IMPROVE PRODUCT INNOVATION AND PROFITABILITY THROUGH INCREASED DIGITAL MATURITY

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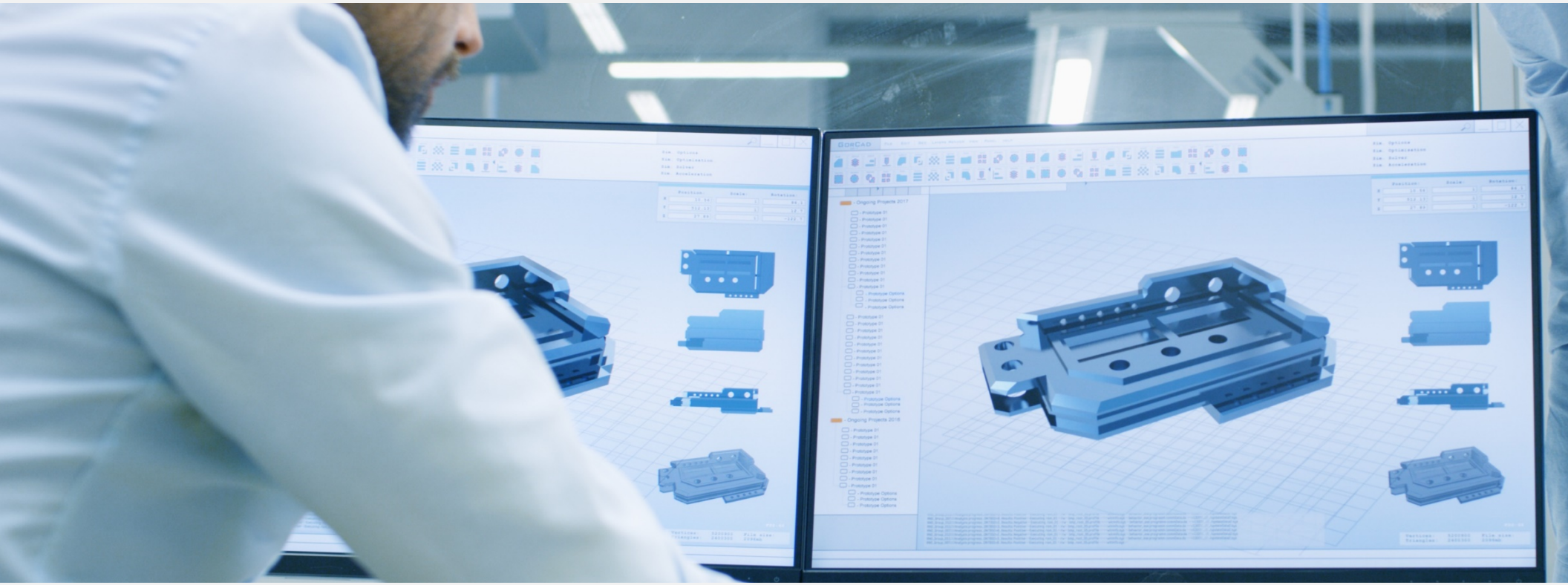
Digitalizing Product Innovation

Digital Product Innovation Creates an Opportunity to Leapfrog Competitors

Digitalization is fundamentally reshaping the industrial landscape. Companies that digitalize are gaining competitive advantages, disrupting markets, and challenging the status quo by driving new levels of innovation, agility, product performance, and quality.

How can companies digitally transform product innovation to improve the way they conceive, design, and develop products to improve profitability and achieve or sustain market leadership? We surveyed over over 150 companies to find out.



