THE VOICE OF THE CUSTOMER

Profitable Innovation Through Requirements Management,
Traceability and Process Integration

EXECUTIVE SUMMARY

Industry-leading suppliers delivering innovative products in competitive markets must overcome many challenges to manage product requirements throughout their enterprise. Among the most difficult challenges are integrating complex systems engineering processes, promoting collaboration among multiple engineering disciplines, and enabling the sharing of intellectual property among globally dispersed teams.

Companies seeking a way to efficiently manage product requirements can leverage a comprehensive product lifecycle management (PLM) solution to:

- Effectively reuse intellectual property to reduce time to market
- Increase innovation by integrating expert teams
- Improve overall traceability of the requirements throughout the product lifecycle

Companies must avoid the inefficiencies in managing product requirements that result in costly product development headaches ranging from rework to customer dissatisfaction and rising development costs. Research shows that early requirements management improves time-to- market and helps manage costs. Requirements management allows organizations to capture and leverage the "voice of the customer" and translate market and customer expectations into new products efficiently—improving overall revenue, margins and customer satisfaction.

Two essential areas of focus that enable companies to best leverage requirements management are process integration and traceability. Process integration eliminates communication barriers by creating a collaborative environment for sharing ideas, requirements and data throughout the product lifecycle. Increased innovation, in turn, fosters ideas that improve products and new product introductions. In addition, continuous traceability — from capturing the customer needs to product definition — makes a significant difference in project cycle times and cost reductions.

This paper will highlight the criteria needed for a comprehensive requirements management solution. This collaborative approach is designed to bring together people, processes, data and systems to deliver products to market faster and more efficiently.

REQUIREMENTS MANAGEMENT IS KEY TO THE RIGHT PRODUCT-TO-MARKET

Requirements management is a consistent, prioritized, and monitored approach for administering and controlling the information that helps an enterprise develop the 'right product for the right market at the right time.' The challenge for most enterprises is not capturing customer requirements (needs). The true challenge is the need for continuous communication, change management and traceability (enforcement) of customer requirements throughout the development cycle.

Effective Requirements Management Lowers Product Development Costs

Poor requirements definition in the early stages of a product is a major factor in rising development costs. Requirements errors specifically can account for 70% to 85% of rework costs. For example, product rework can:

- Represent about 40% of a development organization's total spend—with a significant effort focused on correcting requirements defects
- Consume 30% to 50% of total product development costs while requirements errors specifically account for 70% to 85% of rework costs

As Figure 1 illustrates, correcting requirements errors after a product is released can cost over 100 times more than anticipated. Leading suppliers have learned to make the requirements definition visible early in the product development lifecycle.

In a typical product development lifecycle, eliciting, authoring, analyzing, and managing requirements represents about 10% of a project's resources. A recent study demonstrated that the most successful projects spend roughly 28% of their resources on requirements. This research also shows that early requirements management improves time-to-market and helps keep costs on target.
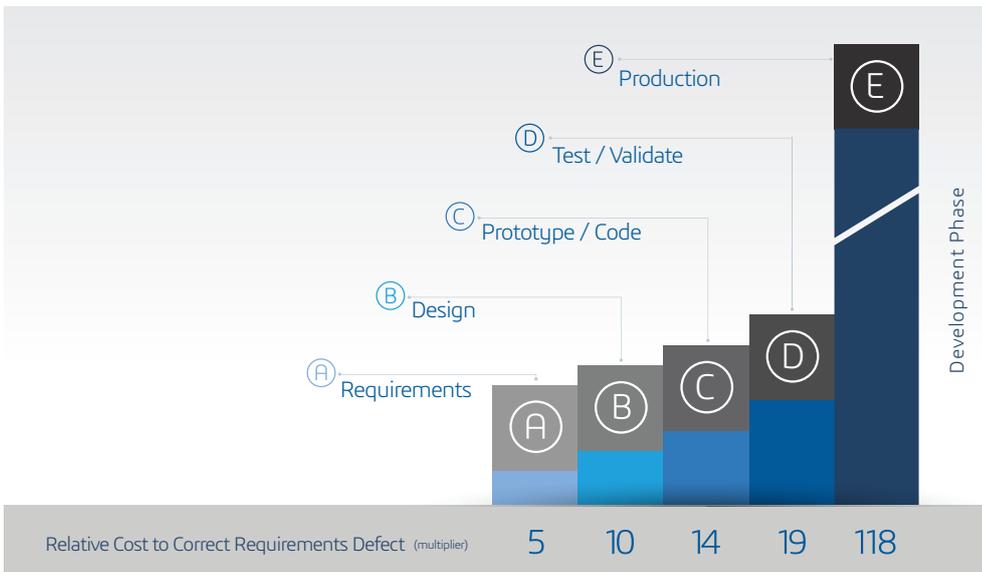

