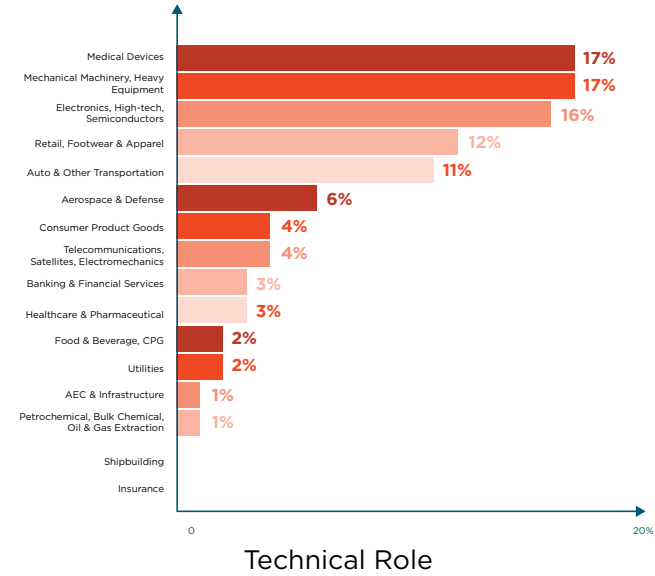
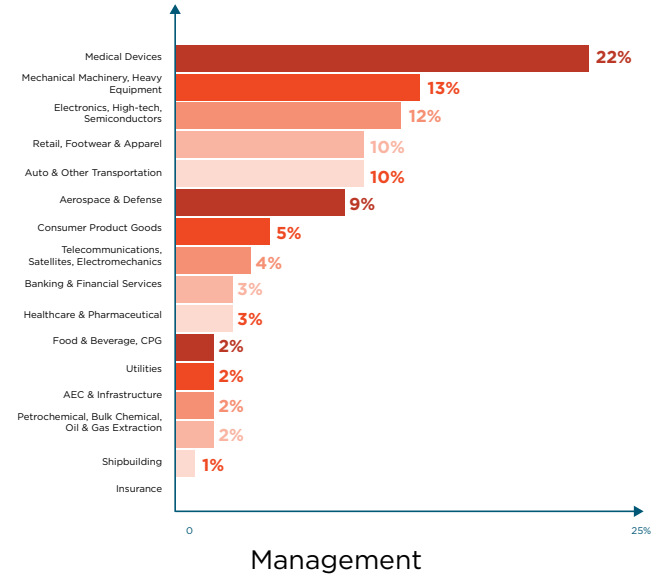
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Overview - What is the primary industry your business unit serves?



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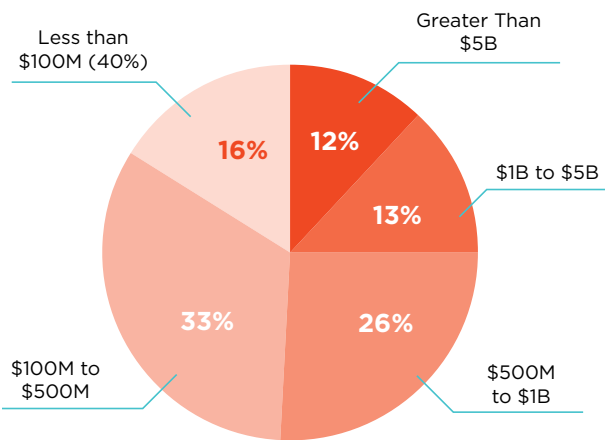
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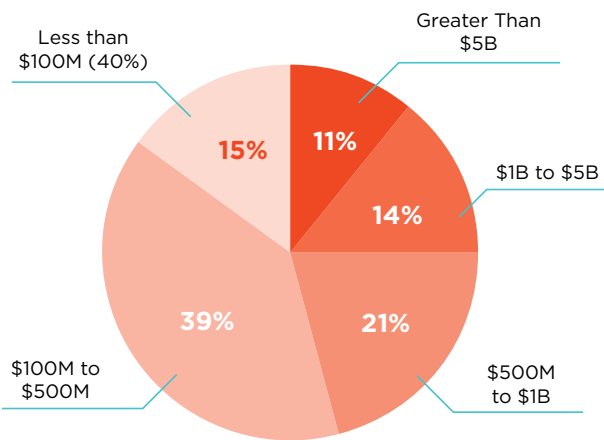
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Overview - What were your company's revenues for the most recent fiscal year?



