Four key strategies for enabling innovation in the age of smart

Using integrated product management from IBM
Executive summary
On a smarter planet, intelligence is infused into the products, systems and processes that comprise the modern world. These include the delivery of services; the development, manufacturing, buying and selling of physical goods; and the way people actually work and live. Nowhere may this transformation be more evident than in the creation of smarter products.

Smarter products are the building blocks for a smarter planet. Embedded with increasingly sophisticated software and instrumentation, they can connect and communicate with other devices and respond intelligently to user needs. Smarter products need to address the needs of a wide variety of different users, whether the differences are a result of unique geographical requirements or unique user preferences. Smarter products are transforming the way the world works in new ways virtually every day. This is true not only in the way products are used but also in the way they are built.

Product innovation has certainly evolved over the past few years. Whereas it used to rely primarily on advancements in hardware and electronics, it is now much more dependent on software. It has also evolved from being primarily managed within a single company to a more collaborative model involving design partners and suppliers. As a result, innovative product development requires an approach that supports tight collaboration and increasingly complex value chains—an approach IBM calls integrated product management (IPM).
**IPM for collaborative, comprehensive development**

To help organizations design and deliver increasingly complex products and manage their life cycles, IBM created an IPM approach that combines capabilities, tools and best practices from across IBM and IBM Business Partner organizations. This strategy can address some of the most prominent product development and delivery goals and challenges today, including:

- Transforming companies into competitive, innovative leaders.
- Developing a portfolio of innovative products and systems—combining mechanical, electrical and software technologies.
- Facilitating collaboration across the design chain with multiple partners and stakeholders.
- Managing assets and operations of an ever-changing ecosystem.

By integrating and managing a product's life cycle across development domains, IPM streamlines innovative product development and accelerates time to market for new products. In turn, IPM facilitates greater marketplace penetration and the creation of “the next big thing.” Because much of innovation may be derived from the software component of smarter products, manufacturers can address competitive threats faster and quickly deliver on consumer demands for a portfolio of products that offer personalization and customization.

Moreover, IPM can help organizations maintain product quality, demonstrate regulatory compliance and pass audits. It helps keep costs under control by decreasing the number of warranty claims and better managing the product supply chain and product development—thus lowering the cost of end products and boosting the bottom line.

As a leading product development technology provider, IBM offers integrated solutions and services for demanding product engineering disciplines—including mechanical, electronic and software life-cycle management. This paper will discuss these four key IPM strategies from IBM, which help organizations design, deliver and manage smarter products designed to offer the highest value and quickest return on investment (ROI):

1. Strategically transform business processes to build new capabilities, save costs, accelerate product introduction and create new market segments.
2. Adopt an advanced systems engineering approach to manage all product dependencies across engineering disciplines and build a strong competency in software development and delivery.
3. Optimize the design chain by automating business processes that leverage existing investments in best-in-class applications and data.
4. Ensure that product and asset maintenance and support is treated as a strategic business process that drives profitability.
Global optimization of business and development processes and organization

The marketplace is generally in flux with dynamic customer needs, quick-moving competitors and industry-changing new technologies. Consequently, companies must regularly monitor their product development practices to ensure that they are responsive and collaborative and to identify and remove redundant or low-value activities.

Strategy 1: Strategically transform business processes to build new capabilities, save costs, accelerate product introduction and create new market segments.

Proper business planning and continual improvement can help organizations make certain that business processes are as relevant and value-driven as the products they build. A strategy may include:

- Bridging design, delivery and management processes.
- Collaboratively defining and managing product requirements for the entire portfolio of products.
- Deploying an integrated platform that converges the design, development and delivery of smarter products and services.
- Tracking in-field service, maintenance and operations support.

By using proven approaches and tools designed for business planning and transformation, organizations can align their business and technology investment strategies and manage ever-evolving project priorities and resources. IBM offers business transformation frameworks and services, product portfolio management tools, and enterprise architecture solutions to help organizations optimize their business strategies.

IBM helps businesses establish a technology foundation on which virtually all enterprise applications can operate synchronously—sharing and reusing processes and information to foster interoperability across the enterprise.

IBM Global Business Services offers strategy and transformation capabilities that can help improve product development processes and optimize, integrate and operate product management environments. And to accelerate the drive to efficiency, IBM can also deliver business strategy alignment assessments and the following business value accelerators:

- Maturity assessment and strategic planning
- Embedded software assessment and strategic planning
- Environmental compliance and strategic planning
- Product cost visibility diagnostics

Hughes Telematics provides smarter products and services with help from IBM Global Business Services

Hughes Telematics developed an onboard sensing and communications telematics system for vehicles that detects crash conditions and car location and provides customer-activated concierge services (such as driving instructions and door unlocking). Upon crash detection, the system dials for emergency help and guides the response unit to the accident location. It also enables the dispatch call center to contact vehicle occupants to alert them that help is on the way.

Hughes Telematics tapped IBM Global Business Services to design, build and deploy a flexible systems and process infrastructure, adapted for telematics. Using the infrastructure, the company can deliver new services through its sensing and communications system in a much quicker time compared with proprietary systems.
IBM Software

Processes and tools that deliver product value and differentiation

Software has infused smarter products with intelligence, leading to an exponential leap in product capabilities—and a commensurate increase in risk and complexity. As if designing and building smart products weren’t hard enough, many of them, such as cars, planes and smart phones, are systems of systems. Features are no longer isolated within individual products—instead, they are delivered through integration with other systems and back-office business processes. For example, a patient who suffers from congestive heart failure has an implanted cardiac medical device that monitors and regulates his or her heart. If the patient has a cardiac event, the implanted device senses it and wirelessly communicates that occurrence to the cardiac center, which can remotely monitor the patient and gather data for diagnosis.

Strategy 2: Adopt an advanced systems engineering approach to manage all product dependencies across engineering disciplines and build a strong competency in software development and delivery.

These complex, smart products and systems present opportunities and challenges. Software is the invisible thread that links components to form an intelligent and coordinated structure—and it is software that offers differentiating functionalities and delivers the real value of smarter products. Organizations that build a strong competency in software delivery will be able to rapidly respond to changes in the marketplace and deliver innovative services much more quickly. Plus, it may be more cost-effective for manufacturers to offer a broad portfolio of products by just changing the software. For example, manufacturers can address different target market segments by releasing products with similar hardware and electronics while using software to provide varying capabilities for the end user.

However, the challenges of developing smarter products run deep because a system of systems has many layers of complexity among the electrical, mechanical and software domains. To help manage and validate these complex interrelationships, organizations can implement or improve systems modeling and enhance requirements engineering, traceability and quality.

Implement or improve systems modeling to manage and validate interrelationships

Organizations need to model their systems prior to investing time and resources into the full product design. Modeling and simulation are also important when a business wants to address a new market segment or revise a product early in its development life cycle—when change is still relatively inexpensive. Modeling facilitates innovation through controlled experimentation and helps organizations assess the technical and commercial feasibility of those changes by showing how the changes to specific aspects of the design can affect product performance, cost and delivery schedule.
Enhance requirements engineering, traceability and quality

Because of scope creep and the widespread effects of changing requirements, it can be difficult to efficiently and effectively design and build products and product lines that meet customer specifications. Requirements verification—either through engineering analysis or physical part and assembly testing—must be performed not only at the end of the development process but also throughout. That helps ensure that requirements are being met. Moreover, it is far less expensive to discover and solve problems and design issues earlier in the development process than later.

Using traceability tools to link tests to requirements throughout the process can improve quality by helping to ensure that the right tests are run and can save time and money by reducing unnecessary tests. Moreover, organizations can perform trade studies when designing a product to not only satisfy the product requirements but also optimally address the design constraints.

Manage, share and validate changes among teams with IBM change management

IBM Rational® integrated product change management solutions help ensure that changes are shared and managed among global teams and across engineering disciplines. Manufacturers can bring together systems designers, software developers and product engineers in a common collaboration environment. This platform manages change in the various disciplines—software, electronics and mechanical—to facilitate strong collaboration and track the impact of change wherever and whenever it occurs.

Rational integrated product change management solutions can help a company:

- Reduce the time it takes to propagate changes throughout the design team.
- Speed turnaround time in design and defect resolution.
- Lower the number of “missed” changes that are discovered late in the project.
- Improve the management of multiple engineering disciplines.
- Increase the visibility of schedules, including the impact of requirement and product changes.
- Manage project costs better.
- Reduce costs by leveraging existing process investments.

Leverage a comprehensive, integrated systems engineering platform for IPM

A holistic, integrated approach to systems engineering and software development is needed to rapidly deliver high-quality products and systems. An IPM approach connects four key disciplines that span the systems and software development life cycle:

- **Requirements management**—manages system and software requirements and tracks conformance to those requirements and compliance to regulations
- **Model-driven systems development**—graphically explores the requirements and builds out the behavior and functionality of systems and software
- **Collaboration and change management**—provides a central communication point and workflow support for diverse, distributed teams across the life cycle to efficiently work together—continually and iteratively
- **Quality management**—establishes a collaborative, customizable quality management hub that can unite teams and provide an enforceable process workflow
The IBM Rational systems and software engineering solution suite provides integrated systems engineering and embedded software development solutions to help organizations build systems and products that address their businesses’ objectives and their customers’ needs. Tools in the suite can share requirements, artifacts and other development components and as well as provide support for comprehensive life-cycle management.

**Figure 1:** The Rational development tools work together to provide a comprehensive, integrated development environment.
Helmes drives innovation through design chain collaboration with IBM Rational software

Helmes—one of Estonia’s leading software development and consulting firms—wanted to find a way to help its staff and clients collaborate and plan development projects more effectively. This IBM Business Partner implemented the IBM Rational Team Concert™ platform—a collaborative development environment—to share information; define requirements, dependencies and priorities; set milestones; and plan workload for each member of the project team.

With a single system managing all development-related information, Helmes and its customers can quickly obtain a comprehensive overview of project status. Customers are involved in the development process at every stage, improving communication and verifying that each new release is closely aligned to their requirements. Advanced workflows and scheduling features enable rapid, efficient development—reducing time to market and improving software quality.

“With IBM Rational Team Concert, we know exactly where we are at all times. There is never any doubt or any need to hunt for a document because all relevant information is immediately at hand.”

— Erkki Aarma, project manager, Helmes

Automation of processes across the ecosystem of system contributors

Disconnected product development applications and processes hinder collaborative development among an extended design chain of departmental, partner and supplier teams. Organizations need ways to include their design and supply partners in a unified process for product development. Specifically, product, project, portfolio and performance information needs to be available and shared efficiently among all the design stakeholders in real time, while being managed by an overarching process.

Strategy 3: Optimize the design chain by automating business processes that leverage existing investments in best-in-class applications and data.

Design chain management helps manufacturers effectively distribute the product design and development process across the extended value chain. And design chain collaboration improves product development, providing increased business performance and executive-level decision support. It drives opportunities for:

- Product cost reductions and quality improvements.
- Faster cycle times and ROI.
- Development costs savings.
Facilitate collaboration across the design chain
All of the teams and partners that contribute to the overall product design comprise the design chain. A company—such as an original equipment manufacturer (OEM)—may manage the entire design chain process, or a company—such as an embedded software developer—may participate in only a small portion of the process. In either case, it is critical that organizations follow a coordinated design process and have access to all relevant data—even if design chain partners are in different companies or geographies.

Product change originates from a variety of stakeholders throughout the design chain. Changes come from every part of the enterprise—including marketing, customer support, development teams uncovering issues and managers concerned with keeping pace with competitors. When a product’s hardware, electrical and software components are built in parallel, changes that occur within one discipline can have a cascading effect on the other disciplines. Therefore it is critical to efficiently communicate changes across the design chain.

Every service and interaction that happens within the multiple systems needs to be managed, monitored and maintained so that the engineers in the different disciplines and participants all along the design chain are on the same page. Methods for managing and validating the interrelationships that occur among the three disciplines and design chain must be found to help ensure that products meet requirements and to support regulatory compliance.

An integrated product and systems development approach helps organizations better collaborate and manage complexities by breaking down the silos among engineering disciplines and managing change across domains. This approach helps ensure product quality by assembling and tracing requirements throughout the product life cycle and across the design chain. It also balances scarce resources across profitable product lines and helps avoid rework and redundancy by leveraging product and architecture commonality.

Leverage existing investments with IBM solutions for the design chain
Organizations that want to implement or improve design chain management shouldn’t need to rip out and replace existing resources to implement new tools or process improvements. Ideally, businesses should be able to build on the value of existing tools and processes. To do so, they need to integrate tools across the design chain and federate information from existing and new sources.

Design chain collaboration solutions from IBM enable line-of-business employees to participate and collaborate in the development process by giving them access to engineering data that may currently be siloed in multiple design and management systems. IBM WebSphere® solutions can help organizations rapidly deploy composite IPM applications on existing tools and data repositories.
Plus, IBM Global Business Services offers reengineering services that consider client-unique situations to help manufacturers maximize existing investments and integrate them with new applications, systems and infrastructure. The group can provide services such as:

- Enterprise application integration.
- Business process management.
- Partner ecosystem management.

Meyer Werft cruises into flexible engineering change management with an SOA solution

Shipbuilder Meyer Werft’s existing product life-cycle management (PLM) process and system landscape lacked the flexibility and scalability to meet current and future business demands. Plus, it lacked transparency and an accurate, up-to-date view of design information and production data, extending no insight for engineering and business decisions.

IBM Global Business Services analyzed the business situation and created a customized application based on service-oriented architecture (SOA) approaches. As a result, the information needed for any job can be consolidated, resulting in more efficiency and fewer errors. Plus, the integration of external partners encouraged new and innovative ways of cooperating.

Visibility and control over assets to improve efficiencies and value

Manufacturers are increasingly offering product operational and support services to increase profitability. And in some cases, service after sales is where organizations make most or all of their profit. For example, few car dealerships profit from car sales—the profitability comes from the maintenance and repair of those cars.

However, companies aren’t always designing products with support requirements and asset longevity in mind. Organizations need to ensure that the products they build can be profitably supported and maintained over a long lifetime.

**Strategy 4: Ensure that product and asset maintenance and support is treated as a strategic business process that drives profitability.**

Asset life-cycle management can help manufacturers ensure proper maintenance and reliability of production line assets—including robotics and conveyers; the software used to operate them; facilities; and all of the critical assets that play a role in the design, delivery and management of a product. Asset management also helps manufacturers establish new revenue streams with service-after-sales models for existing products. Tracking “as deployed” and “as maintained” products and their performance after sales can help design teams identify:

- Common configuration problems.
- After-market parts that may cause issues.
- Fixes that can be used by maintenance teams.

Tracking this information can help developers continually improve the quality of their business processes and of their products—including their reliability, compliance and application. It has become particularly important as products increasingly include firmware and software that must be maintained.
Moreover, integrating asset management with the service desk can boost customer service by unifying the management of field requests, customer problems and workflows. It can automatically route those problems to the design or the maintenance teams that own the problem, thereby improving quality of service and customer loyalty.

To leverage an asset management and operations approach, manufacturers can integrate enterprise asset management with service life-cycle management. The IBM solution for asset management provides life-cycle management of all assets—from their design to field support and maintenance. It can monitor, manage, support and provide insight into the production and after-sales health of products. It also helps maintenance teams use bill-of-materials information, manuals and three-dimensional views of “as designed” and “as built” products to accelerate product deployment, maintenance and problem resolution. The solution can collect information from the field and automatically route it to the design teams that need it for fixes and design planning.

The IBM solution for asset management has capabilities that include:

- Deployment, maintenance and change tracking across smart, physical and IT assets.
- Manufacturing support, including for the capital equipment involved in manufacturing or preparation of work instructions or maintenance procedure publications.
- Monitoring of asset status to identify problems before they affect customers.
- Service after sales, including customer support or direct maintenance, repair and operations services for customers.
- Integrated project management and enterprise asset management integration for IBM clients that have existing solutions but want to support service after sales.
- Tracing product faults back to design or requirements, thereby facilitating continual product improvement.

Support for tight collaboration within increasingly complex value chains

As products become more complex, interconnected and intelligent, innovation is derived increasingly from a collaborative model among design partners and suppliers. Consequently, IPM needs to be approached in a strategic way to help organizations deliver high-quality, innovative products to the marketplace faster and more frequently. Manufacturers can apply four key strategies—spanning business planning and transformation, product and systems development, design chain collaboration, and asset management and operations—to support an IPM approach to product design, manufacturing and support.

IPM from IBM is supported by more than 30 IBM offerings, which can be used in just about any combination. It addresses the unique needs of manufacturers by offering industry extensions built on a service-oriented architecture. IBM continually strengthens the integrations among its IPM products and adds new components to help keep IPM relevant to the needs of the current marketplace.
Organizations that incorporate IPM solutions into strategic business processes can achieve the process flexibility and performance needed to address the demands of today’s—and prepare for tomorrow’s—complex, interconnected world. Specifically, IBM offers:

- **Applications**—leading IPM software and technology from IBM and global IBM Business Partners.
- **Advanced IPM architectures**—IPM innovation, including industry frameworks, cloud computing and smarter products.
- **IPM research**—collaborating with clients and industries to further advance the science of IPM.
- **Methodology, skills and global delivery**—core IPM strategy and offerings, supported by IBM global centers and delivery resources.

With consultants and technical staff in 160 countries, IBM delivers systems, solutions and services to more than 20,000 clients worldwide. IBM offers a proven track record of delivering advanced solutions in a variety of industries and market segments.

**For more information**
To learn more about the comprehensive integrated product management offerings and strategies from IBM, please contact your IBM representative or IBM Business Partner, or visit: [ibm.com/integratedproductmanagement](http://ibm.com/integratedproductmanagement).

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