Figure 1.
Correcting errors after a product is released can cost over 100 times more than if the problems are found early in the product development process. Best-in-class companies have learned to make the requirements definition visible early in the product development lifecycle.

Challenges of Effective Requirements Management

Today, most standalone requirements management solutions fall short after the initial requirements capture and analysis. Many companies use groupware applications and manual processes to manage product requirements. These manual processes are slow and prone to error. Groupware solutions create "information silos" which are not integrated with downstream processes directly. Project teams must spend costly manual person-hours to ensure traceability, driving up product overhead costs. Requirements management as part of a PLM solution vastly improves decision support by linking business functions and key areas of product development, providing:

- Global collaboration via a common platform that fosters innovation by bridging the gap across all disciplines to share requirements, design and product launch data;

- Effective traceability allowing direct links to product line planning, systems design (features/options), designed product definitions (Engineering Bill of Material [EBOM] releases), and use-case testing (prototype and test);

- Automated governance (rules) to enforce validation at each development state (e.g. system engineering, design, prototype, and test), ensuring that all requirements are met.

Downstream Process Integration and Traceability

Integration of requirements with downstream processes removes "information silos." This collaborative environment leverages shared ideas and data throughout the product development cycle. A common, shared view of customer needs drives innovation, whether an evolutionary change in existing products or a revolutionary new product. Collaboration also supports continuous improvement of products and business processes. Typically 61% of a company's profits are generated from new innovative products (i.e. new ideas, radical concepts). Additional revenue is driven from existing products and extensions of current product lines. Requirements management packs a powerful punch. Companies can create product concepts and requirements, evolve product lines (roadmap), determine engineering feasibility and establish early product quality and manufacturing criteria, ensuring they are aiming at the correct target.

The business impact of having requirements management processes within a PLM platform includes shorter cycle times, lower product and quality costs and the ability to take advantage of tight market windows.

TIME METRICS	Average Reduction
Searching Data	45%
Entering/Re-keying Data	50%
Authoring/Managing Customer Requirements & Specifications	25%
Initiating/Processing Changes	25%
Managing Customer Programs	30%
Authoring/Managing Designs	25%
Gate Reviews & Related Activity	25%
Testing Product to Requirements	10%
Addressing Potential Defects	20%
Preparing Bid/Quote/Estimate	10%

OPERATIONAL METRICS	Average Reduction
Product Launch Costs*	~1%/Yr
Engineering Costs/Program*	~5%/Yr
Engineering Costs* (design re-use)	~2%/Yr
Cost of Poor Quality*	~20%

COST OF GOODS METRICS	Average Reduction
Prototypes & Samples	**
Overtime	**

REVENUE METRICS	Average Improvement
Lost Sales-Preventable* (cost & capabilities)	~2%/Yr
Lost Margin*	~1%/Yr

PERSONNEL METRICS (HIRING PRACTICES)	Average Reduction
Staff Avoidance (growth-based hiring practice)	~25% FTE/Yr
Cost of Staffing (interview/select/hire/train)	~25% FTE/Yr

* Taken from UPSIDE Magazine (not used in financial calculations)
** Not disclosed

Figure 2.
Case study results of a facilitated tier-1 automotive electronics manufacturer that realized product development cycle improvements with requirements traceability.