Management



Technical Role



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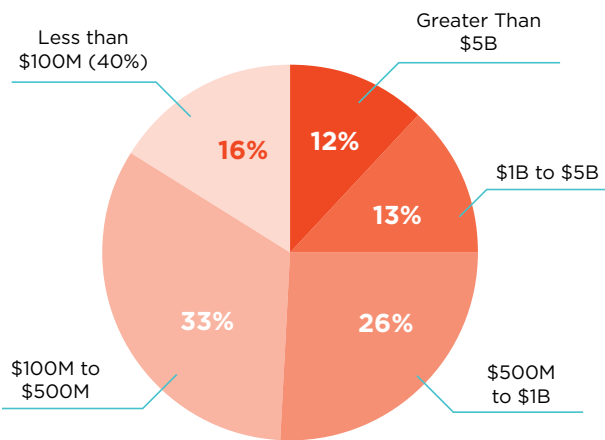
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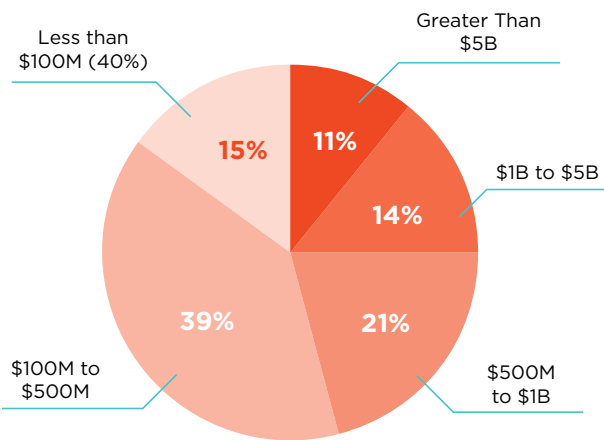
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Overview - How many employees does your company have?



Management



Technical Role

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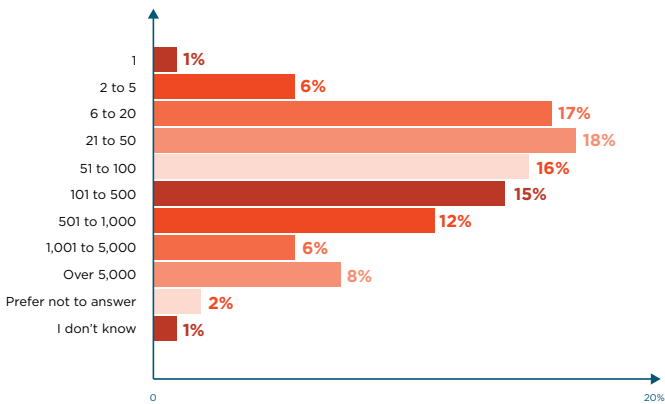
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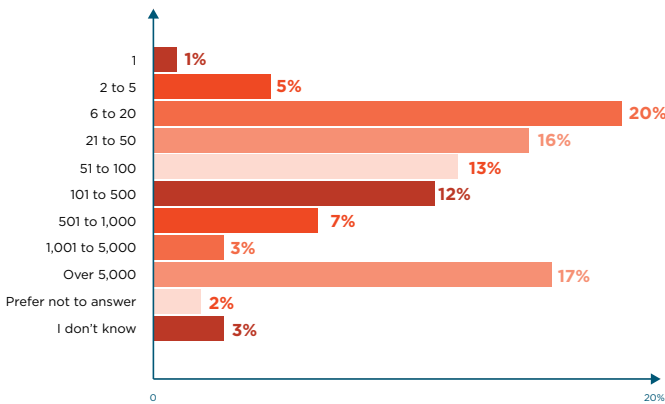
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Overview - How many engineers/designers work for your company?