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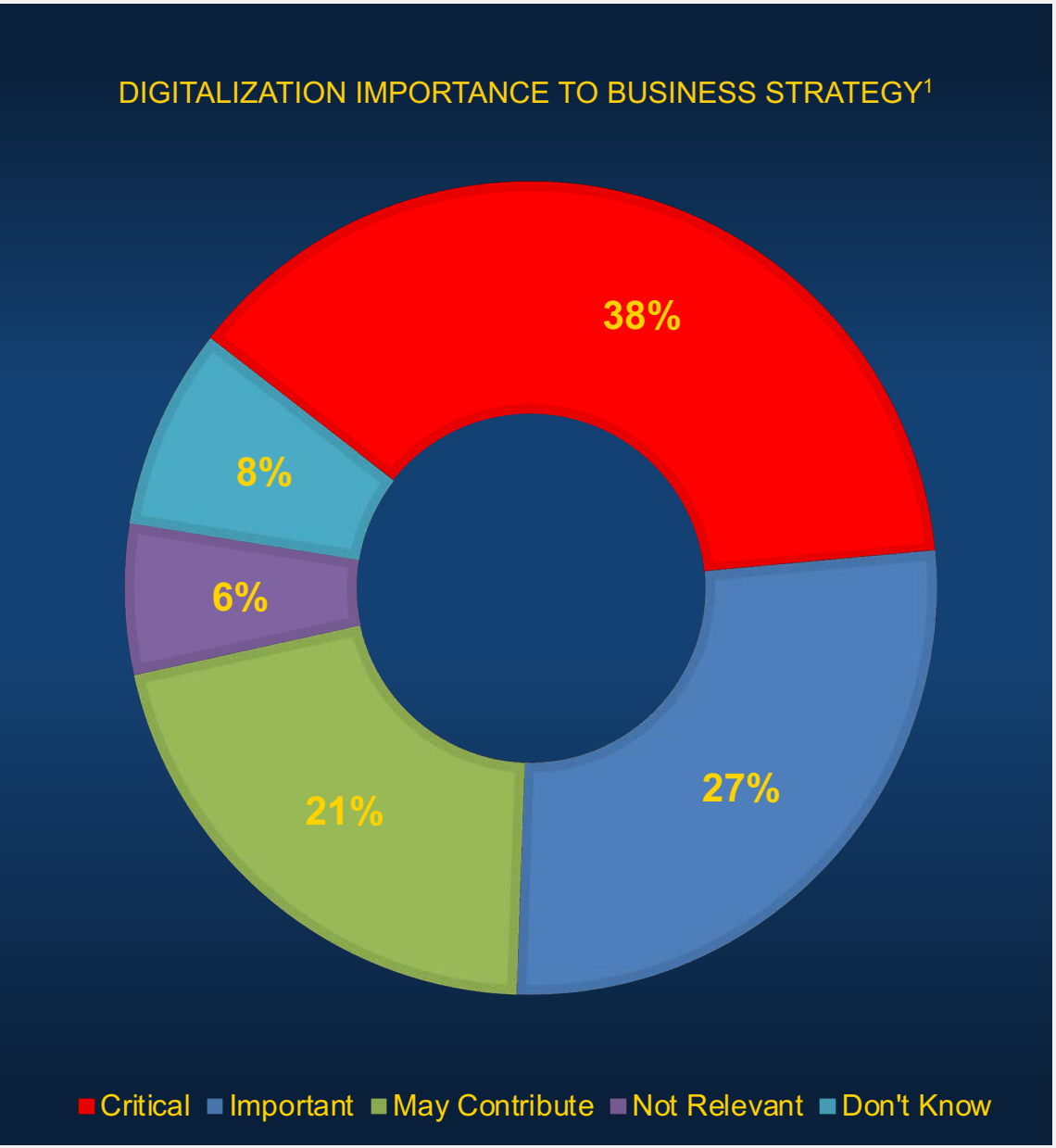


Digitalization is Disrupting Everything

The message from strategic advisors is clear. Go digital or die. Andrew Vaz, Global Chief Innovation Officer for Deloitte, predicts that "In today's world of exponential change, organizations that get too comfortable with the status quo are at major risk of disruption." [1] Acccenture's CEO, Pierre Nanterme, shares that this is already happening, "Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000." [2] This is a fundamental shift that can't be taken lightly.

Digitalization is Mandatory

Digitalization is impacting industrial companies regardless of whether they produce a piece of equipment, a device, a vehicle, a marine vessel, a consumer good, a building, or some other physical item. We believe this shift will have major consequences. Our research concludes that "the manufacturing industry is changing rapidly and companies have to digitalize or risk losing their market position." [3]

Digital Product Innovation is Compelling

Many companies struggle, however, with where to begin their digitalization journey. Innovation is a smart place to start. Few things impact a company's bottom line more than the results of their product innovation and product development processes. In fact, three-quarters of executive respondents report that product innovation is one of the most important factors impacting their company's success and profitability. What could be a more strategic place to begin?

The Business of Innovation is Challenging

Markets are Challenging

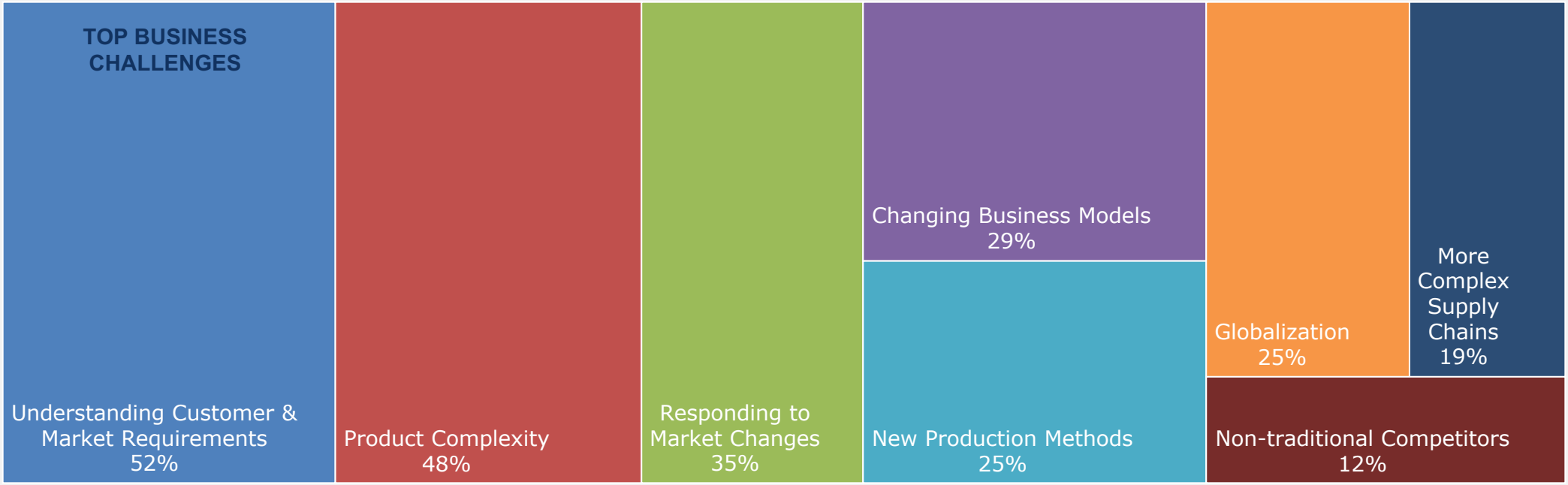
Improving innovation is an opportunity that comes with obstacles. Developing profitable products requires overcoming multiple business challenges. Just over one-half of respondents report trouble identifying evolving customer and market needs. Digital transformation is likely a big source of this difficulty. Requirements are becoming more dynamic as the pace of change accelerates with digital markets and economies.

