# FIND THE BEST BALANCE BETWEEN QUALITY, REGULATIONS & COST

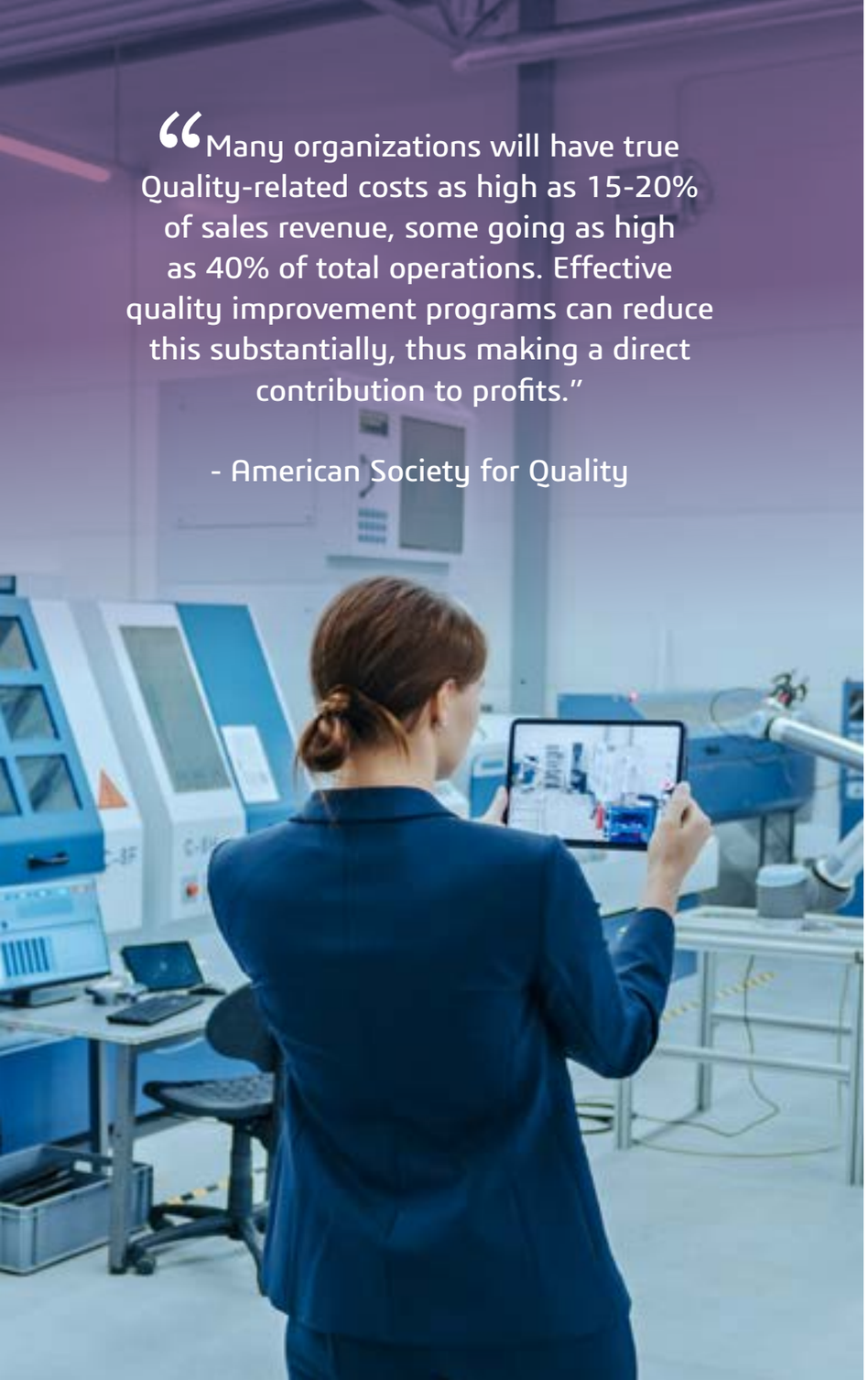
## Move Beyond Digital Continuity to Achieve Total Quality Management

## INTRODUCTION

# STATE OF THE INDUSTRY

Across all industries, product quality matters. With the American Society of Quality estimating that many organizations incur quality-related costs as high as 15-20% of sales revenue, it is no surprise that manufacturers are adopting Total Quality Management (TQM) as a strategic business initiative.

With advancements in Artificial Intelligence (AI), Machine Learning (ML) and Virtual Twin technologies, organizations are able to analyze massive amounts of Quality data to detect patterns, find correlations and make evidence-based decisions, making TQM objectives more achievable than ever.



> “Many organizations will have true Quality-related costs as high as 15-20% of sales revenue, some going as high as 40% of total operations. Effective quality improvement programs can reduce this substantially, thus making a direct contribution to profits.”
>
> - American Society for Quality

With so much at stake, why haven’t more organizations achieved their Quality goals? It is because the challenges working against total quality objectives are considerable:

- Increased in product and process complexity strain quality resources.
- Accelerated delivery schedules leave less time to ensure quality.
- Quality management consists of siloed systems and data sources.
- Disparate product development systems (design, simulation and manufacturing) inhibit using product data to proactively identify and resolve quality issues.