Management



Technical Role

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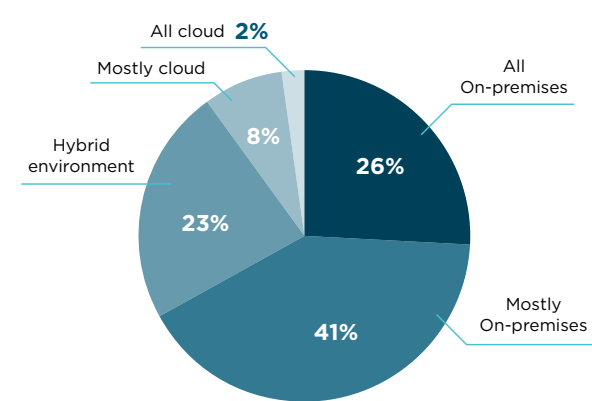
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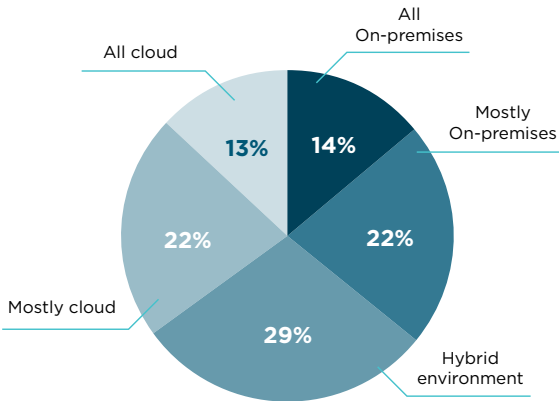
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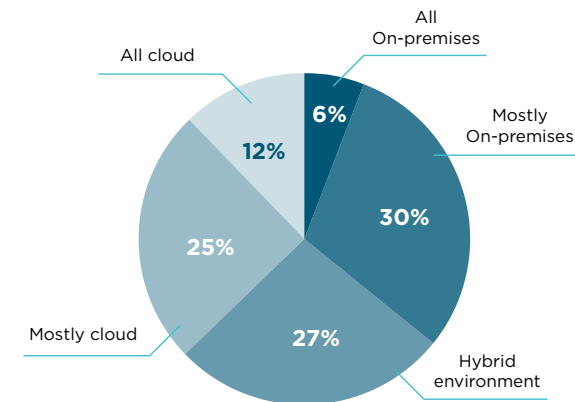
Pg. 7 - How aggressively has your company embraced moving data analytics and simulation activities to the cloud today? Where will you be in five years?



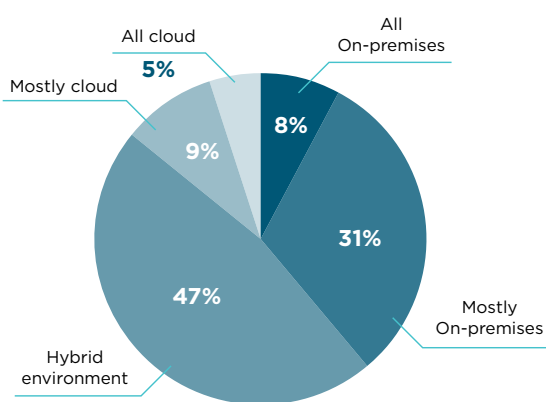
Management  
Today



Management  
In Five Years



Technical Role  
Today

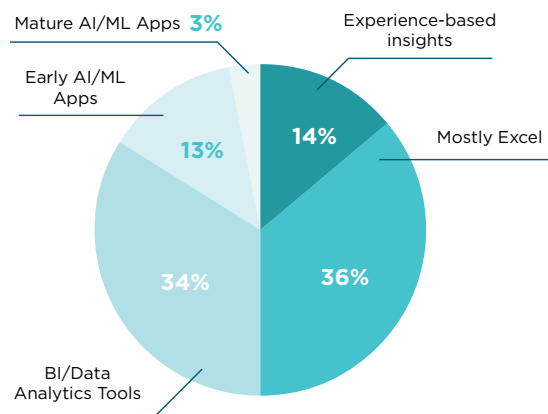


Technical Role  
In Five Years

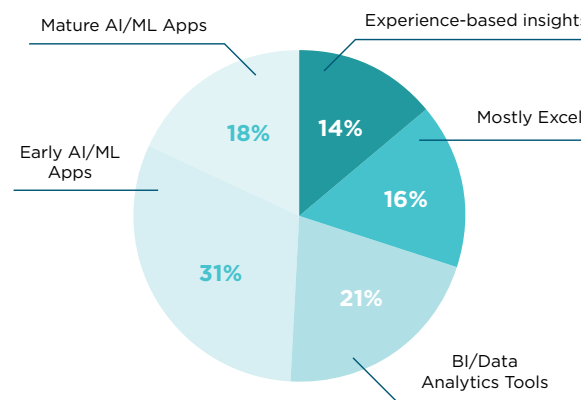
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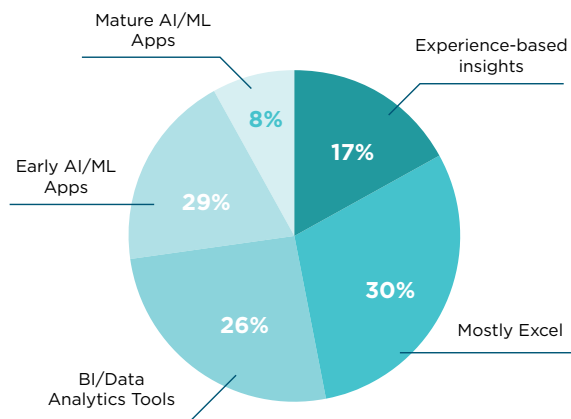
Pg. 8 - The data-driven enterprise drives decisions throughout the company using data analytics, machine learning, and artificial intelligence (AI) for insights. Where is your organization on this path today? Where do you think it will be in five years?



