MARKET RESEARCH

The Definitive Digital Twin Primer: Delivering on the Next Generation of Product Lifecycle Management

Findings and analysis from the survey of **small to mid-market (SMB) Industrial Machinery & Heavy Equipment (IMHE)** executives who are involved in the product lifecycle management in organizations in the US, UK and Germany.

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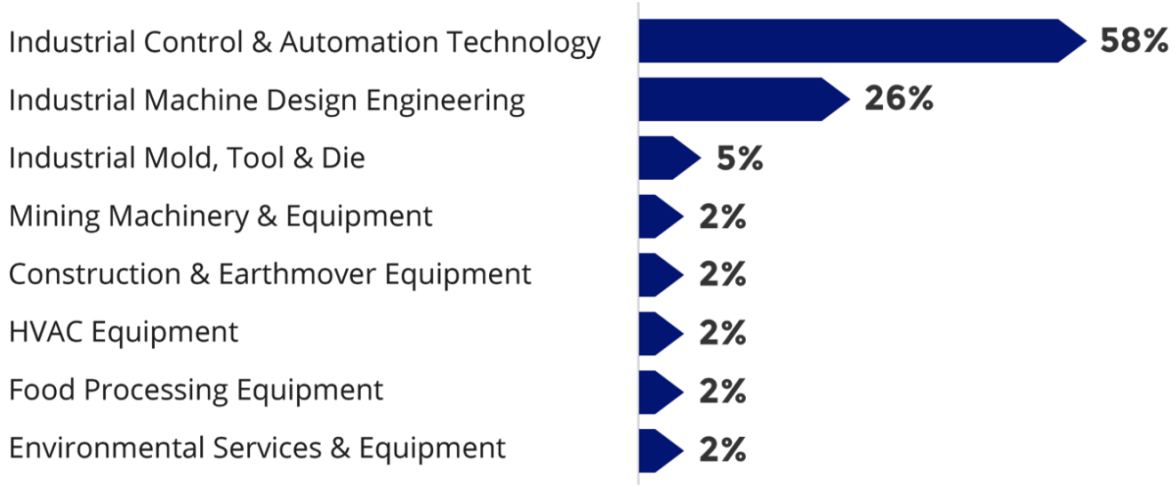
Research Demographics.

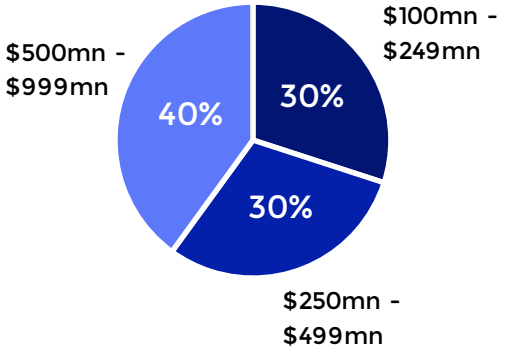
Incisiv conducted a quantitative survey of **43 industrial machinery & heavy equipment executives** in the **US** spanning key business functions such as PLM, engineering, design, R&D, and operations.

49%	19%	16%	5%	5%	5%
Product Lifecycle Management	Engineering	Operations	Design	Research & Development	After-sales

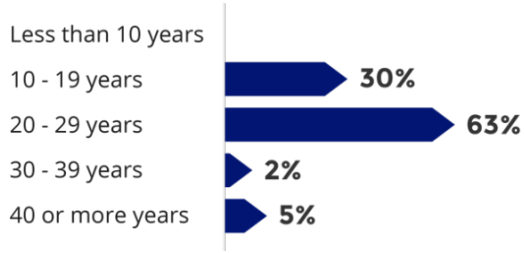
These **43 industrial machinery & heavy equipment executives** in the **US** belong to various industry groups:



Representation of **43 industrial machinery & heavy equipment executives** in the **US** spanning across bands within the SMB space.