TRACEABLE CUSTOMER REQUIREMENTS

Dassault Systèmes ENOVIA® Traceable Requirements traces customer needs and the product requirements that satisfy them. In addition, the supporting **3D**EXPERIENCE® platform enables the integration of requirements with the functional and logical design of complex systems. As requirements are linked to program and project management activities, all disciplines get full traceability throughout the entire development process, ensuring that products that are developed meet original market goals. Traceable requirements provide integrated capabilities for global enterprises to capture, define, engineer, manage, trace, and leverage requirements systematically throughout the product development lifecycle. They decrease development costs and rework effort by successfully bridging the communication between all disciplines and the extended enterprise involved in the product development lifecycle. The solution enables a cross-functional and organization change process that maintains the integrity of the reported problem to the internal resolution of the problem via an engineering change. The change process maintains full traceability of all the affected items from hardware to software, and accountability of all the implemented items, in one flexible structured single lifecycle. The requirements analysis process enables users to review, assess, prioritize, and balance customer needs. Users can derive and decompose requirements from a high level into detailed low-level requirements by partitioning and allocating to products and system components. The result is an effective means of maintaining design decisions throughout the product lifecycle and ensuring traceability to the underlying foundation of the original designs.

In summary, ENOVIA traceable requirements management on the **3D**EXPERIENCE® platform enables companies to:

- Improve efficiency and effectiveness of the product planning process using a common source to manage requirements

- Fully manage the requirements lifecycle from the initial authoring to fulfillment with a product launch

- Improve configuration of requirements to reduce development costs and project schedule slippage by establishing baselines agreed to by all stakeholders

- Enhance sharing and communication of requirements to cross functional organizations resulting in less rework, unfulfilled objectives, and missed deadlines

- Support optimal design architecture definition by enabling trade-off analysis that balances functionality, performance, and cost

WHY DASSAULT SYSTÈMES?

Dassault Systèmes, the **3D**EXPERIENCE® Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced and supported. Dassault Systèmes' collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 190,000 customers of all sizes, in all industries, in more than 140 countries.

3DEXPERIENCE Platform

The **3D**EXPERIENCE® platform is a business experience platform. It provides software solutions for every organization in your company — from engineering to marketing to sales — that help you in your value creation process to create differentiating consumer experiences. With a single, easy-to-use interface, it powers Industry Solution Experiences — based on 3D design, analysis, simulation and intelligence software in a collaborative, interactive environment. It is available on premise or via public or private cloud.

ENOVIA traceable requirements uses the **3D**EXPERIENCE platform to bring these benefits to users:

Global Collaborative Innovation
Everyone with a stake in the product has the ability to participate in the development lifecycle—from sharing new ideas that reflect customer needs to product validation.

Lifelike Experience
Leveraging Industry Solution Experiences from Dassault Systèmes, users can collaborate in an immersive online 3D environment.

A Single PLM Platform for Intellectual Property Management
All deliverables related to the requirement process (e.g. product designs, definition, and validation) are stored and managed in a single enterprise platform eliminating translation and communication errors.

Online Collaboration and Innovation
Internet access for all stakeholders to access and read requirements means increased requirements reuse (and all associated deliverables), enabling improved time-to-market and lower development costs.

Ready to Use PLM Business Processes
Immediate value is possible with the use of out-of-the-box processes to capture, organize and publish requirements with the ability to trace those requirements to designs and validation throughout the development lifecycle.

Strategic Requirements Management
In the Experience Economy, customers take a more proactive role in communicating their requirements and preferences for the products that they ultimately purchase. This phenomenon requires the ability to manage customer requirements not as an afterthought, but as an inherent part of the product development process. The ENOVIA requirements-driven systems engineering approach to developing products, with the customers' desired experiences in mind, is visible to all stakeholders involved.

Reference Materials:

1. Leffingwell 1997, "Calculating the Return on Investment from More Effective Requirements Management"

2. Grady, Robert B. 1999. "An Economic Release Decision Model: Insights into Software Project Management"

3. Boehm and Papaccio 1988, "Understanding and Controlling Software Costs, IEEE Transactions on Software Engineering"

4. Leffingwell 1997, "Calculating the Return on Investment from More Effective Requirements Management"

5. Hofmann and Lehner 2001, "Requirements Engineering as a Success Factor in Software Projects"

6. Kim, Chan & Mauborgne, Renee 2005, "Blue Ocean Strategy – How to create uncontested market space and make competition irrelevant"

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

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Americas	Europe/Middle East/Africa	Asia-Pacific
Dassault Systèmes	Dassault Systèmes	Dassault Systèmes K.K.
175 Wyman Street	10, rue Marcel Dassault	ThinkPark Tower
Waltham, Massachusetts	CS 40501	2-1-1 Osaki, Shinagawa-ku,
02451-1223	78946 Vélizy-Villacoublay Cedex	Tokyo 141-6020
USA	France	Japan