Enterprise business processes are mainly designed to support the so-called “happy path.” Unexpected situations are very often handled aside from the standard operating procedures. Exchanges and issue resolution are not properly tracked and reported back into the enterprise process.

When viewed from both cost (recalls, warranties) and opportunity (customer loyalty, competitive differentiation) perspectives, it is clear why organizations are viewing TQM as an essential component of overall business strategy. This eBook discusses quality challenges faced by product development organizations and provides valuable insight into how the **3D**EXPERIENCE® platform and its Virtual Twin capabilities uniquely address them.

Global demands are different depending on a country's level of economic development and its cultural preferences, giving rise to complexity for global companies. The Internet is driving Industry 4.0 with new regional regulations, elevating demand for ever-higher quality and streamlined operations that can increase the capacity to deliver innovative products, control costs and maximize profits.

So while regulators are presenting challenges of their own, manufacturers are also pressured to appeal to their global customers' diverse wants and needs. To address this, manufacturers usually employ siloed solutions to attempt to solve challenges along the value chain.

That approach offers some level of quality management, but it is clearly insufficient to meet the demands of the future with confidence — it is not Total Quality Management.

To satisfy customers' expectations, Total Quality is imperative, and companies should be able to provide this level of customization across all their products. The expectation is that manufacturers will be agile and flexible enough to incorporate the latest technologies into existing product line-ups, as well as offer new products at a rapid pace.

What is needed is a single, end-to-end solution that gives innovators the confidence to **find the best balance in quality, regulations and cost** and deliver products that turn customers into brand loyalists.

## CHAPTER 1

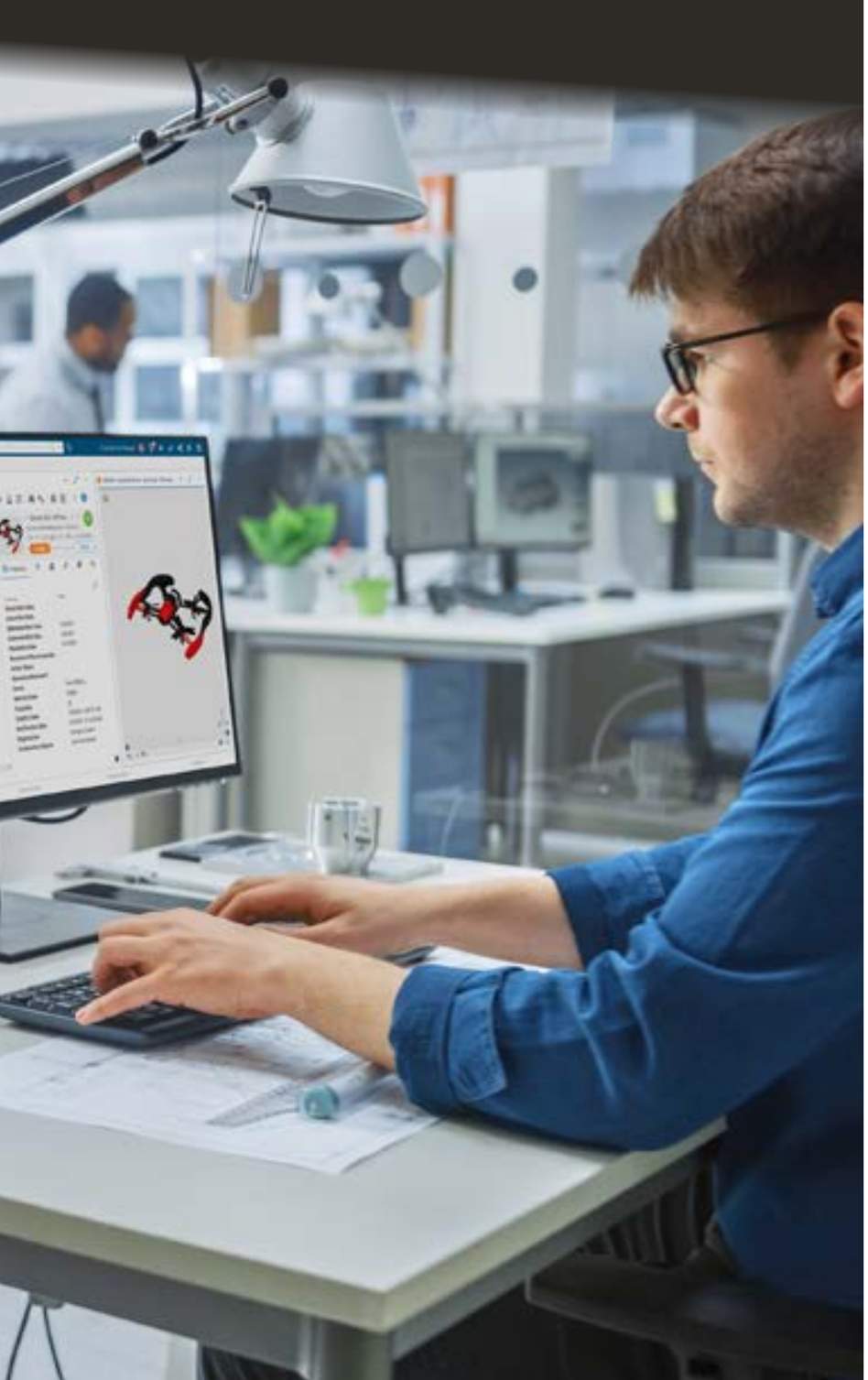
# ESCAPING THE SILOS

Although ensuring quality certainly comes at a cost, falling short on Quality can have catastrophic effects on the bottom line. The cost of a failed or recalled product can put a company's financial position at risk.