Average age of flagship end-product (years): **23.2 years**

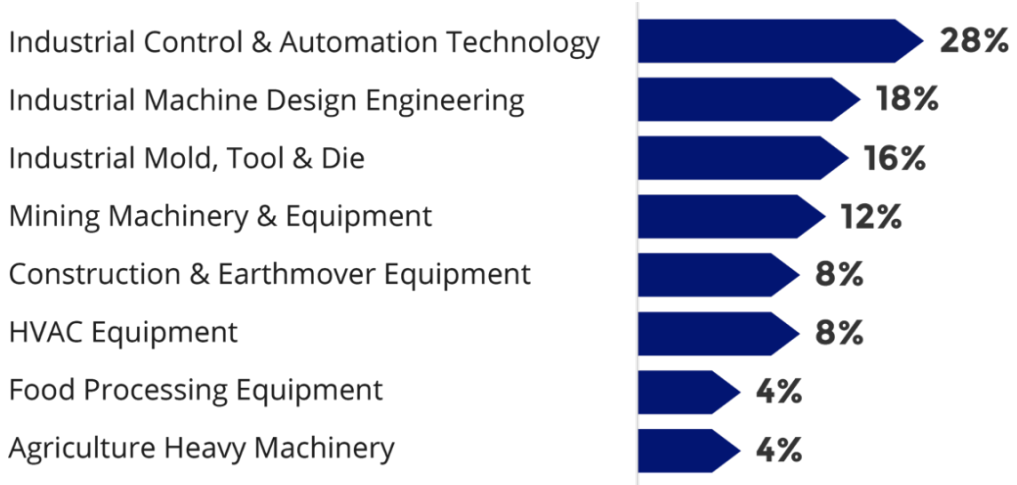


Research Demographics.

Incisiv conducted a quantitative survey of **50 industrial machinery & heavy equipment executives** in the **UK & Germany** spanning key business functions such as PLM, engineering, design, R&D, and operations.

30%	26%	24%	10%	10%
Operations	Product Lifecycle Management	Engineering	Design	Research & Development

These **50 industrial machinery & heavy equipment executives** in the **UK & Germany** belong to various industry groups:



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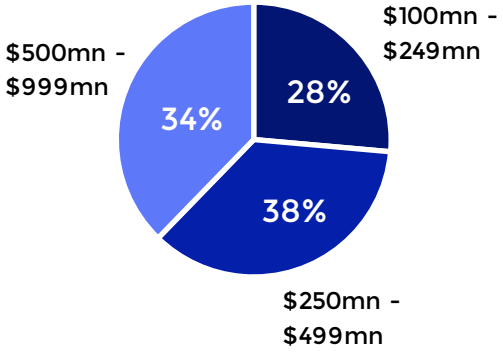
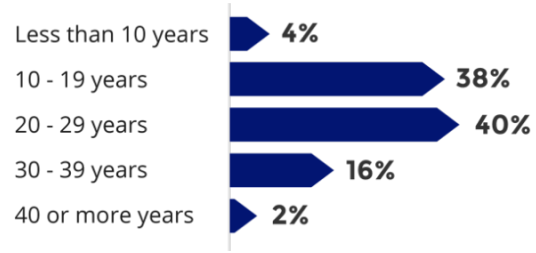


Average age of flagship end-product (years): **22.4 years**



The need for rapid, innovative new product development is stronger than ever.

More than 50% of companies indicate that the creation of new products, services or business models will be key to generating organic growth over the next 3 years[1].

More than **25%**
of total revenue and profits across industries comes from the launch of new products.[1]

Companies have been increasing R&D spend year-on-year since 2005, now totaling over
$1.5 trillion
globally (equivalent to the GDP of Canada).[1]

Nearly
3 in 4
executives say new product development is a top-three priority for their organizations.[2]

From the Industry

3M

40% of 3M's revenue in 2017 came from products that did not exist before 2012.