Product Complexity is Growing

Beyond more dynamic markets, companies struggle with growing product complexity. Growth in product complexity typically includes smarter products, new materials, higher levels of configurability, and globalization. In this survey, one-quarter of companies also mention new production methods. This likely includes 3D printing. This challenge is increasingly prominent in our surveys, indicating that product innovation challenges go beyond R&D and Engineering.

Strategic Challenges are Lower on the Radar

One concerning finding of this study is that companies more frequently report struggling with market and product issues than strategic issues. Just over one-quarter report facing challenges from changing business models such as product-as-a-service or the IoT. Similarly, only about one-eighth report issues with non-traditional competitors. These strategic issues are more likely to pose a business risk than the tactical issues and likely deserve more attention.



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Innovating and Developing Products is Hard

Product-Centric Challenges are Most Common

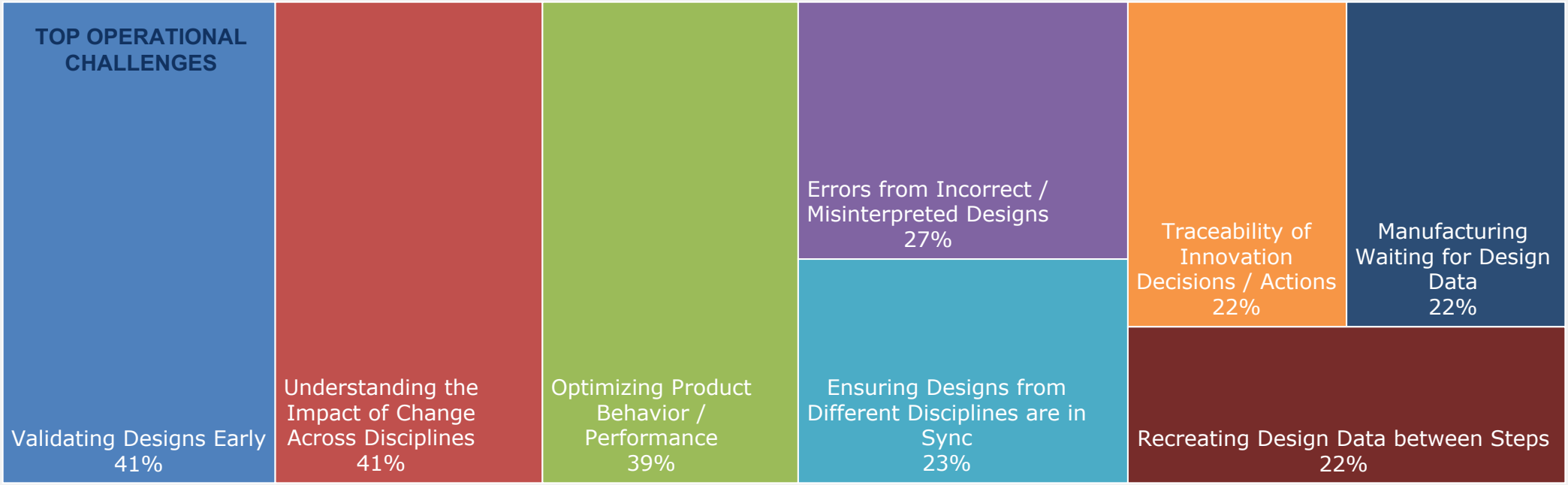
Business challenges aside, simply executing a successful product innovation, design, and development process is challenging. Respondents most frequently report product-centric challenges including validating products and understanding design change impacts across disciplines. At the same time, over one-third say they face issues optimizing product designs. These coincide with the most commonly reported factors that influence company success and profitability, where product-centric factors including quality, reliability, and performance are mentioned most frequently.

Less Concern About Inefficiency

Surveyed companies appear to focus more on getting the job done than on doing it efficiently. Just under one-quarter of companies report recreating data, traceability, or keeping designs in sync as top challenges. Despite the lower prevalence in this survey, these are still common problems. These accepted inefficiencies will become an increasing liability.

Technical Resources Still Spend Too Much Time on Overhead

Engineering productivity is still an issue. Surveyed companies report that their technical people are only spending, on average, about one-half of their time on product innovation, product development, and engineering. A tremendous amount of time is spent on non-value-added activities. On the other hand, digital companies are raising the bar by using digital twins, digital threads, and digital manufacturing approaches to increase agility and productivity.