In one instance, $22.1 billion in claims and warranty accruals by automakers and suppliers resulted from a 53.1 million vehicle recall in the US.[1]

Despite efforts by some organizations to embed Quality into their processes, the information and data required for effective quality management is still locked in silos.

Early in development, teams are faced with a lack of information needed to plan for success due to disparate systems and ineffective communication. Later on, teams struggle with late or incorrect data leading to poor decisions and wasted effort. Quality issues are often discovered during the launch process, and compliance is routinely treated as a reporting function toward the end of product development that leaves companies simply hoping that no violations are discovered.



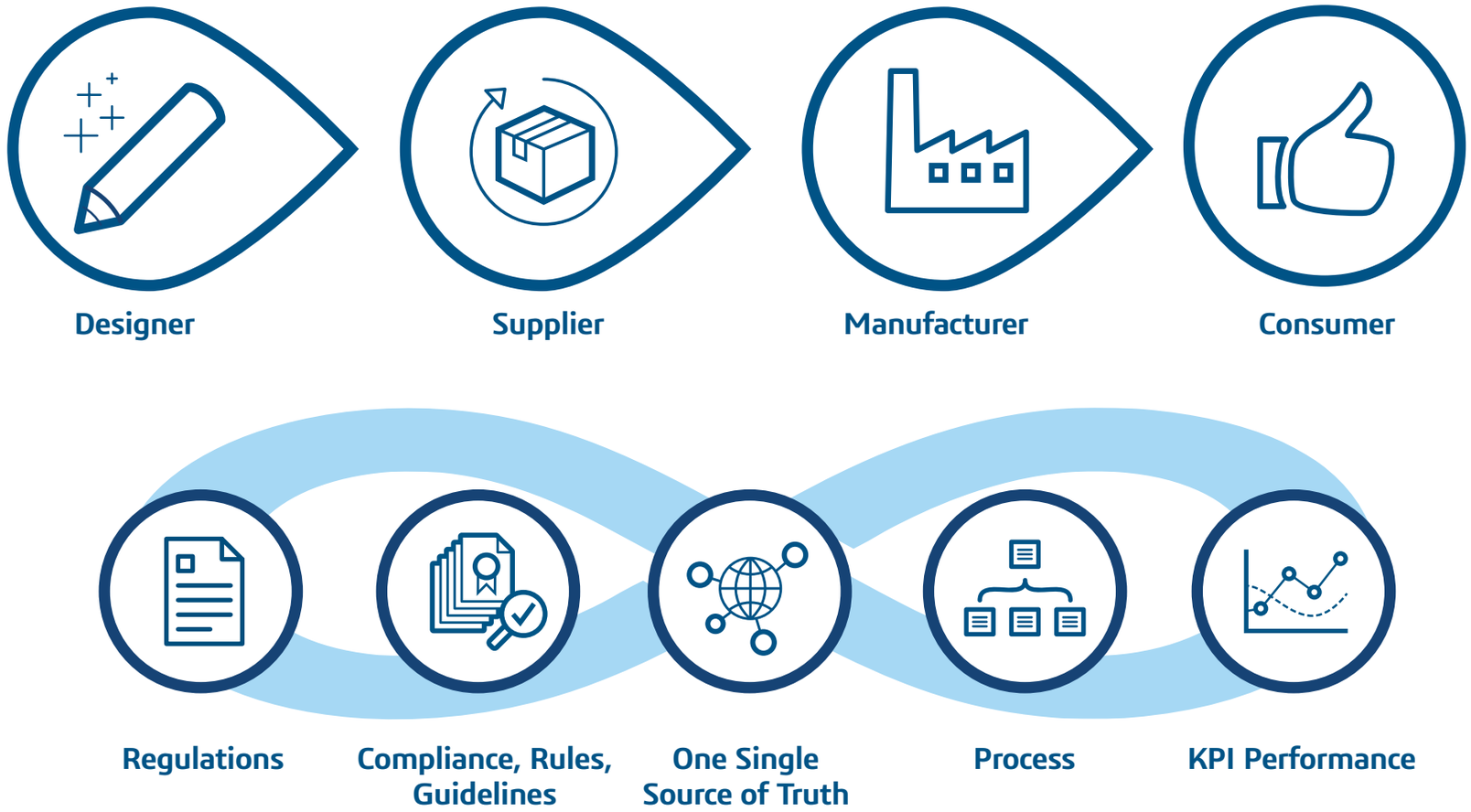
## Silos, the obstacle to Total Quality.