New Product Development in manufacturing is a complex process associated with high risks of failure and losses.

The capital-intensive nature and high operating cost in industrial manufacturing has risen the stakes for new product development higher than ever.

Stakes are high with expensive and repetitive prototype trials and high failure rates resulting in longer time to market, cost overruns, margin erosion and poor customer experience.

More than **90%** of the cost of the heavy equipment lifecycle comes from running today's machines.[3]

Failure rate for industrial new product launches exceed **50%**, putting a drag on profitability.[4]

80% of all product-related costs are determined in the development phase, largely determining its market feasibility and success.[5]

From the Industry

BOEING

The development of the Boeing 787 missed its stated deadline by multiple years, costing 4x the original budget of $5B. Upon launch it experienced multiple product failures, resulting in many order cancellations and severe loss of reputation.

Complexity of product lifecycle management (PLM) drives considerable friction across the industry.

Complex and expensive engineering processes drive the need for simplification and modularization of processes.

While emerging regulations on environmental consciousness, data security (GDPR) and rising import tariffs increase production costs, manufacturers need to maintain competitive pricing to compete with rising global competition. This puts greater pressure on developing an effective product lifecycle management strategy.

Top-3 challenges

44%
Complex data security

37%
Complexity of engineering process

30%
Cost management

46%
Complexity of engineering process

44%
Complex data security

30%
Expensive prototype trials

Base: % of all respondents

Challenges in PLM can be addressed with Digital Twin technology as an enabler.

The Digital Twin is a virtual replica of a physical asset or process that connects to and receives data from the latter. Digital Twin technology enabled by real-world data simulates an actual operating environment and helps companies confidently understand, predict and optimize performance prior to physical deployment.

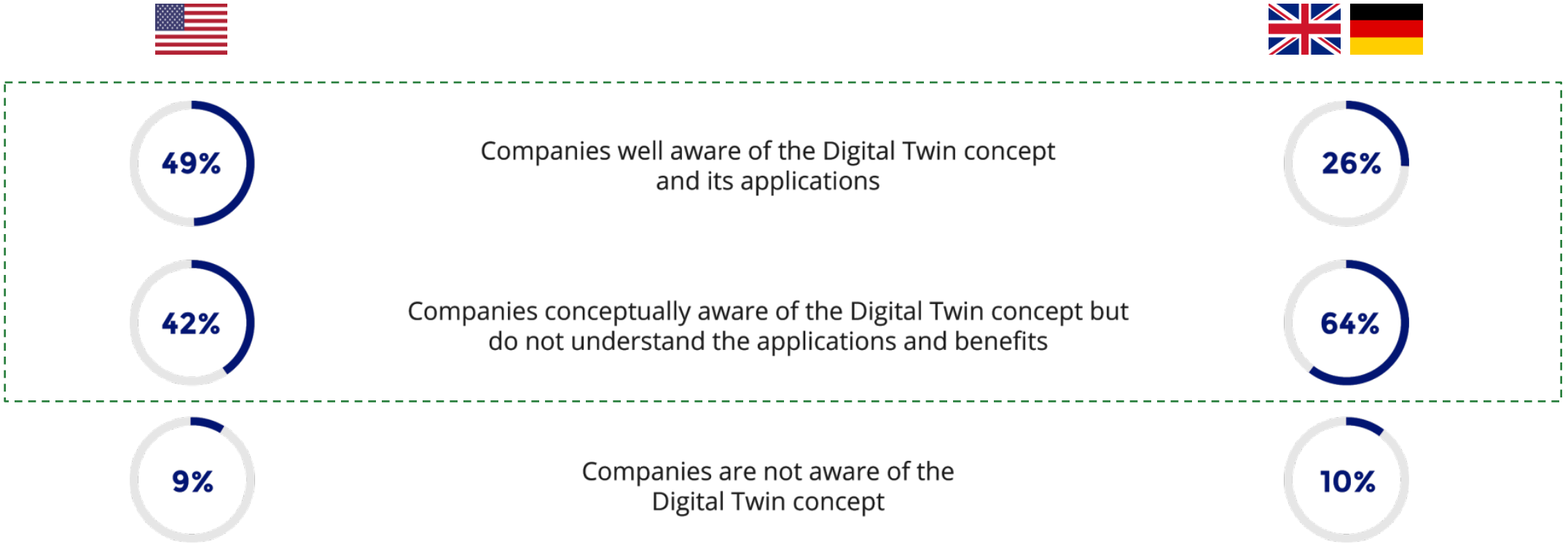
Top challenges in PLM	Digital Twin addresses these challenges by
Cost management	Improving product design with less iterations. Increasing productivity and equipment efficiencies. Reducing variations in performance parameters.
Difficult cross-organization collaboration	Extending coverage beyond engineering department. Focussed training and development.
Complex data security and integration	Securing data integration with connected devices and IoT. Integrating customer insights data and monitor real-life product performance. Embedding software elements into bill of material (BOM).
Shorter new product development cycles	Identifying products in market that need to be upgraded/replaced. Identifying products with longer lead-time components and impact on Supply Chain.
# repeat physical prototype trials	Diagnosis and predicting product defects quicker. Detecting quality breaches and simultaneously perform root-cause analysis.
Impact of external environment	Quicker implementation of new regulatory compliances. Developing digital records of raw materials for better recalls and warranty claims. Managing adherence to mandates on tracking requirements.