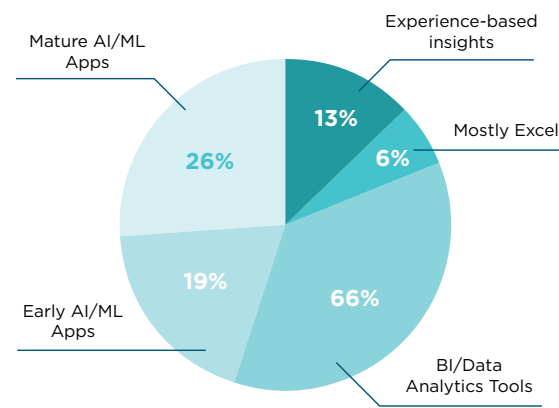
Management  
Today



Management  
In Five Years



Technical Role  
Today

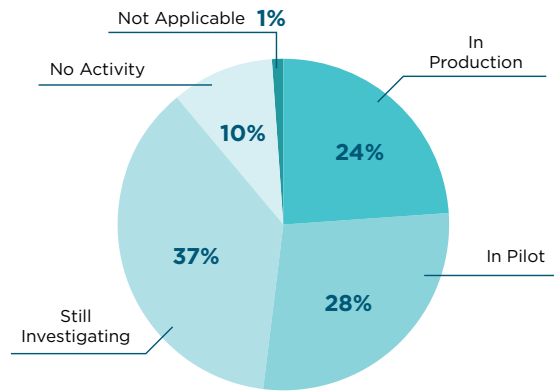


Technical Role  
In Five Years

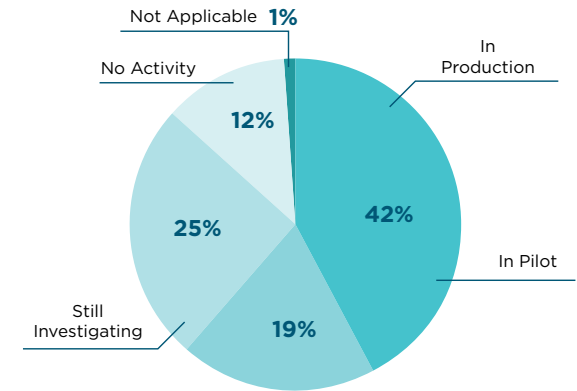
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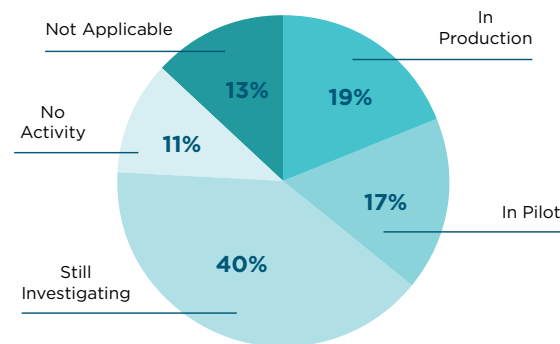
Pg. 9 - Digital twins have applications across the product lifecycle, from helping companies understand product behavior early in the lifecycle to understanding product behavior in the field. Where is your organization on your digital twin journey today? Where do you think you will be in 5 years time?



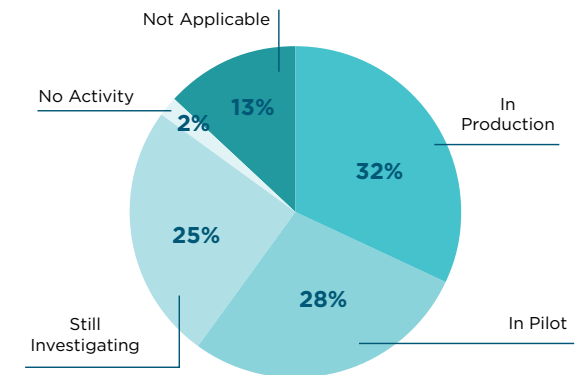
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Today