Quality issues reported by users, customers and consumers are addressed by the after-sales organization. This means Quality organizations struggle to qualify individual issues and consolidate them to detect the emergence of a common problem.

These quality delivery failures lead to an increase in rework, prolonged time-to-market and poor customer satisfaction. Furthermore, all of these issues increase development and material costs and negatively impact sales and brand value.

**Manufacturers and their suppliers cite a myriad of Quality challenges as a result of operating in silos. These include:**

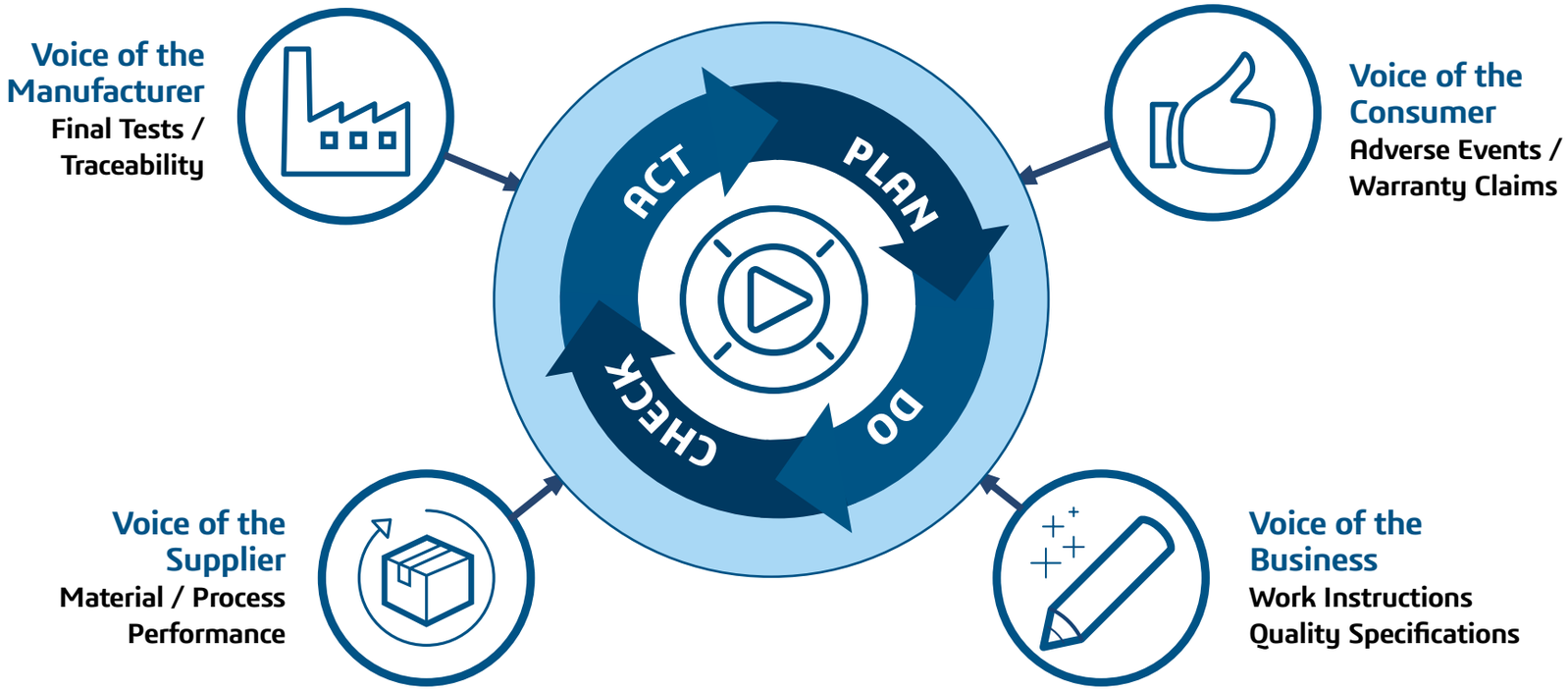
- Lack of systematic problem-solving approach results in continually repeating the same quality issues.
- No standard quality metrics to apply to customer-specific requirements because these often fall outside the scope of Quality standards defined by third-party certification bodies (e.g. ISO/TS 16949, ISO 9001, ISO 14001, etc.).
- Insufficient flexibility in their Quality Management System (QMS) to accommodate customer-specific requirements.
- No ability to represent customer identified problems, issues or defects on the 3D product model.
- Methods and tools that do not support embedding Quality into design and current processes per established best practices like Design in Quality, Design for Manufacturability and Design for Six Sigma.
- Loss of know-how, teachers and mentors due to a large number of retiring workers over the next five to eight years.
- Inability to effectively feed warranty and recall information back into processes in order to improve future product quality and reduce costs.




True digital continuity begins with a single source of truth that keeps all stakeholders in sync, from end to end.

That way, regulation, compliance, design and safety issues are transparent across the entire value chain, giving every stakeholder the ability to ensure quality at every point and meet KPIs.