Base: % of all respondents

Industrial manufacturers are aware of the Digital Twin but more than half are not clear on its application.

US SMB's have a far better understanding of the benefits of Digital Twin but education is required if broad adoption is going to occur

The concept was first recognized in year 2002. Though, it only gained acceptance in the industry recently with the recent adoption of smart and connected technologies (IoT and cloud technologies). The cost of ownership has significantly reduced with facilitators such as high storage capacity, high computation capacity, high throughput messaging, security and many more.



Base: % of all respondents

Companies aware of Digital Twin believe that it holds promise across the product lifecycle.

SMB manufacturers find Digital Twin concept relevant for addressing product development challenges around escalating cost, long development cycles and maintenance.

US companies in IMHE are more aware of the benefits of Digital Twin technology and believe that it has greater potential impact on PLM processes across the board. Product design, preventative & proactive maintenance and process optimization show to have the most relevance for digital twin in the US while product prototyping was the most relevant for European companies.

Rate the relevance/perceived value of Digital Twin concept on the following aspects on a scale of 1-5 (5 indicates extremely valuable and 1 indicates not at all valuable)?

Digital Twin has the potential to significantly improve operational KPIs.

Companies aware of the concept in the US are more optimistic than Europe and see slightly different benefits.

Most anticipated impact on PLM areas leveraging Digital Twin

69%

Reduce # prototypes required for testing/validation

69%

Increase speed-to-market for new product launches

69%

Reduce cost of product/process development

58%

Reduce processing time through standardized interfaces

56%

Increase speed of response to changes

47%

Reduce time to implement models

Base: % of all respondents familiar with the application of Digital Twin concept who rated significant impact on the area

Improved data management and extended product life drive interest in Digital Twin.

With the costs associated with new product development, extending a product's life with lower costs drives huge benefits for manufacturers

Top-3 benefits

59%

Extended product life

38%

Improved data management

38%

Better downtime management

51%

Improved data management

40%

Extended product life

29%

Improved product quality

From the Industry

JCB

Created 3D models for virtual prototype testing of the advanced diesel engine that resulted in superior product quality.

LOVOL

Used PLM Software solutions and reduced prototype and testing cost by 50% while increasing design accuracy by 30%.