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Identifying the Top Innovators

Performance Banding Identifies the Top Innovators

How can companies excel at innovation? Analysts used our Performance Banding process to identify which companies achieve the greatest success in innovation and product development. The top 25% were identified based on their reported revenue growth (over the last 2 years), margin growth (over the same 2 years), and percentage of new products less than 3 years old (which serves to measure innovation) as compared to their competitors.

Top Performers Achieve Significant Business Advantages

These leaders enjoy greater performance relative to their competitors. In addition, these companies report higher actual sales and margin improvements. Top Performers have significant top- and bottom-line advantages over Others. Top Performers have:

- Grown revenue twice as much, on average, as Others
- Improved profit margins almost three times as much

The rest of the analysis focuses on how Top Performers use digitalization to achieve their better product innovation capabilities and business results.

METRIC	TOP PERFORMERS	OTHERS
Revenue Improvement over Past 2 Years	31%	15%
Profit Margin Expansion over Past 2 Years	25%	9%

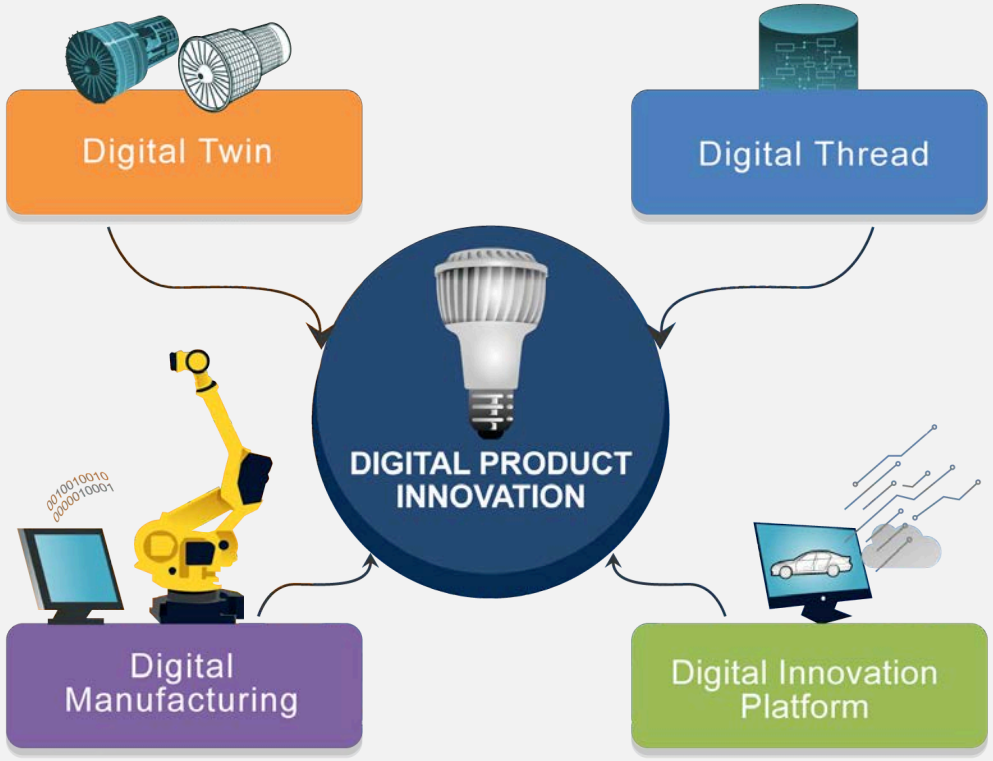
Top Performers are the companies with greater innovation and product development success.

They are the top 25% of respondents based on innovation-related business metrics including:

- Revenue growth
- Profitability / margin growth
- Percentage of products < 3 years old

Researchers investigated how Top Performers achieve this higher level of performance.

Top Performers have Higher Digital Innovation Maturity



Analyzing Top Performers' Innovation Advantages

Researchers used the performance bands to understand how digital maturity correlates with innovation performance. In addition to financial performance, Top Performers report higher capabilities compared to their competitors in their ability to:

- Get new / changed products to market quickly
- Design innovative products
- Meet market cost requirements
- Develop high performance products
- Deliver high quality / reliable products

Analyzing Top Performers' Digital Innovation Maturity

Researchers also used the performance bands to compare the approaches Top Performers take to product innovation. The research finds that Top Performers are more digital than Others, specifically that they have more mature capabilities in four pillars of digital product innovation maturity:

- Digital Twin
- Digital Thread
- Digital Manufacturing
- Digital Innovation Platform

Let's look at the details of this analysis and more specifically what Top Performers do differently.

Innovation Leaders Leverage Digital Twins

Design using the Digital Twin

Definitions of what a "digital twin" consists of vary widely. From an innovation perspective, we define the digital twin as a virtual model of a physical item. The model represents a specific product, configuration, piece of equipment, plant, city, or other physical asset with enough fidelity to predict, validate, and optimize performance and behavior.

Digitalize Product Models

Digital twins, at the core, rely on a digital product model. A digital model defines a product in a way that can be interpreted programmatically and leveraged beyond the design tool initially creating it. It documents product designs and frees the information up to be shared with other people, processes, and software applications to better communicate, collaborate, and coordinate designs across the organization and supply chain. Top Performers are almost twice as likely as Others to have digital design models as opposed to using traditional file-based formats.