**Total Quality is a matter of detecting inconsistencies in business processes and identifying shifts between procedures and their execution.**




Perhaps most troubling is the fact that many quality issues are repeat problems that occurred in previous projects and, although they already have been investigated and corrected, have occurred again. In fact, one study found that 80 percent of issues encountered are repeat problems with known solutions.[2]

The ability to observe enterprise processes and then plan, do, check and act across the entire value chain from conceptualization to post-sale ensures the continuous and authentic experience of quality that product innovators want.

Companies have long been implementing QMSs and processes as a structured way of delivering a better product. This is done by documenting information such as procedures, work instructions, policies and forms that enable those tasked with quality execution to systematically meet a company's quality requirements. As a part of this effort, many manufacturers have focused on tools for quality issue prevention, such as Quality Functional Deployment (QFD) and Failure Mode and Effect Analysis (FMEA).

But, if these tools are designed to predict and prevent Quality issues up front, and processes are in place to manage the closure of quality and compliance issues when they are found, why do companies still struggle with Quality issues?

One main reason is that the vast majority of Quality and Compliance practices today are primarily reactive to issues in the product development process. In most organizations, Quality Management is a separate function that establishes processes for planning and assurance, control and improvement. And, although the creation and execution of a closed loop process has improved overall quality, it has provided only incremental gains and still often relies on the end customer to report issues.

Quality management must become a pervasive, holistic, enterprise-wide endeavor — it needs to be become **Total**. Teams need to come together on a single innovation platform to predict, manage and meet the challenges of new product development projects that allow manufacturers to design in quality and compliance from the start. The Virtual Twin then becomes a backbone that enables users to project quality findings on one common referential.

## CHAPTER 2

# TOTAL QUALITY IN MOTION

How can product innovators be better prepared to respond to changes in market trends, regulations and standards? It's a question of the processes and the chosen platform. The answer lies in adopting a platform that enables manufacturers to validate quality priorities and processes while responding to changing market opportunities.

> “The value is real. Improving Quality maturity can reduce the Cost of Quality by 5% of total revenue.”
>
> - LNS Research

## What if there were a way to digitalize the entire testing, simulation and physical prototyping process for a fraction of the cost and enjoy a new level of ROI?

Testing on physical prototypes simply takes too long. To stay competitive and provide customer experiences with the right quality level in compliance with regulations, companies need to rely heavily on digital solutions like virtual simulation. True end-to-end digital continuity is the necessary transformation that must take place to improve margins and protect revenues by preventing issues, rather than reacting to them.

When you do this, Quality transforms from a burden into an advantage; improved quality, increased compliance and less rework ensures companies can become and remain Quality leaders. When you can protect your product investments and market access, you can turn customers into advocates.

Product manufacturers have many siloed experts, processes and tools. What they need now is to be able to connect all of that. The Virtual Twin is the enabler to connect the Voice of the Customer with the Voice of the Process, the Voice of the Suppliers and the Voice of the Business.

## Data analytics offers significant value potential for TQM.

Combining data from physical and digital sources with AI/ML capabilities enables organizations to both learn from past events and predict possible future quality issues.

Analytics connect the Voice of the Process and the Voice of the Customer helping to reduce Cost of Quality:

