Product Development Strategies for Systems Engineers

Optimizing project management for faster, more efficient product and system development success in highly competitive markets.

The "smarter" and more complex a modern system gets, the more complicated the process required to build it becomes. Systems engineering teams working in regulated industries, such as such as automotive, aerospace, defense and medical device manufacturing — as well as highly disruptive industries focused on embedded systems — suffer an unfair share of the pain of product and systems development and management. In such industries, operational margins are tight, with little room for product integrity errors.

> **The number of connected machine-to-machine devices has increased 300% since 2008.**
>
> – McKinsey Global Institute

According to Machina Research[1], the number of connected machine-to-machine devices will increase from 5 billion in 2014 to 27 billion by 2024. As software becomes more and more embedded into technology, the rate of innovation accelerates. Connected software has also changed expectations, as customers demand seamless interaction with technology solutions across form factors and devices. They also expect their technology will constantly evolve or update post-purchase.

Delivering these products to market requires teams to operate at different cadences and introduces new methodologies and practices. But many organizations have a hard time keeping up with the rapidly accelerating pace of change, especially when their teams work in silos using outmoded systems.

Strategic Collaboration Is Key

The demand for highly functional device performance requires deeper collaboration among teams developing products. This includes everyone across the supply chain.

Companies actively look to build partnerships and integrations for specific expertise to meet business demands. They seek solutions using fewer commoditized materials and more specialized materials, which translates to greater sharing of data across distributed teams, partner organizations and business units.

Processors, sensors, memory and power management subsystems are being pushed to become smaller and cheaper and to consume less power. These demands have ripple effects throughout the supply chain with subsystem suppliers not only having to anticipate the features on finished products but also needing to get ahead of release schedules and component costs.

With increased focus on getting to market faster and customer-driven development, complex manufacturers can gain an edge by aligning business objectives with development. Increased levels of collaboration throughout the supply chain are central to R&D efforts as companies look to share the development costs and drive toward innovative solutions. Additionally, the new focus on software dramatically impacts development throughout regulated industries, an effect that will only intensify in the future. In this new paradigm, focused, cross-functional collaboration is the key enabler of innovation.

Five Obstacles to Optimized Product Development

According to research[2] conducted by Forrester Consulting on behalf of Jama Software, there are five main factors that cause product delays:

1. Product teams often lack clear understanding of customer needs while unclear or changing requirements plague product delivery. And not being able to get timely feedback on possible solutions results in delays and wasted time, effort and money.

2. Conflicting priorities caused by stakeholder disagreements put product delivery teams in an unfortunate bind while unclear objectives, assumptions and possible discussions of alternative solutions lead to a lack of focus.

3. Complex products often require a wide variety of cross-team collaborations spanning multiple locations for successful development. The reality of the global marketplace means that co-located development is rare while globally distributed teams are increasingly common.

4. Unnecessary handoffs and delayed decisions reduce momentum and impair quality. However, rapid delivery is an increasingly competitive differentiator in the marketplace.

5. Delivering a winning product requires unprecedented collaboration across diverse roles within the organization, from executives and operations to marketing and quality assurance.

Strategies for Modern Requirements Management

Modern systems engineering approaches are fully collaborative, with live data being shared and accessed anytime by teams spanning geographic boundaries. Teams work together throughout the entire product development lifecycle, and the solutions a company employs can be a key differentiator in delivering business value. Outdated document-based methods delay progress while an evolutionary leap forward comes from modernizing requirements definition, engineering and management processes.

> Decisions need to be made and documented in real time with instant notifications to everyone impacted. Meetings, emails and hallway chats don't work when you need to work fast.

Modern product teams coordinate across departments and roles. They understand customer needs and work together throughout the entire process. Disruptive technologies are not seen as a threat but as an opportunity, and change is embraced rather than constrained. The old way of sharing documents via email attachments and having meetings to discuss decisions doesn't work when you need to move fast. Decision-making needs to happen in real time and everyone impacted by those decisions needs to be notified immediately — within the solutions they are already using.

Now, systems engineers working in complex manufacturing industries can take specific actions, like the ones that follow, to help their teams manage complexity, coordinate effectively and develop, verify and validate faster than ever before.

Five Practices to Implement for Immediate Impact

1. Establish a Common Definition of Success

Clarify expectations to your team for what the terms "define," "build" and "test" mean. In addition to defining the features and functions, define and share the reasons why. Approach development with an understanding of what success looks like, based on feedback loops (customer interviews, value testing and design reviews). Build with a view of what outcomes the product should deliver to your customers.

Most importantly, define and clearly communicate the business outcomes your product needs to achieve. Teams need alignment — business with product development, hardware with software, systems with components and buyers with suppliers — on what they are building so they don't waste time on low-significance features. Define the "why," and you'll deliver faster.

2. Empower Better Decision-Making

With a clear understanding of "why," team members can make better decisions faster, articulate acceptable tradeoffs and navigate technical complexities. This will also give business leaders full visibility into the progress and tradeoffs under consideration and give definers and developers visibility into the expectations. When you define clear decision-making responsibilities, capture decisions and assign them to owners, those involved can initiate and resolve follow-up questions and issues.

Good decisions need situational awareness, comprehension of impact and a way to gather input from others. With appropriate context, strong relationships and an understanding of the "why," your teams will react to new information more effectively and eliminate waiting for status check-ins or change control board meetings.

3. Tighten Up Your Traceability

Regulated industries may need to demonstrate compliance with governmental, environmental, security or privacy rules. Traceability analysis proves you have tested your system against regulatory demands and that it meets contractual terms.

In development, traceability generally refers to engineering activities such as change impact analysis (examining dependencies to resolve issues arising from changes), change and risk analysis (supporting general engineering and management reporting procedures) and verification (requirements have test cases, epics have stories, systems have components, components have sub-components).

Coverage analysis helps a team find gaps and understand positive and negative progress; many of these "events" require a follow-up action to either close the gaps or determine contingencies and next steps. When you extend traceability beyond engineering processes, you can link your development and test activities back to the business rationale. When engineering and business are connected, faster evaluation of all the up- or downstream implications of decisions occurs.

4. Collaborate with Purpose

Modern collaboration for systems engineers means connecting data to people — not a feedback free-for-all. The key to purposeful collaboration is keeping communication connected to the work.

Use collaboration to tie conversations, negotiations and resolutions directly to the specific requirement, specification or use case in question. Don't make decisions outside the process, in documents or emails. Keep conversations connected to the work itself for easy access and understanding.

5. Reuse Your IP

Don't limit reuse to code; you can repurpose entire IP blocks — design artifacts, specifications, test cases, content for data sheets and process information — at the outset of new development. With purposeful collaboration integrated into your product development process, you can import every conversation and decision about changes into new projects. The key benefit is that teams can be confident they are using only the latest approved and validated information. With best practices built on reusing IP, organizations have a template for repeatable success.

[1]Machina Research, "IoT Global Forecast & Analysis 2015-2025" (2015)
[2]Forrester Consulting. "The State of Modern Product Delivery" (2013)

ABOUT JAMA SOFTWARE

Jama Software brings innovative analytics, solutions and insights to companies creating complex products and mission-critical software systems. With expanded product and service capabilities, the Jama Product Development Platform empowers large enterprises to accelerate development time, mitigate risk, slash complexity and verify regulatory compliance.

Representing the forefront of modern development, its rapidly growing customer base of more than 600 organizations — including SpaceX, NASA, Thales and Caterpillar — use Jama Software to streamline processes and bring complex products to market. Through Predictive Product Development, Jama equips its customers to make the most of their revenue potential and achieve ongoing competitive advantages.