Integrate Product Definitions

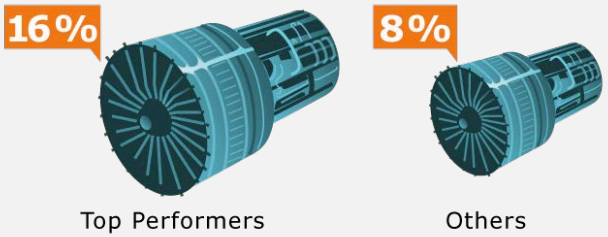
Beyond simply creating a digital model, Top Performers are over two-thirds more likely to integrate product design information across disciplines. For example, they may integrate mechanical design information with electrical design data in their models. Some Top Performers report they integrate data from all disciplines, for example including embedded software.

Integrated, digital product models aren't the most *common* way for either performance band to document their products, but they are the most *differentiating* approaches between Top Performers and Others.

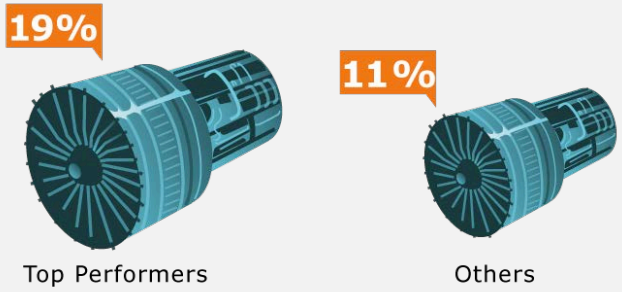
Leverage the Digital Twin to Optimize Products

Beyond modeling products with the digital twin, the leaders use their digital twins to improve innovation. Top Performers are 19% more likely to predict and optimize product performance based on simulations conducted regularly throughout design. They are also about four times as likely to improve simulation models by comparing with sensor / IoT data, although this is not yet a common practice even in Top Performers.

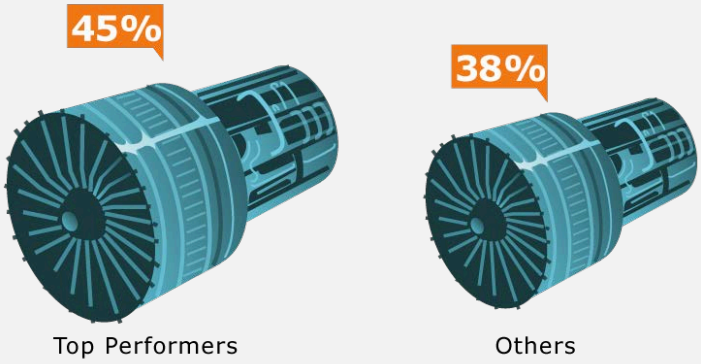
DIGITAL PRODUCT MODELS



INTEGRATED PRODUCT INFORMATION



SIMULATION DURING DESIGN



Higher Performing Innovators Employ a Digital Thread

Create Design Continuity and Traceability across the Innovation Lifecycle

The "digital thread" likely has as many different definitions as the "digital twin," if not more. Our view is that the digital thread ties product information, decisions, and history together in a structured, integrated way that captures product innovation and knowledge throughout the product lifecycle. It establishes traceability from early in the front end of innovation through development and beyond.

The digital thread approach also incorporates streamlined design creation by sharing and/or reusing design data across the stages of innovation. Design continuity along the digital thread allows designers to add their design information to a design model, directly incorporating and extending design data from prior steps instead of recreating design information.

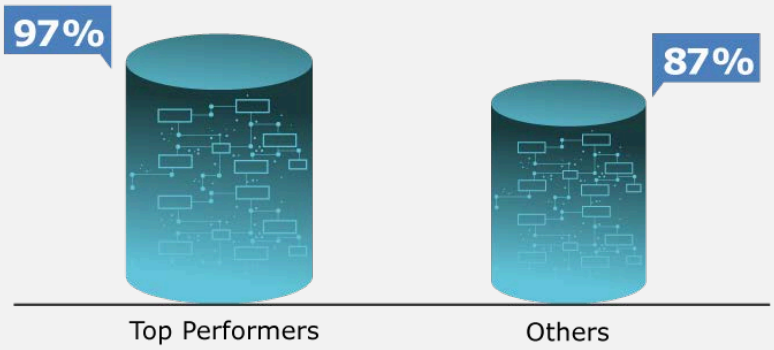
Make Design History and Decisions Readily Available

Capturing and tracing design history provides value in most industries and is mandatory in others. It captures design decisions and creates reusable product knowledge. Top Performers are 11% more likely to have the data their company needs to trace design history and decisions stored and accessible, saving wasted effort assembling data when needed.

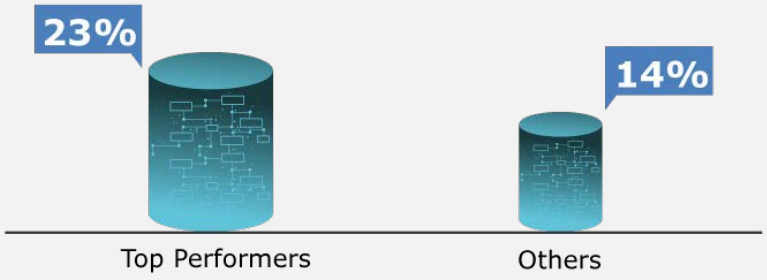
Streamline Innovation with Digital Data Continuity

Digital design continuity leverages data from prior design steps as the basis on which to add new design information. This approach streamlines design and reduces the need for design translation and remodeling between design functions. It also helps coordinate design data and processes across the product lifecycle to improve efficiency and decision-making such as understanding the cascading impact of design changes. Top Performers are about two-thirds more likely to share and/or reuse design data across the stages of innovation.