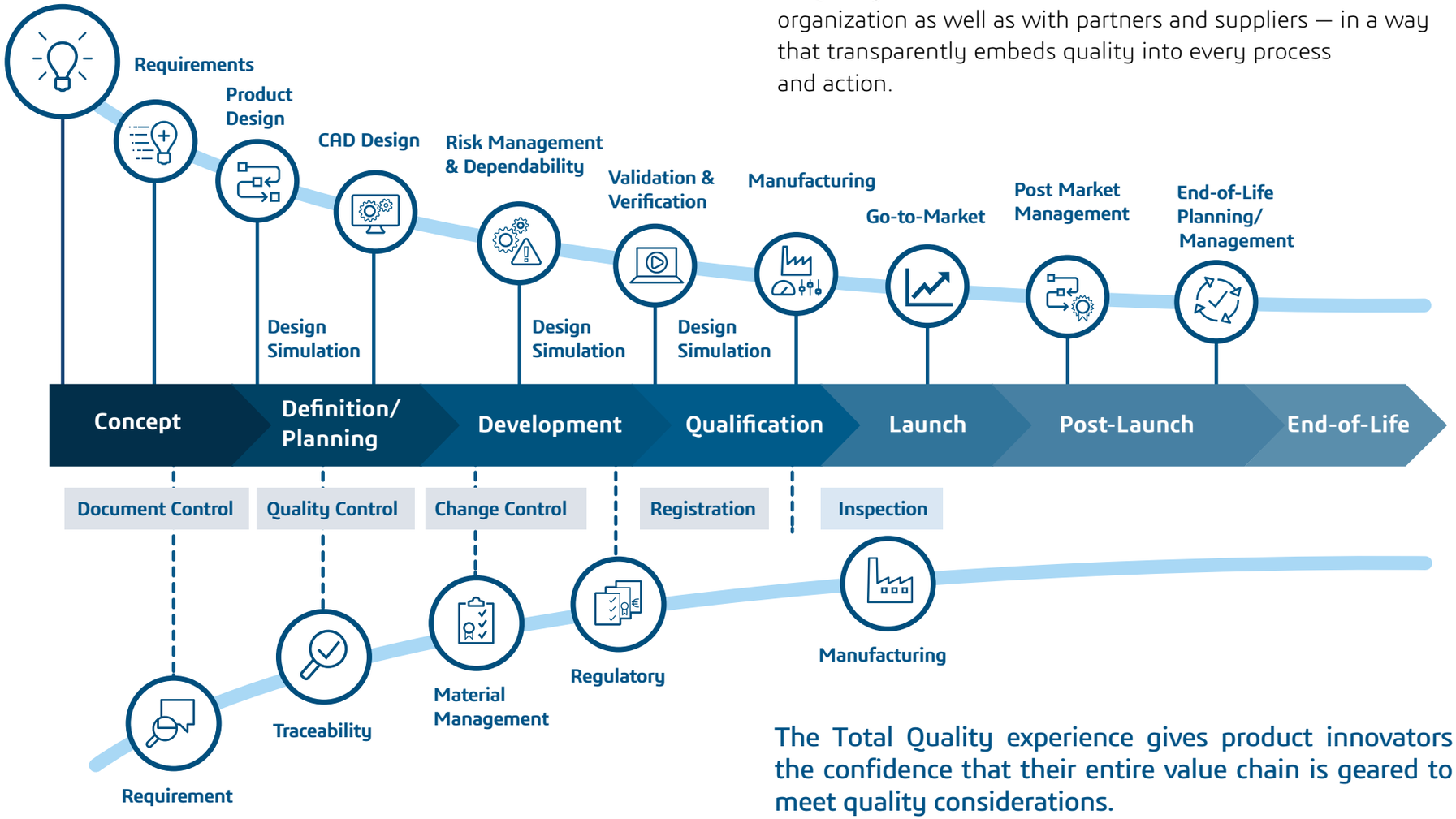
- Using semantic analytics to detect quality issues in customer claims.
- Applying trained ML models to detect patterns and similarities between issues.
- Helping after-sales teams leverage previously acquired knowledge to solve similar cases.
- Enabling engineering teams to perform proactive root-cause analyses and establish preventive action plans.
- Utilizing knowledge-graph models to search for correlations between issues and shifts that happen in the execution of business processes.

The power of Quality analytics helps teams drive continuous improvement across business processes, operations and products. In turn, this supports faster and more informed decision making when issues are identified and, ultimately, improves customer satisfaction.

## Total Quality Management seamlessly embeds quality into every process.

There's no doubt that production complexity, and the ever-growing amount of data that comes with it poses real challenges for product manufacturers and suppliers when it comes to effective quality management.

TQM provides a strategic and systematic set of principles that allow manufacturers to take a process-centered approach to quality that focuses on customers. The TQM approach is best driven by a platform that enables digital continuity to connect all Quality contributors across the value chain — within the organization as well as with partners and suppliers — in a way that transparently embeds quality into every process and action.




The Total Quality experience gives product innovators the confidence that their entire value chain is geared to meet quality considerations.

When an innovation platform supports the practice of TQM, every stakeholder in the product development process is connected. This environment enables fact-based decision-making and communication, while allowing teams to predict, manage and meet the challenges of new product development projects transparently. This also seamlessly embeds Quality every step of the way.

**Digital continuity ensures knowledge can be shared consistently throughout the product lifecycle.**

For example, the Advanced Product Quality Planning (APQP) framework is pervasive across all industries. However, not all manufacturers are achieving the best results from it. APQP *should* provide a flow of information throughout the organization as well as up and down the supply chain, thereby driving quality throughout the development process. In reality, a huge amount of administration and paperwork is required to manage the process. The problem lies not just in the volume of documents involved, but that these various spreadsheets and project files often exist in multiple versions that are stored locally across various users' drives. The inability to share this information effectively means all involved parties cannot work in a truly collaborative way. Only by switching to a central TQM platform can manufacturers and suppliers track, re-use and leverage existing data.

