



EBOOK

Manage by Exception: Data-Driven Practices to Improve Product, Systems, and Software Quality

Table of Contents

| | |
|---|----|
| Introduction | 3 |
| Why “Data-Based Management” is Critical, and How it Uncovers Gaps..... | 5 |
| Examples of Exceptions in Daily Product, Systems, and Software Development and Requirements Management | 7 |
| Critical Metrics to Consider | 14 |
| How to Proactively Prevent Exceptions Using Jama Connect® Advisor™ and Live Traceability™ | 18 |
| Managing by Exception: Getting Started | 20 |



1 Introduction

Requirement errors in product development cost time and money and create potential liabilities. The expense of these errors can make up **between 70% and 85% of all rework costs**.

When leaders don't have data related to the execution process, teams aren't tracing requirements back to the “why,” and when there's a lack of insight into aspects like verification coverage, you're much more likely to encounter programs late in the development cycle, resulting in expensive problems.

This creates the all-too-familiar scenario seen in the news of product, systems, or software defects and the resulting fallout. Organizations can avoid many of these challenges by accessing the right data at the right moment — and ideally early — in the development process.

As most executives and managers know, you can't manage what you can't measure. Using data to measure allows your teams to spot recurring patterns and abnormalities early, before they grow into larger challenges later in the development cycle.



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2

Why “Data-Based Management” is Critical, and How it Uncovers Gaps

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Management by exception is a method that empowers your team with data focused on early warning indicators. It’s these warnings that help support faster and more informed decisions.

As a result, leaders can focus on exceptions rather than needlessly micromanaging and intervening with teams when the data shows that development is going as expected.

In other words, when using data, the goal isn’t to micromanage, but to do the opposite: leverage the data to do less micromanagement.

The result is fewer manual requests, fewer status updates, fewer test procedure specification reports, and fewer unnecessary meetings.

Data-driven practices help you automatically evaluate exceptions without needlessly relying on a person to manually hunt them down, evaluate them, and communicate about them. Instead, abnormalities and oversights are brought forward to reduce managerial workloads by minimizing unnecessary intervention and allowing more time to be spent in areas that have the greatest impact.





3

Examples of Exceptions in Daily Product, System, and Software Development and Requirements Management

Examples of Exceptions in Daily Product, System, and Software Development and Requirements Management

As you adopt a data-driven approach, there are several considerations, but the first is identifying the expected or acceptable process for your research and development function.

Many organizations don't have a defined practice; instead, operations are based on how things have always been done. Defining processes gives you greater focus.

Once you have an expected process, you can leverage the data to manage by exception but also take things a step further by managing requirements quality, traceability, and completeness. These capabilities will help predict and prevent poor outcomes in product, system, and software delivery.



A tool such as Jama Connect® can help you successfully manage exceptions, such as in these four examples.



Requirements missing verification



Derived requirements missing rationale



Remediate rejected requirements



Find poorly written requirements



1. Version and change management

The Jama Connect dashboard shows requirements missing verification. For example, it might flag two requirements missing verifications, and if you click for more details, you can view a filtered list of those requirements. And you can ask Jama Connect to show those missing a downstream verification. The filters are a powerful way to understand and create audits for capturing those exceptions in your process.



2. Derived Requirements Missing Rationale

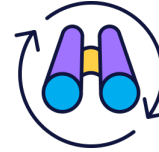
Using a filter, Jama Connect allows you to see if a particular requirement has a missing rationale. For example, a hardware or software engineer may create a new requirement. But when that's done, it's crucial to have a solid rationale for why, especially if the requirement is not directly related to a stakeholder's need or contractual requirement. You don't want to introduce unnecessary capabilities that aren't going to align with the actual user needs or have a real rationale behind them.



3. Remediate Rejected Requirements

Jama Connect has a capability called **Review Center**. It allows you to send

requirements into a review with colleagues, which can increase the quality of the requirements and create a shared understanding. Leaders can quickly spot the rejected requirements and discuss how to move forward. With many organizations working remotely, this capability helps increase asynchronous collaboration so that working sessions and meetings can more efficiently focus on exceptions.



4. Find Poorly Written Requirements

The International Council on Systems Engineering (INCOSE) created a

handbook of recommended rules to author well written requirements. For example, requirements using vague terms that are not testable could be flagged for improvement.

With **Jama Connect Advisor™**, powered by natural language processing, INCOSE's best practices, and the Easy Approach to Requirements Syntax (EARS), teams can now check the quality and accuracy of their requirements.

RESOURCE

Download our datasheet to see how Jama Connect Advisor helps teams to improve the quality of requirements, saving time and continuing to enhance team authoring skills.

[Learn more here »](#)





4

Critical Metrics to Consider

Critical Metrics to Consider

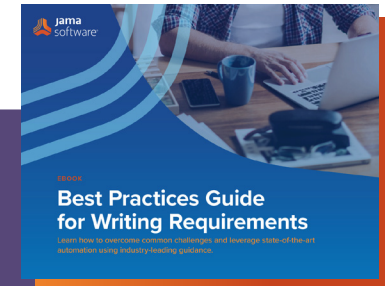
Having data, a way to view it in context, and metrics to track it empowers your leaders to make the right decision at the right time and predict how well the project or product development will trend. Metrics are an essential part of that equation, and here are two to consider tracking.