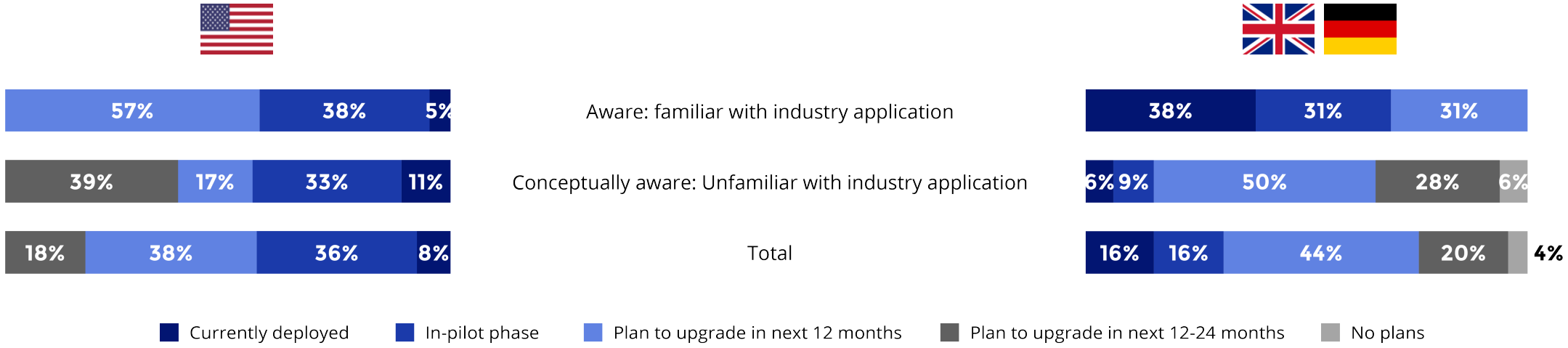
EISENMANN

Designed an electrified monorail system for food carts and shortened the final throughput testing through virtual commissioning validation cases.

Base: % of all respondents aware of Digital Twin concept

Adoption outlook looks promising for companies who understand the true applications of Digital Twin.

Digital Twin adoption looks promising for near-future, assisted by increased adoption of IoT and sensory technologies.



While current adoption is low in relation to PLM systems in general, companies who understand Digital Twin and its applications will be in pilot or implementing in the next 12 months, confirming their belief in the concept.

In the UK and Germany, a higher percentage of companies have deployed Digital Twin. The remainder of those companies that understand its value are in pilot or plan to implement in the next 12 months.

Base: % of all respondents aware of Digital Twin concept

Cultural and technology debt continues to hamper IT investment.

The importance of product development is greater than ever yet perceived risks hurt innovation.

Barriers to investment don't change dramatically across technology solution areas. Lack of IT resources and operational risks in scaling initiatives speak to a culture that doesn't prioritize the value of IT.

Top impediments to investments in Digital Twin

71%
Lack of skilled IT resources in-house

62%
Lack of innovative solutions

52%
Inability to quantify ROI

38%
Operational risks in scaling transformation initiatives

31%
Lack of skilled IT resources in-house

31%
Lack of innovative solutions | Inability to quantify ROI

Base: % of all respondents familiar with the application of Digital Twin concept

Although SMB manufacturers understand the benefits of Digital Twin, they are unclear how it applies to their sized business.

Perceptions around costs and ease of integration must be answered before wide-spread adoption can occur for SMB's in the industrial manufacturing industry.

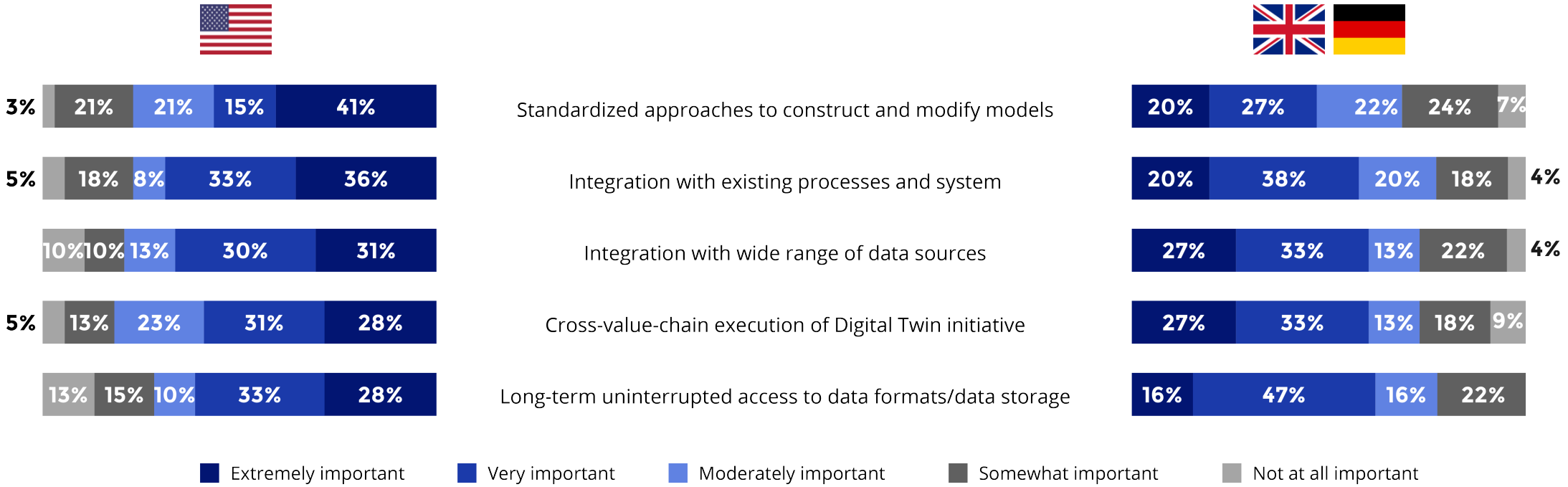
85%	of companies consider themselves **too small** to deploy Digital Twin technology	40%
77%	of companies say **integration with existing tools and processes** is a big challenge	73%
67%	of companies say Digital Twin technology does **not deliver a clear ROI**	51%

Base: % of all respondents familiar with the application of Digital Twin concept

Operational and system readiness is critical for the successful execution of Digital Twin.

Uninterrupted access to data, standardized procedures and established integrations with existing processes are prerequisites for successful execution.

Most respondents place high importance on operational and system readiness for successful execution of a large initiative as the digital twin. Respondents stress the need for standard operating procedures and integrated data and systems as the key prerequisites for a successful implementation.



Base: % of all respondents aware of Digital Twin concept and applications

Key recommendations for the advancement of Digital Twin.

Companies aware of applications of Digital Twin see the value, so priority should be to boost education of the solution.

Obtain base case education on the use-cases of Digital Twin

- Educate business users about the relevance of Digital Twin.
- Demonstrate ROI through real-life case examples.

Establish clear business case for Digital Twin considering strategic business objectives

- Establish clear budgetary allocations (CapEx/OpEx) and projected benefits (efficiency, effectiveness, customer service, etc).
- Leverage industry best practices to estimate ROI.

Start small

- Pilot the concept for 1-2 products (preferably one net new product and one mature product).
- Weigh-in the inherent risks against the economic value, that are associated with costs, security, privacy and integration.

Involve cross functional teams across the program: assessment, business case development and pilot

- Deploy cross-functional team for business case development, change management and implementation.
- Designate CXO/VP level owner for the initiative for clear communication of strategic intent.
- 61% of companies believe strategic objectives can be achieved by more collaboration across functions paired with quick decision-making.[6]

Overcome challenges of IT skills and business availability

- Deploy cloud-based systems.
- Engage with technology partners for innovation.
- 50% of companies rate their technology partners as their most important innovation collaborators.[6]

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