Management  
In Five Years



Technical Role  
Today



Technical Role  
In Five Years



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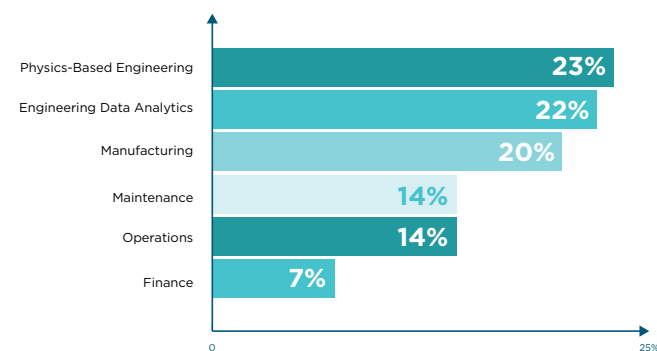
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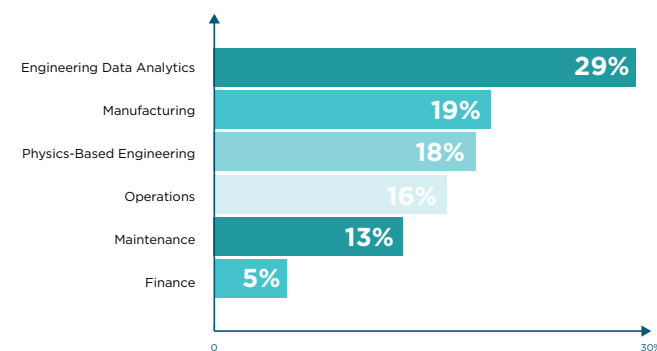
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Pg. 10 - There are many possible types of digital twins that can support the product through its life. Please select all of the types of digital twins your organization plans to pursue in the next five years.



Management  
In Five Years

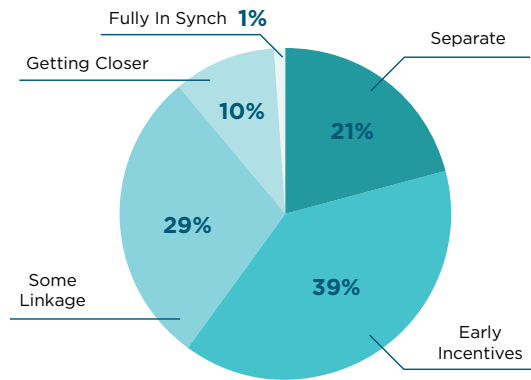


Technical Role  
In Five Years

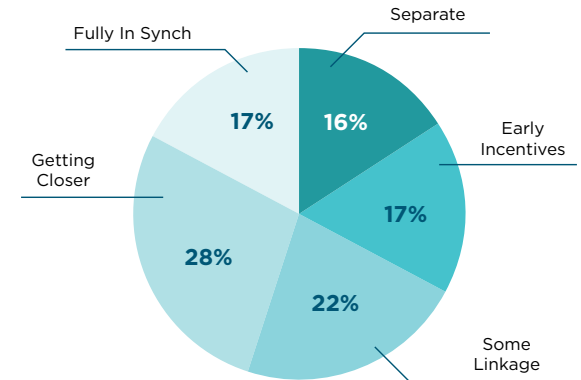
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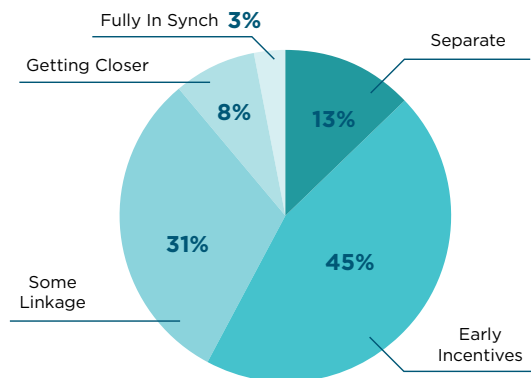
Pg. 11 & 12 - Multiple digital twins have relevance to many aspect of an enterprise, e.g., business systems and operations, components and products, production systems and processes, maintenance, etc. Digital twins can be driven by data from many sources, including those that are traditionally part of your IT infrastructure and some that come from OT. How aligned are your IT and OT systems today to drive digital twin initiatives forward today? Where do you think your organization will be in five years time?