1. Requirement quality

Most product, system, or software failures are due to undocumented, poorly written, or misunderstood requirements. And the later in the product lifecycle the problem is discovered, the higher the cost. Measure your requirement quality, and if you need support, your Jama Software team of in-house experts can help with audit assessments, training, and other resources to help improve the quality of your requirements.

2. Traceability Score™

Traceability is a core tenet of building complex products, but it hasn't been measured in a standard way in the past. But if you can measure it, you can improve it.



Better requirements lead to clearer, more effective communication between stakeholders.

Download our best practices guide to learn more about writing high quality requirements

[Download it here »](#)

For example, Jama Software has aggregated and anonymized over 40,000 projects and over 6,000 traceability models using Jama Connect. And we've defined an actual approach to measure a **Traceability Score™**.

Our **Traceability Benchmark** study shows this traceability score produces a clear correlation between quality and time to market.

It starts with setting up the expected behavior of your engineering team – **the traceability model**. We take the number of established relationships among the different model elements in the traceability model and divide that by the number of expected relationships defined by the project's relationship and traceability model. This gives us the traceability score.



Calculate the Traceability Score

$$\text{Number of Established Relationships} \div \text{Number of Expected Relationships} = \text{Traceability Score}$$

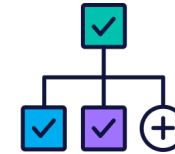
For example, a requirement should have three different elements:



Upstream Need



Downstream Subsystem Requirement



Verification Test

Imagine an example where you have two of those established, but one is missing. The Traceability Score is 66%, and with that metric, you can take the appropriate action. Our above-mentioned benchmarking research showed that higher Traceability Scores™ equaled improved product quality and faster time to market.

Integration of your digital engineering tool suite is critically important. In product development, many tools such as Excel, development applications, modeling applications, testing applications, and others are used. These tools capture critical data about your product and system development lifecycle.

But if they aren't integrated, you can't measure critical information like your Traceability Score. As a result, managing by exception isn't possible due to a lack of data, which risks product delays, extra costs, and even compliance and audit failures. Ensure that critical tools are integrated to support real-time data visibility.

The first step is to baseline current process performance and to focus efforts on traceability since it spans the entire product development process, is a data management concept that is understood, enables systems engineering benefits, and is required by industry standards.

Learn more about how we can help assess your traceability and provide tailed feedback by leveraging our **Requirements Traceability Diagnostic™**.





5

How to Proactively Prevent Exceptions Using Jama Connect Advisor[™] and Live Traceability[™]

How to Proactively Prevent Exceptions Using Jama Connect Advisor™ and Live Traceability™

Jama Connect Advisor is Jama Software's proprietary application that provides live, in-application recommendations to support requirements improvement.

Jama Connect Advisor is a state-of-the-art requirements authoring guide and optimizer powered by natural language processing for engineering that helps teams write effective, well-organized requirement specifications based on industry-accepted INCOSE rules and the EARS: Easy Approach to Requirements Syntax, originated by Alistair Mavin. It helps:



Improve the quality and usability of your requirements.



Save time authoring, reviewing, and updating requirement statements.



Continuously enhance team requirement authoring skills with regular use.



Deliver programs and projects on time and on budget with long-term success.

For example, when you're trying to draft requirements very quickly, this tool provides a safety net to check and improve the requirement's accuracy and quality. In addition to managing by exception, Jama Connect Advisor takes it a step further, helping prevent some of those exceptions from occurring in the first place. It helps your team reduce late-stage errors and save time, and it functions as a training tool.

With Jama Connect Advisor, teams can:

- Leverage natural language processing for efficient assessment of alignment to industry-leading practices for requirements authoring based on INCOSE Rules and EARS Notation: The Easy Approach to Requirements Syntax.
- Get advice delivered during the authoring task and directly in Jama Connect to optimize workflow efficiency.
- Have a direct integration within Jama Connect cloud as an add-on capability.
- Help train inexperienced engineers in authoring well written requirements that remove ambiguity





6

Managing by Exception: Getting Started

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As you consider data-driven practices to improve product quality and managing by exception, a great starting point is defining key metrics.

Requirements quality and traceability scores are impactful ones to consider. Also, ensure you're aligning a key business owner to report on the exception, both where you're falling short and where you're succeeding.

And remember, you don't need to go to it alone. If you want to improve your product quality, the team at Jama Software can help. Our **Success Programs** with in-house industry experts, offer training, benchmark assessments, consulting, and technical services.

For more information, check out our **Customer Success Catalog** resources. They include a comprehensive training library for improving the quality, processes, and traceability of your requirements.



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Contact us to get started »



Jama Software® is focused on maximizing innovation success in multidisciplinary engineering organizations. Numerous firsts for humanity in fields such as fuel cells, electrification, space, software-defined vehicles, surgical robotics, and more all rely on Jama Connect® requirements management software to minimize the risk of defects, rework, cost overruns, and recalls. Using Jama Connect, engineering organizations can now intelligently manage the development process by leveraging Live Traceability™ across best-of-breed tools to measurably improve outcomes. Our rapidly growing customer base spans the automotive, medical device, life sciences, semiconductor, aerospace & defense, industrial manufacturing, consumer electronics, financial services, and insurance industries. To learn more, visit us at jamasoftware.com.