ACCESSIBLE DESIGN HISTORY FILE

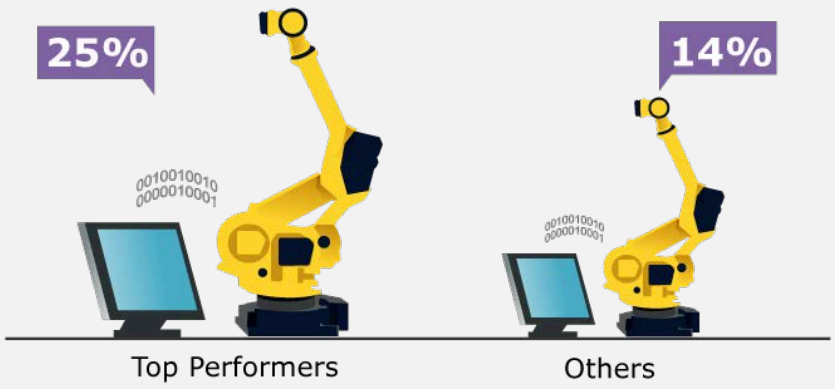


DATA CONTINUITY ACROSS INNOVATION STAGES

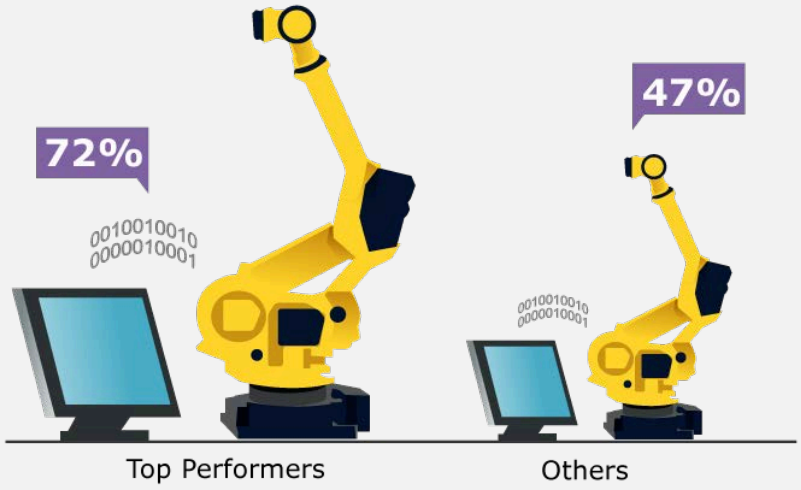


Top Performers Exhibit Digital Manufacturing Maturity

MANUFACTURING INSTRUCTIONS IN PRODUCT DESIGN



EQUIPMENT INCLUDED IN MANUFACTURING INSTRUCTIONS



Remove Barriers between Products and Production

Digital manufacturing is the application of digitalization to the design, optimization, validation, and commissioning of production. Digital manufacturing connects product and production design in order to ensure products are designed for manufacturability and streamline the transfer of product designs to the plant. Digital manufacturing incorporates Industry 4.0 and smart manufacturing concepts.

Integrate Manufacturing Processes with Product Designs

Creating a cohesive model that addresses both product and production engineering provides a consolidated way to develop production methods in parallel with product design. This integrated approach helps support change management, encourage reuse, and support digital commissioning by creating holistic product and production models. Top Performers are 81% more likely to create manufacturing instructions from design information by adding / associating manufacturing steps to the product design model. On the contrary, 30% of Others report that they don't model production steps / processes at all.

Bridge the Gap Between Processes and Equipment

Production performance is highly reliant on the considered relationship between process steps and production equipment. Integrating equipment into manufacturing instructions, as described in standards like S88, help ensure quality and performance. Top Performers are not only more likely to integrate product and production design, they are over 50% more likely to include production equipment in their production process / step designs. Top Performers are clearly embracing digital manufacturing.

Top Innovators Adopt Digital Innovation Platforms

Digitalize Design Data

Leading companies support product innovation with digital data. For the purposes of this research we define "digital data" as data in a database that can be accessed by any application. Digital data does not include files that must be opened by a specific tool or data embedded in documents, forms, files, CAD models, or scanned data. Top Performers are 50% more likely to have fully digital design data than Others.

Digitalize Design Processes

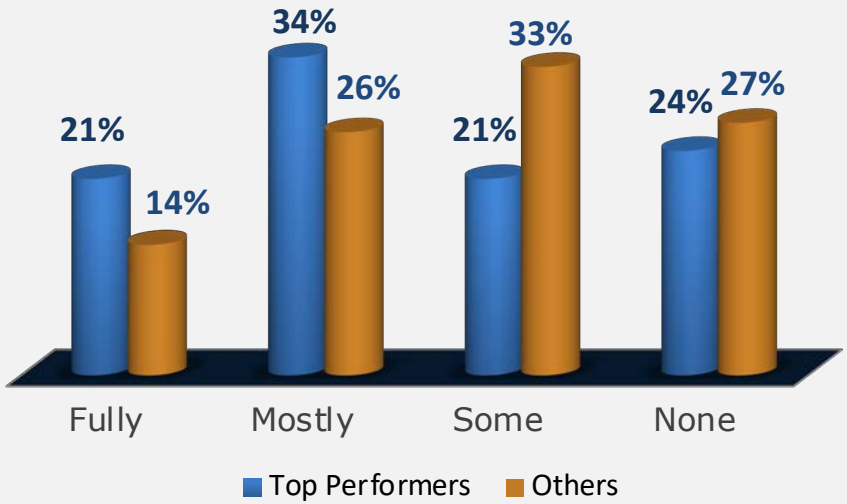
Digitalization extends beyond data to processes. We define "digital processes" as those that are executed based on computer-managed workflows and tasks. An example is managing engineering changes and approvals via digital workflows. Top Performers are over three times as likely to have fully digital design and development processes.

Innovate with a Digital Innovation Platform

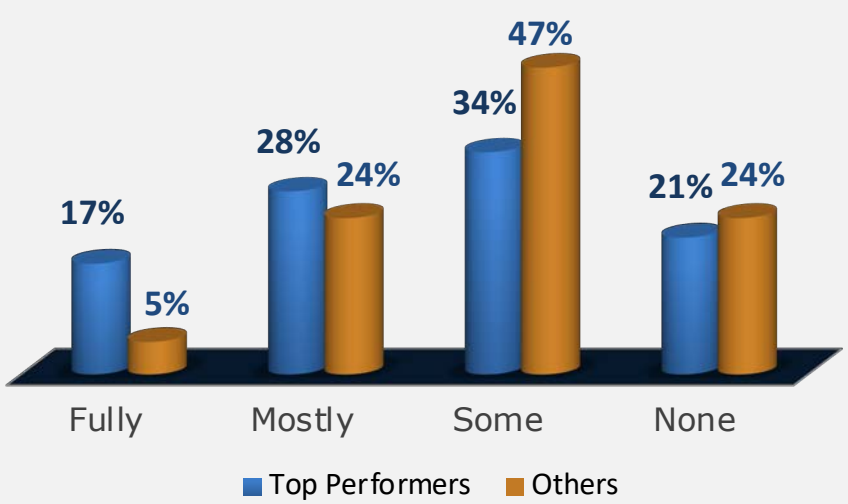
Digital product innovation requires the support of digital technology. The digital innovation platform provides the backbone for the digital twin, digital thread, and digital manufacturing capabilities used by the leading product innovation companies. A digital product innovation platform supports integrated, digital product models coupled with integrated applications to design, optimize, validate, and collaborate on products. It can also be readily integrated with other systems, used for analytics, and leveraged for new purposes to support digital transformation.

Digital product innovation is not possible without an integrated product innovation platform. In fact, Top Performers are 47% more likely to use a PLM system as a primary system to support product innovation, development, and design.

DESIGN DATA DIGITALIZATION



DESIGN AND DEVELOPMENT PROCESS DIGITALIZATION



Conclusions

Industry is Transforming

Digitalization is fundamentally transforming industry. The shift is allowing manufacturers to improve quality, agility, and innovation to disrupt their markets. Companies that embrace this change will find new opportunities and distance themselves from their competition. Those that continue to focus solely on tactical issue will fall behind.

Top Performing Innovators have Higher Digital Maturity

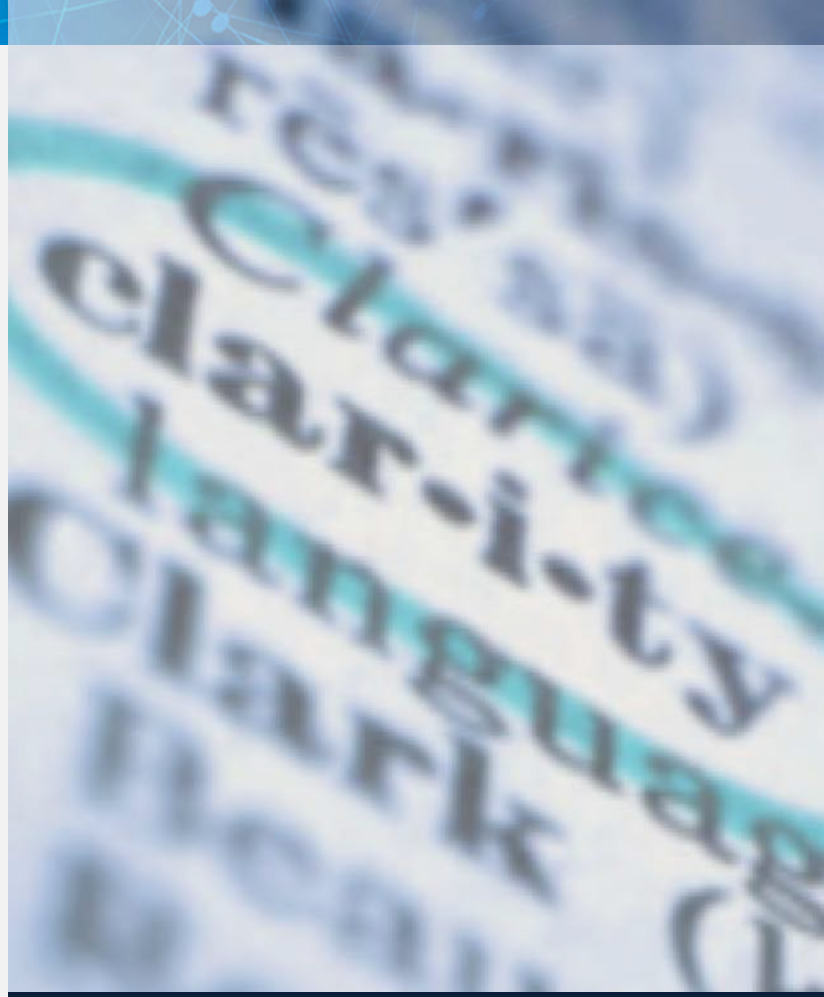
Digital product innovation is critical to company success and profitability. Digitalizing product innovation helps companies better bring new / changed products to market, design innovative products, meet market cost requirements, develop high performance products, and deliver high quality / reliable products. The end result is significantly greater revenue and margin growth. Top Performers are achieving superior levels of performance with higher digital maturity, including increased adoption of digital twin, digital thread, and digital manufacturing techniques.

Support Digital Maturity with a Digital Product Innovation Platform

Top Performers support digital approaches like the digital twin with digital technology. These leading companies are digitalizing data and processes to improve product innovation performance. These capabilities are available from digital innovation platforms that combine digital data and processes with the right capabilities to design, optimize, and validate products. In addition, these platforms bridge the gap to help companies ramp up production effectively and efficiently.

Digital Opportunities Extend Beyond Product Development

The analysis from this survey investigates the benefit of improving product innovation and product development through digitalization. The benefits of digitalization, and digital innovation platforms, go well beyond this into the full lifecycle of a product. Digitalizing product innovation is a great place to start and build a foundation to grow on.



Survey results show a clear correlation between product innovation performance and digital innovation maturity.

About the Research

Data Gathering

Tech-Clarity gathered and analyzed over 150 responses to a web-based survey on Digital Product Innovation. Responses were gathered by direct e-mail, social media, and online postings by Tech-Clarity and Siemens.

Industries

The respondents represent a broad cross-section of industries including Industrial Equipment / Machinery (27%), Automotive / Transportation (20%), Aerospace / Defense (15%), Electronics / High Tech (12%), Life Sciences / Medical Devices (12%), Architecture / Engineering / Construction (10%), Energy / Utilities (10%), and others including Consumer Products (Retail and Hard Goods), Building Products and Fabrication, Consumer Packaged Goods, Marine, and Chemicals.*

Company Size

The respondents represent a mix of company sizes, including 38% from smaller companies (less than $100 million), 28% from companies between $100 million and $1 billion, and 34% from larger companies greater than $1 billion.

Geographies

Responding companies are headquartered in North America (57%), Western Europe (26%), Asia (11%), and other locations including Latin America, Eastern Europe, Australia, and the Middle East.

Product Innovation Role

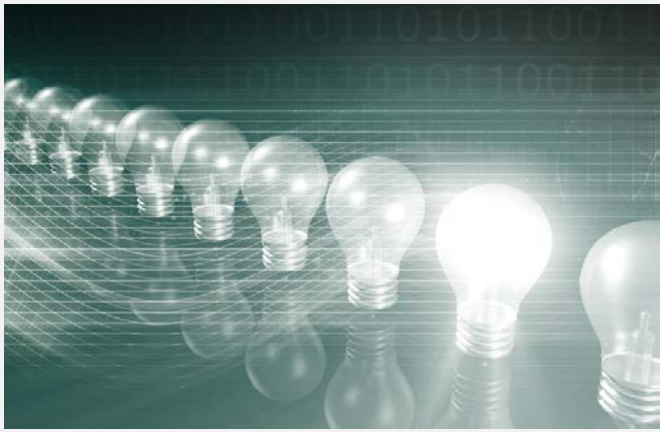
86% of respondents included in the analysis directly design or develop products. The other 14% provide engineering or design services to support those efforts.

Role

The respondents are comprised of Executive / "C-level" (10%), Vice President / Director (14%), Manager (24%), Non-manager / staff / individual contributor / engineer (49%), and others (3%).

Organizational Function

Respondents are primarily in engineering or manufacturing roles, specifically Product Design / Engineering (46%), Manufacturing (12%), IT (8%), Industrial / Manufacturing Engineering (6%), Industrial Design (5%), Project / Program Management (4%), and others including General Management, Plant / Facilities Engineering, Analyst / Simulation Expert, Quality, and Service / Support.



For the purposes of this study we defined "Products" as the outcome of a company's innovation and production. A product could be a piece of equipment, a device, a vehicle, a marine vessel, a consumer good, a building, or some other physical item.

* The values total greater than 100% because companies reported doing business in multiple industries.

Acknowledgments

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About the Author

Jim is a recognized expert in enterprise software for manufacturers with over 25 years of experience in application software, management consulting, and research. He has extensive knowledge on how industrial companies use product innovation, product development, engineering, and other enterprise solutions to improve business performance.

Jim is actively researching the value of improving product innovation and operational performance through digitalization.

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1) Andrew Vaz, "Courage under fire: Embracing Disruption," Deloitte, 2017.

2) Pierre Nanterme, "Digital disruption has only just begun," World Economic Forum, 2016.

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