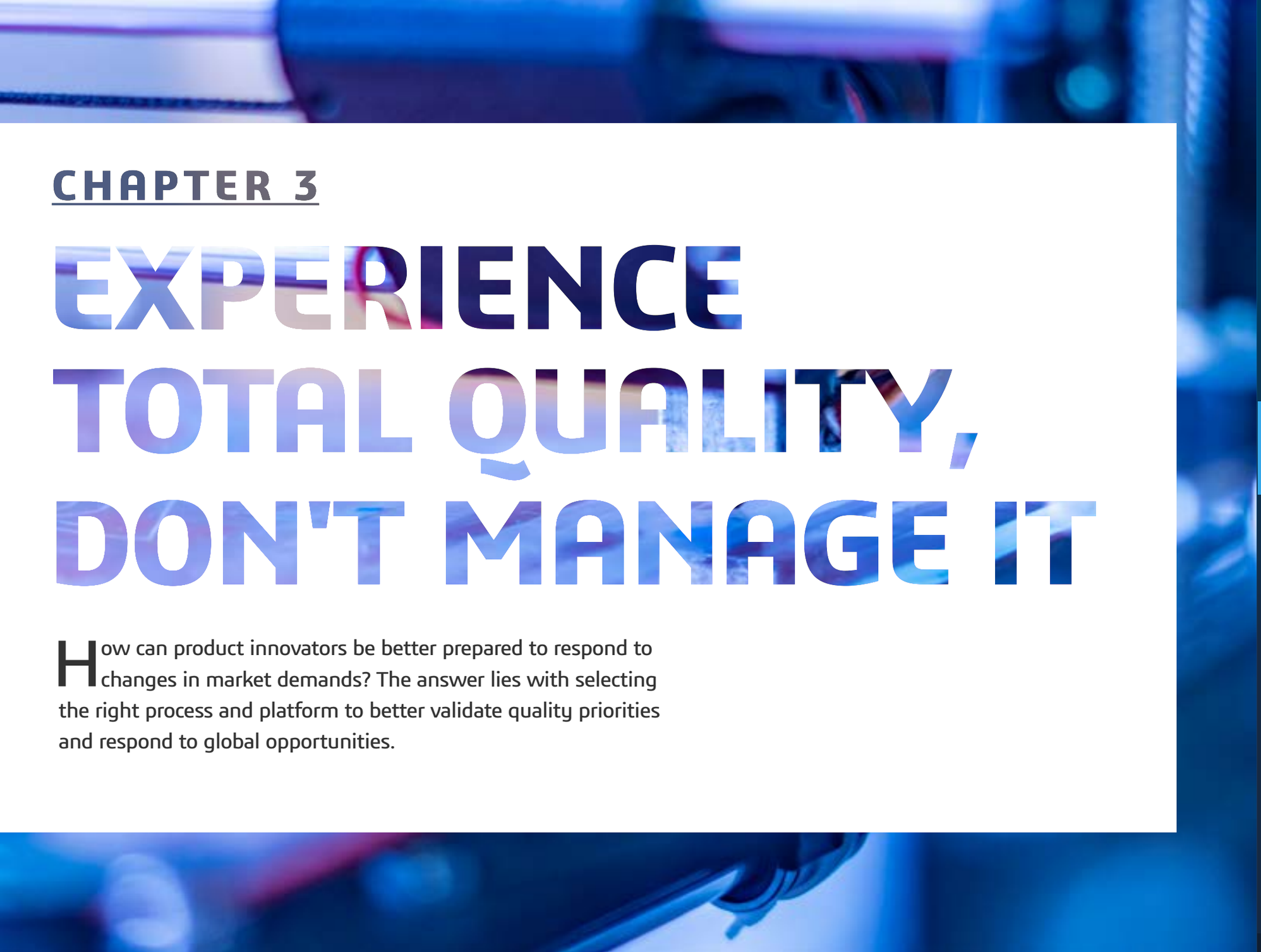
Quality Management doesn't stop there. When developing a new product, manufacturers can either begin from scratch or recycle data from previous projects. Whenever possible, it makes business sense to reuse 3D models of parts in new designs. This enables them to considerably cut costs, reduce market delivery time and appeal to customers that value reliability but also want high quality at an attractive price point.

## Are you thinking about turning mass customization into a market advantage?

Imagine confidently releasing many dozens of customized designs per week and calling upon hundreds of thousands of production parts in your database to customize many more.

The ability to reuse parts from a continuously optimized product data management database is key to bringing high-quality products to market quickly.

High-quality products turn customers into brand loyalists. Studies show that a 5 percent increase in customer loyalty can increase profits by 25 to 50 percent.[3] You retain your customers by keeping them happy, and gain new customers through the power of grassroots, word-of-mouth advertising from happy customers — this comes easily when you have high-quality products. The question is: How?



## CHAPTER 3

# EXPERIENCE TOTAL QUALITY, DON'T MANAGE IT

How can product innovators be better prepared to respond to changes in market demands? The answer lies with selecting the right process and platform to better validate quality priorities and respond to global opportunities.

> “We can monitor the overall quality of a vehicle from ideation to manufacture in real time and deliver products at a fast pace with zero defects.”
>
> - Dr. N. Saravanan,
> Senior Vice President and
> Head of R&D, Ashok Leyland

In today’s markets, being innovative in product development isn’t enough. Control is a critical part of any process. TQM with a platform that provides digital continuity establishes the framework for control, automation and visibility that embeds efficient and effective Quality Management into all of an organization's processes and decisions. This includes providing the means for implementing predictive analysis across the entire quality management landscape.

When assessing the cost to obtain Quality — the balance point between cost of investment in quality and cost of defect — shifting to a TQM approach on an innovation platform allows your company to find and monitor this balance point. When product developers find this balance, they become quality leaders that protect their product investments and market access.

## The platform for TQM.

The **3D**EXPERIENCE platform uniquely provides the applications, collaborative processes and single data source to embed Quality throughout the product development process. The platform enables digital continuity to ensure Quality challenges are not only met, but transformed into advantages.

With the **3D**EXPERIENCE platform, contributors across the extended enterprise better anticipate and mitigate errors, rather than react to them. This supports the creation of a learning organization that doesn't repeat quality issues and delivers an authentic TQM experience.