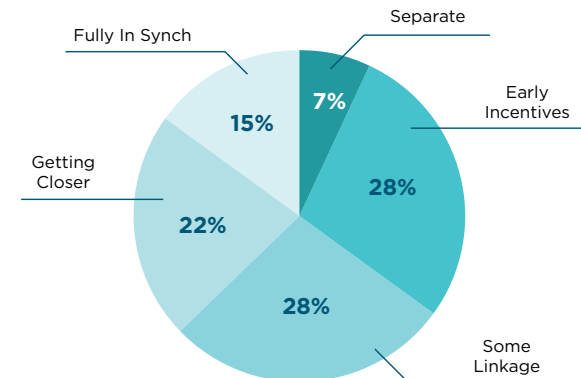
Management  
Today



Management  
In Five Years



Technical Role  
Today



Technical Role  
In Five Years

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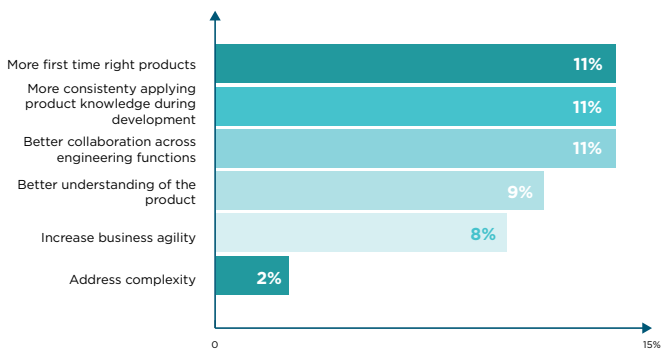
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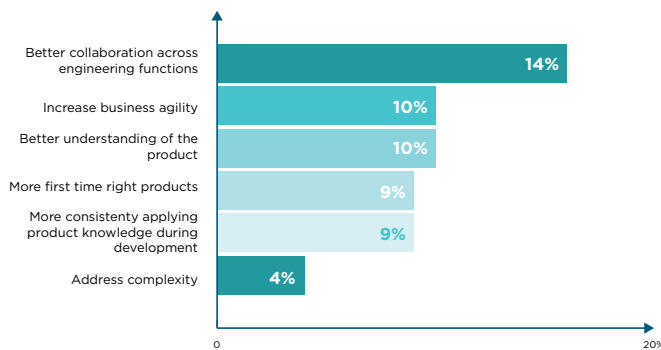
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Pg. 13 - What benefits from digital twins does your organization expect?



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In Five Years



Technical Role  
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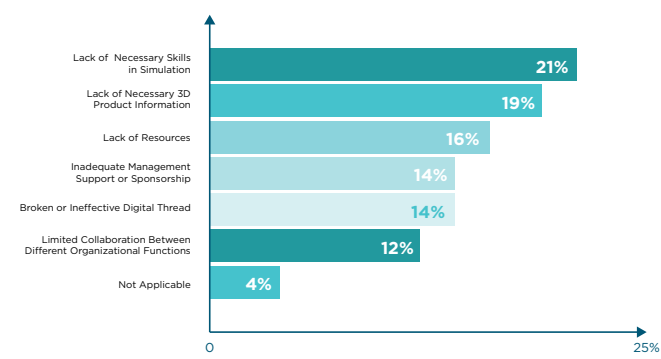
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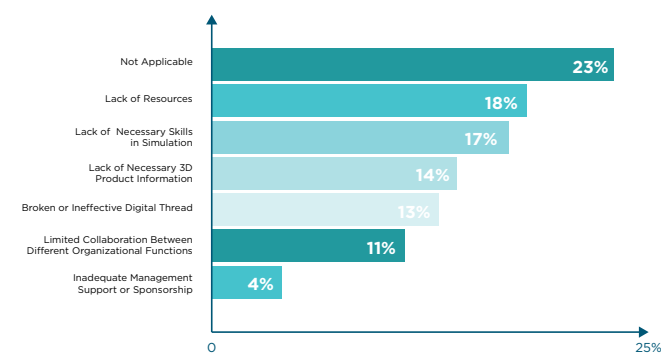
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Pg. 14 - What factors will keep your organization from reaching it’s digital twin vision?



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In Five Years

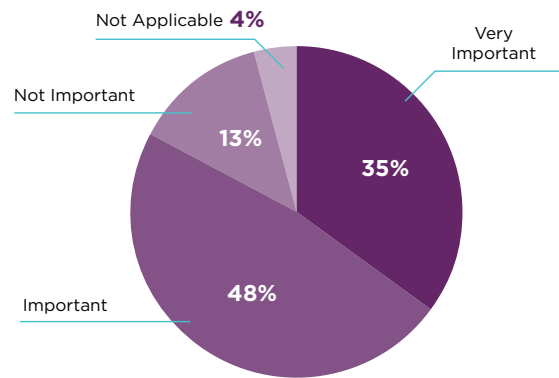


Technical Role  
In Five Years

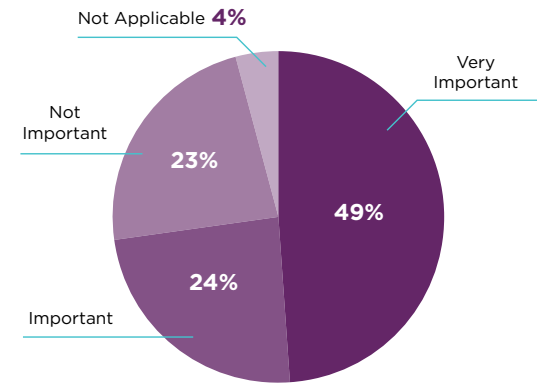
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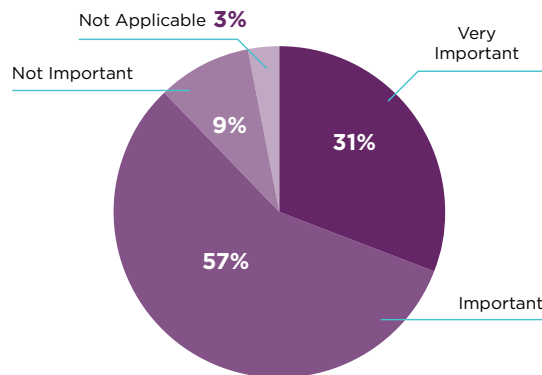
Pg. 15 - The Internet of Things (IoT) has helped take products from just (potentially) being smart to being smart and connected. How important is IoT to your company's strategy today? How important will IoT be to your company's strategy in 5 years?



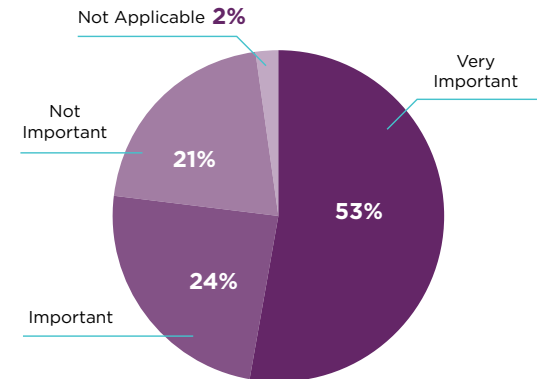
Management  
Today



Management  
In Five Years



Technical Role  
Today

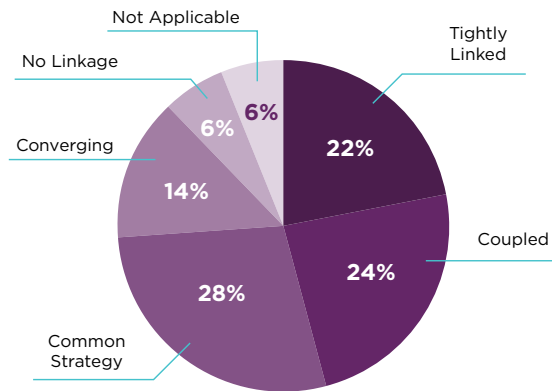


Technical Role  
In Five Years

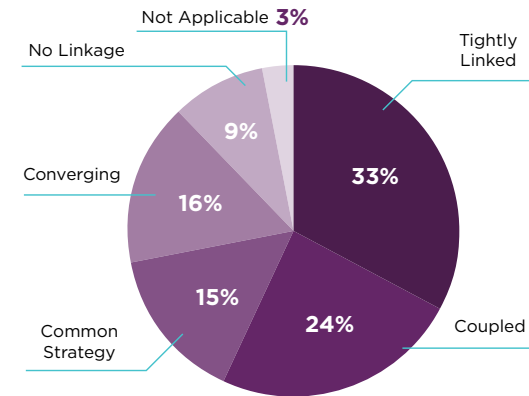
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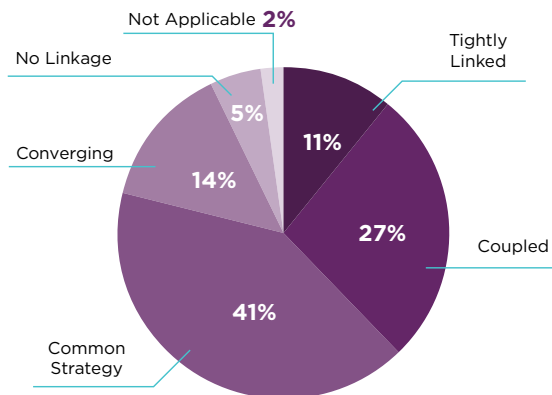
As the world continues to transition to smart, connected products, how linked is your company's IoT strategy to your mainstream product development activities today? In five years?



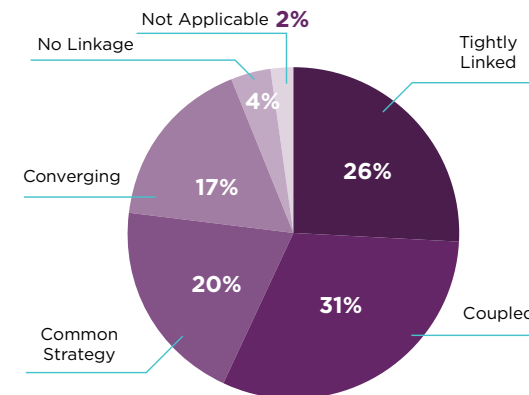
Management  
Today



Management  
In Five Years



Technical Role  
Today

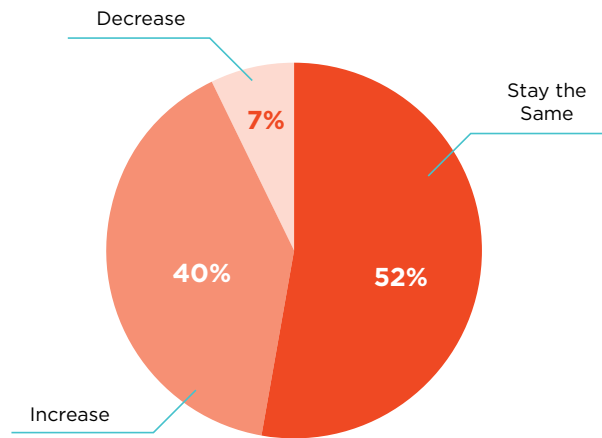


Technical Role  
In Five Years

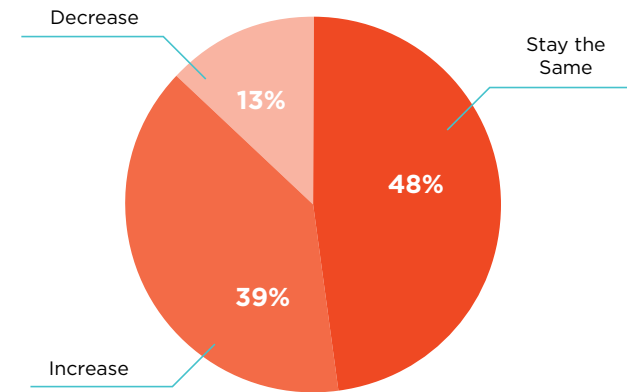
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Pg. 16 - The COVID-19 pandemic has accelerated investment or necessitated a shift in new, and sometimes unplanned, Information Technology projects during a time of aggressive expense management for many companies. Did your IT budget?



Management  
In Five Years



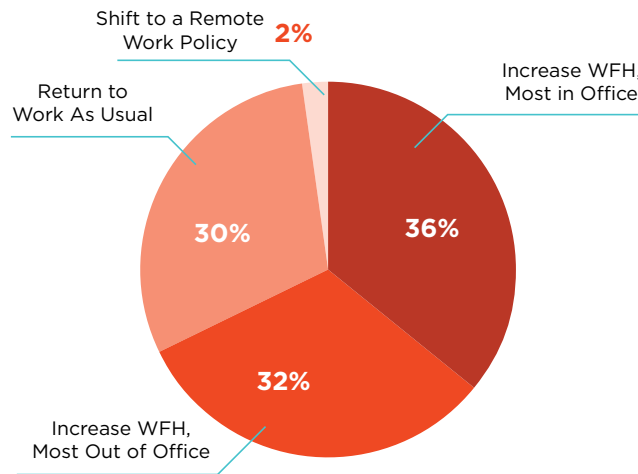
Technical Role  
In Five Years



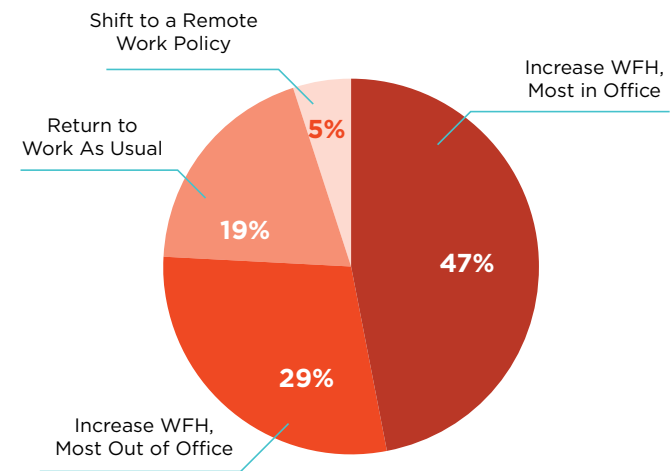
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Pg. 17 - As the pandemic subsides do you feel that your company will predominantly...



Management  
In Five Years



Technical Role  
In Five Years



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