> "Positioning the gearbox and battery pack in the car's very limited space could not have been done in time and with this quality without the applications of the **3D**EXPERIENCE platform."
>
> - Helmut Kastler,
> Head of Mechanical and Electrical
> Engineering, Kreisel Electric


The **3D**EXPERIENCE platform supports Design Failure Mode and Effect Analysis, Process Failure Mode Effects Analysis and Corrective and Preventive Action processes to proactively identify and resolve quality issues. It enables you to virtually validate and certify designs, reducing the dependency on physical validation. Traceability from initial requirements to product delivery ensures consistency and completeness of all tests and verifications.

> "The **3D**EXPERIENCE platform helps us ensure compliance because we have all the documents secured in one place."
>
> - Hugues Le Cardinal,
> Head of Airworthiness, AeroMobil

By automating the prototype testing process with virtual simulation, **3D**EXPERIENCE platform users are able to help customers reduce 10 percent of their annual costs. When testing, simulation and prototyping can cost up to €1 billion for some manufacturers, that 10 percent savings constitutes €100 million in ROI through Dassault Systèmes' virtual simulation capability.

## The 3DEXPERIENCE platform offers the following capabilities to ensure that TQM is embedded from end to end:

- **A Lean approach**
  Digitalized Lean practices offer intuitive tools that leverage Lean methodologies to reduce or eliminate non-value added work and ensure efficient processes.

- **Project management methodology**
  Quality methods are governed as projects with automated and event-driven tasks, change orders and actions, and a model-based enterprise approach for requirements and functions.

- **Risk-based thinking**
  As part of Quality Management (e.g. ISO9001/EN9100/AS9100), risks are managed, controlled and synchronized with tasks throughout all design, manufacturing and services processes. Fully embedded tools, such as FMEA and FTA, link directly to designs, product definitions and process flows. All Quality decisions are based on risk thinking.

- **Complaints, deviations and non-conformance management**
  Customer complaints and non-conformances are managed and directly linked to the product definitions, reusing past experiences either for efficient resolution or to enrich the know-how database.

- **Audits for compliance**
  A fully traced process — from ideation to go-to-market — with audit and inspections tools allows for continual and seamless compliance with regulations and internal requirements.

- **Analysis and reporting**
  Organizations can reveal and analyze multi-source, heterogeneous, structured and unstructured Quality and Compliance data to improve Quality processes and gain competitive advantage. With digital analysis, future Quality issues can be predicted and prevented before they reveal themselves.

- **AI/ML**
  Reduce the cost of non-quality by connecting and analyzing real-world data to provide insights into business operations and products. AI/ML analysis allows continuous quality improvement with the ability to detect, anticipate and resolve non-Quality through early detection.

- **Virtual Twin Experience**
  Map real-world insights onto a common referential to reveal complex and/or invisible information on the 3D representation of products. Capture knowledge and know-how within a single platform to ensure continuous improvement.

# VIRTUALLY OPTIMIZE DEVELOPMENT

How can product innovators be better prepared to respond to changes in the market, new regulations and updated standards? The answer lies in selecting an innovation platform that enables manufacturers to embed Quality into the end-to-end product development process.

**To keep ahead of the competition and meet increasing customer expectations, manufacturers must continue to innovate.**

Delivering innovation requires early and ongoing collaboration from design, simulation and manufacturing disciplines. It also requires active contributions from Quality, Costing and Service organizations. To ensure sustainability in the innovation process, critical success factors from across all contributors must be captured for re-use in a systemic process to fortify your knowledge base.

Yet this is often not enough to maximize quality. As products become more complex, product validation requirements increase beyond what is practical with physical tests. Addressing this gap requires connecting virtual- and real-world product data via virtual twin experiences that provide the ability to run enhanced failure mode studies that optimize designs based on an unlimited number of 'what-if' scenarios.

Only Dassault Systèmes delivers industry leading 3D design, simulation and manufacturing technologies on a single platform. Use the platform's integrated, automated solutions to:

- Synchronize and enhance multi-disciplinary design, engineering and production collaboration.
- Implement governance to integrate distributed programs for global synergies.
- Transform engineering processes with holistic systems engineering development and performance.
- Accelerate requirements fulfillment and regional reporting.
- Perform virtual testing to increase product performance and safety.
- Maintain traceability from ideas and requirements throughout the product lifecycle.

## Surpass requirements, manage costs and ensure success.

Today's most promising and innovative opportunities aren't always aligned with your resources and priorities. They may also include complex global and local requirements that stretch your enterprise capabilities beyond their current limits.

The **3D**EXPERIENCE platform enables your teams to accomplish this with industry-proven tools and processes. You can analyze opportunities, win optimal new business, then design, engineer, validate, manufacture and deliver on target to your customers' satisfaction.

Explore your options at www.3ds.com



### Our **3D**EXPERIENCE® platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3D**EXPERIENCE Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3D**EXPERIENCE platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 290,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit **www.3ds.com**.

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**Europe/Middle East/Africa**
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

**Asia-Pacific**
Dassault Systèmes K.K.
ThinkPark Tower
2-1-1 Osaki, Shinagawa-ku,
Tokyo 141-6020
Japan

**Americas**
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA