

Collaboration in Product Development: The Sum of Its Parts Drives Success

WHITE PAPER

Sponsored by: Adobe Systems Incorporated

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October 2009

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IN THIS WHITE PAPER

In this white paper, IDC Manufacturing Insights looks at how manufacturing companies manage and communicate important product information to support collaboration among product development stakeholders. We interviewed executives from large global manufacturing companies to understand how they manage and communicate product requirements, how they collaborate with nonengineering functions during product design activities, and how they transfer information to manufacturing during early and ramp-up production stages.

We used these interviews to ascertain the process improvement opportunities and potential benefits of an information collaboration environment that provides efficient and secure collaboration across functional and organizational boundaries.

Summary of Key Findings and Recommendations

This study establishes that many manufacturing companies typically use informal tools and processes to author, communicate, and manage critical product information such as market requirements, product specifications, product design, and manufacturing instructions. Moreover, many companies still make extensive use of paper-based information and often reduce 3D information to 2D in order to accommodate users who do not have access to 3D viewing software, which is frequently the case when the intended recipients of the information belong to a different organization.

Absent formal and structured methods for managing and sharing information, companies rely heavily on informal ad hoc methods. Most commonly, they use a variety of document types and styles to capture information and information exchanges through unstructured email threads. This unstructured approach inhibits efficient, effective, and secure collaboration with multiple stakeholders across product life-cycle phases. In particular, these methods elevate the risk of intellectual property (IP) loss and regulatory noncompliance.

Product companies operate and compete in an increasingly complex and challenging global economy, and effective collaborative analysis and decision making across all product development phases is fundamental to improving agility and fidelity in product-related decisions.

IDC Manufacturing Insights believes that manufacturing companies should implement information technology tools that facilitate comprehensive and secure information exchange that supports effective collaboration. By synthesizing and harmonizing the perspectives of multiple stakeholders into a cohesive and reliable view, organizations can achieve higher levels of agility and decision-making fidelity.

Research Methodology

This research was sponsored by Adobe Systems Incorporated and conducted by IDC Manufacturing Insights. The primary research component of this paper consists of formal interviews with IT personnel from 40 firms across a broad population of companies that design and manufacture products. To be included in the study, the firms represented by these individuals had to have annual revenue of at least \$500 million. Each respondent was screened based on involvement with relevant technologies and business processes. Findings of the study are presented in the figures throughout this paper in aggregate.

While IDC Manufacturing Insights feels strongly about the business value of collaborative product development needs and practices as discussed in this analysis, this paper is not intended to recommend any product or vendor.

SITUATION OVERVIEW

Product companies operate in an increasingly complex environment and face numerous challenges, as shown in Figure 1. Consider the following:

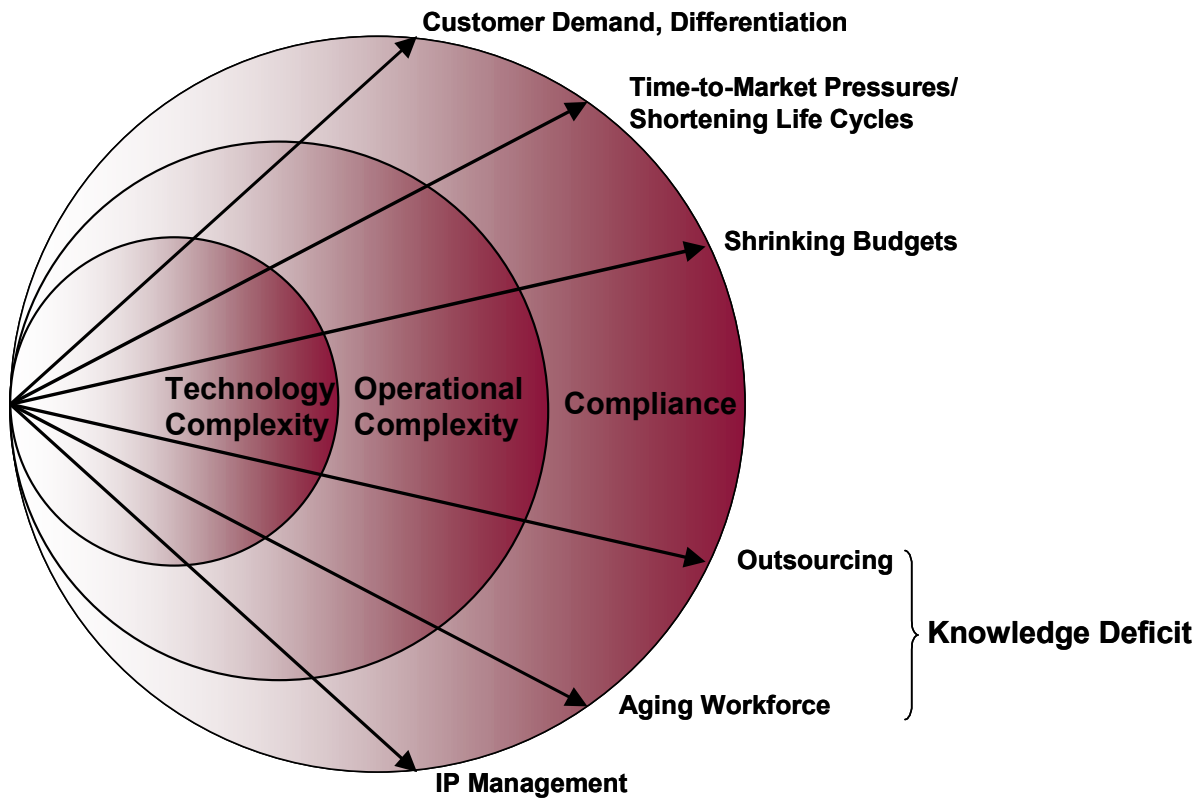
- **Technology complexity is rising rapidly.** New technologies allow designers to pack more functionality into smaller form factors, often at lower manufacturing costs; but, at the same time, they create complex products that are increasingly more difficult to build, operate, and maintain.
- **Operational complexity is also on the rise.** There is hardly any product company that does not rely on an intricate network of partners, suppliers, or sales channels to support and grow its business. Companies that once were vertically integrated and accustomed to operating within a smaller and familiar universe now must deal with many partners, stakeholders, and decision makers, many of whom are from external enterprises in remote geographies.

- **These complexities are further exacerbated by the necessity to comply with a range of sustainability imperatives.** Industrial, social, and political pressures require product companies to alter their processes to be aligned with environmental and financial regulations and other government and industry mandates and their variants across regions.

Under these challenging circumstances, product companies must excel in conceiving, designing, producing, selling, and supporting high-quality products with clear differentiating features that meet the expectations of demanding and discerning customers.

FIGURE 1

Complexity in the Manufacturing Ecosystem



Source: IDC Manufacturing Insights, 2009

The Knowledge Deficit

During these trying times, many industries are facing the loss of key workforce personnel and expertise due to imminent demographic upheaval. An experienced and aging workforce is nearing retirement, while a technologically advanced yet inexperienced population enters the workforce.

Operating in this ever-changing environment and pressured by shrinking budgets and aggressive time-to-market expectations, many product companies struggle to remain competitive and profitable. To combat some of these issues, many manufacturers choose to outsource engineering activities and seek ways to utilize manufacturing capacity in lower-cost regions as a means to improve efficiencies and resource utilization, and to reduce manufacturing and operating costs. However, the loss of in-house personnel and expertise, and the extended collaboration with and increased reliance on contracted and outsourced talent lead to a potential loss of knowledge, which, unless managed closely, could have dire consequences that impact the company's agility and long-term competitiveness.

In addition, these practices, which require extensive collaboration and information sharing, raise severe concerns about the ability of product companies to protect their intellectual property against attrition, loss, and theft.

The ability of organizations to make effective decisions in this complex and challenging environment remains key to successful collaborative product development. Better decision making hinges on a multidisciplinary collaborative process, inclusive of all stakeholders throughout the product life cycle, spanning communities of practice, geographies, and enterprises that represent diverse technical and business disciplines and practices. While the active participation of these communities is crucial, one must also recognize that effective collaboration must account for the varied, often conflicting, business and technology drivers of the participants.

To better understand how product companies collaborate during product development, we looked into their collaboration and information communication practices during three stages of product development: requirements definition, design, and manufacturing ramp-up.

Market Requirements Management

Demanding and discerning customers necessitate faster time to market of higher-quality products with differentiating features. It is critical to get the right product to the correct market at the optimal time. To do so, product companies must excel in defining and managing the market requirements for those products.

Devising relevant and market-differentiating requirements is an iterative and collaborative process. Analysis of customer needs and expectations and information concerning competitive products are collated from many sources within and outside the company to identify core requirements. These requirements are then iterated and enhanced to reflect diverse considerations that include features and functions, market forecasts and price competitiveness, manufacturing engineering, supply chain planning, regulatory compliance, and many more.

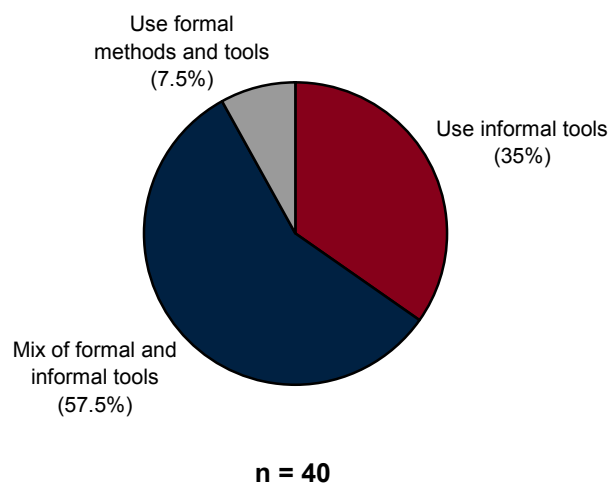
Our market research reveals that a company rarely employs a unified and centralized environment to administer an effective requirements management process, one that not only assembles a diverse set of considerations into a cohesive view for design engineers and product marketing specialists but also maintains continuity and transparency.

In this study, we found that only 7.5% of the manufacturers we interviewed use a single, formal enterprisewide requirements management application that can be accessed by all stakeholders (see Figure 2). Most of the companies rely on a myriad of formal and informal tools to author and exchange requirements documents. These companies use a range of document types and typically use email to communicate the information and to collect feedback.

FIGURE 2

Requirements Management

Q. Please select the statement below that best describes the involvement of nonengineering stakeholders, such as marketing, purchasing, and service, during the requirements definition phase.



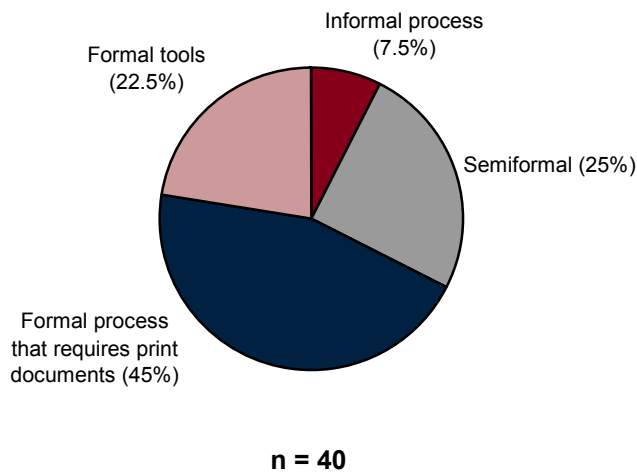
Source: IDC Manufacturing Insights, 2009

We observed a similar trend in companies' practices for reviewing and approving requirements. Because most companies employ informal processes and tools to gather and track requirements, they also tend to be less formal when reviewing and approving final product requirements and specifications. As Figure 3 illustrates, only 22.5% of the interviewed companies use a formal process that is completely paperless. The approval process at the rest of the companies we interviewed necessitates separate electronic and often print documents. Moreover, even the 45% of respondents who use formal approval tools still depend upon print documents. Interestingly, these companies do not necessarily represent highly regulated industries such as pharmaceuticals, as one might expect. In fact, these companies can be found in a broad range of industrial sectors.

FIGURE 3

Requirements Review and Approval

Q Please select the statement below that best describes how your organization reviews and approves requirements.



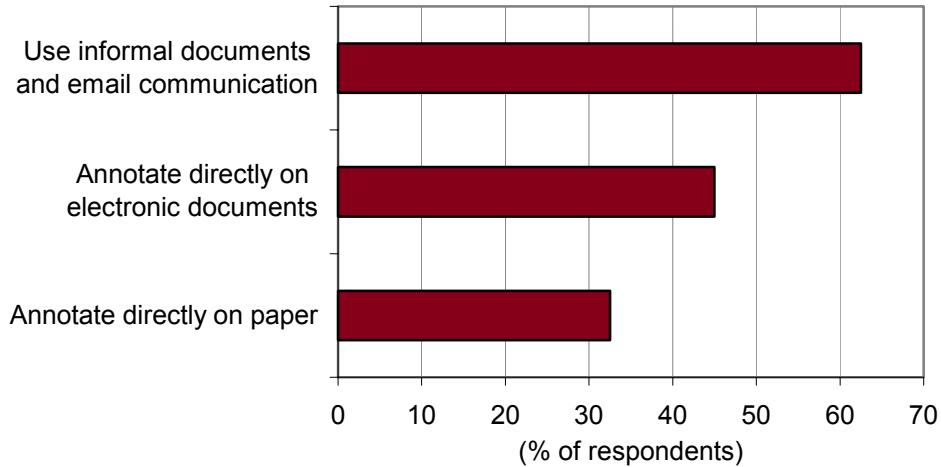
Source: IDC Manufacturing Insights, 2009

The absence of a centralized formal requirements management process also dictates that review and feedback be provided in a variety of forms and methods: Less than 50% of the respondents employ tools that support direct annotation on electronic forms, approximately one-third communicate feedback using paper documents, and the vast majority use informal tools (predominantly email) to communicate feedback (see Figure 4).

FIGURE 4

Review and Feedback

Q. Please select the statement below that best describes how nonengineers provide feedback to product information they receive.



n = 40

Source: IDC Manufacturing Insights, 2009

Design Collaboration

Product designers and other, nonengineering, functions often need to communicate product information and specifications outside the four walls of the enterprise. We examined the practices of manufacturing companies in exchanging design information with external partners and, in particular, with nonengineering functions such as suppliers.

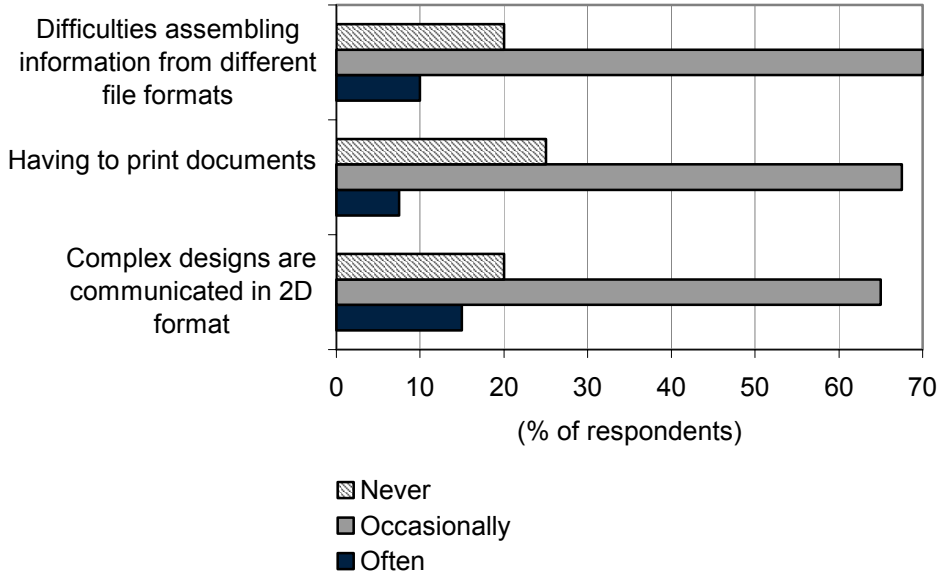
Most manufacturing companies we interviewed use informal communication means when dealing with stakeholders. Typically, this collaboration entails gathering individual documents from multiple sources and sending them as email attachments. As Figure 5 shows, most companies experience difficulties assembling information that resides in various electronic files and occasionally are forced to convert 3D information to 2D. Sometimes, these companies need to reduce the information to paper printouts for consumption by other stakeholders.

The top concern expressed by manufacturing executives participating in this study (see Figure 6) was the intellectual property risks introduced by the use of informal systems and, in particular, paper documents that need to be shared with external stakeholders and cannot be effectively controlled and traced.

FIGURE 5

Issues with Communicating with Internal Stakeholders

Q. How often do you encounter the following issues in communicating product data among multiple stakeholders within your company?



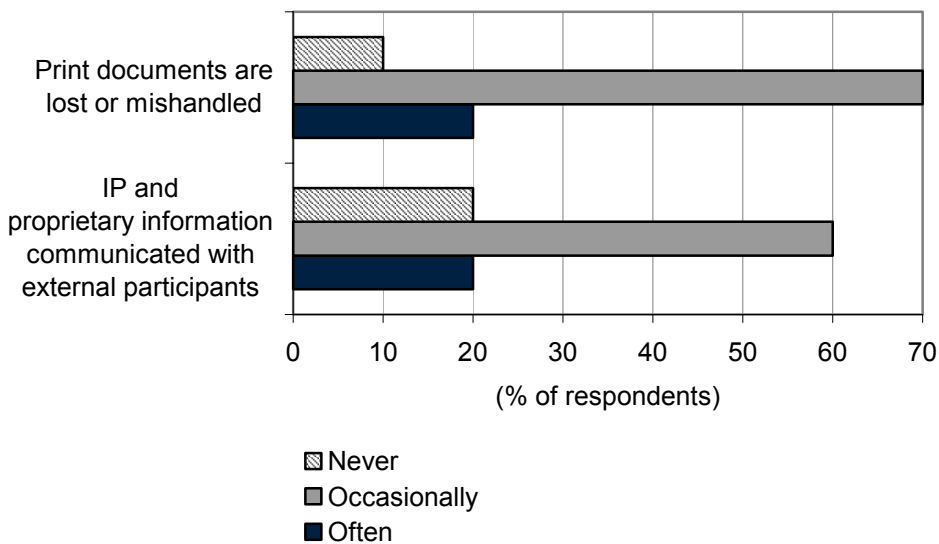
n = 40

Source: IDC Manufacturing Insights, 2009

FIGURE 6

Issues with Communicating with External Stakeholders

Q. How often do you encounter the following issues in communicating product data with stakeholders outside your company?



n = 40

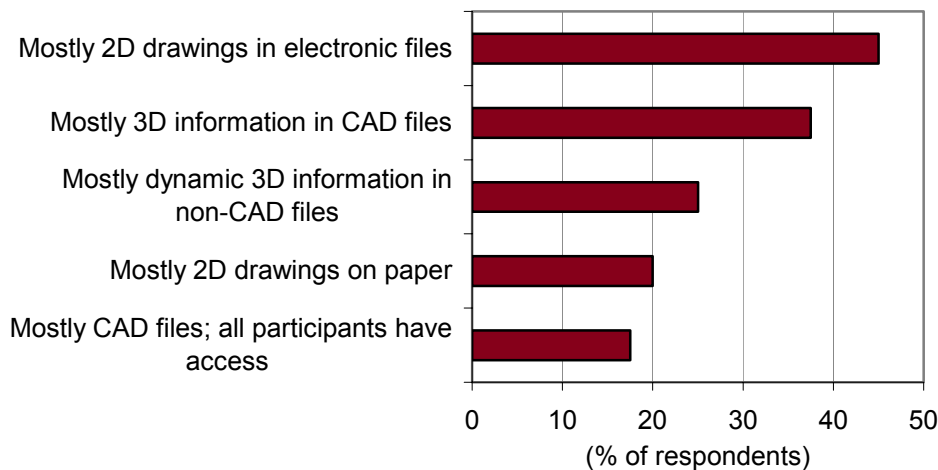
Source: IDC Manufacturing Insights, 2009

Given the complex nature of many products and the criticality of effective communication, it is surprising that many companies still use 2D drawings to communicate with stakeholders and partners. As Figure 7 shows, nearly half of the companies we interviewed use 2D information, and an additional 20% produce this type of information on paper. While companies find that converting 3D information to 2D documents, whether electronic or paper, makes this information accessible to a broader audience, 2D cannot communicate the richness and complexity embodied in dynamic 3D rendering.

FIGURE 7

Communicating Product Information

Q. Please select the statement below that best describes how product information is communicated with nonengineering stakeholders, such as marketing, purchasing, and service.



n = 40

Source: IDC Manufacturing Insights, 2009

Manufacturing

We also explored the methods product companies use to manage and communicate information in support of the manufacturing process, especially during the transition from design to manufacturing, such as design documents, work instructions, and supplier information.

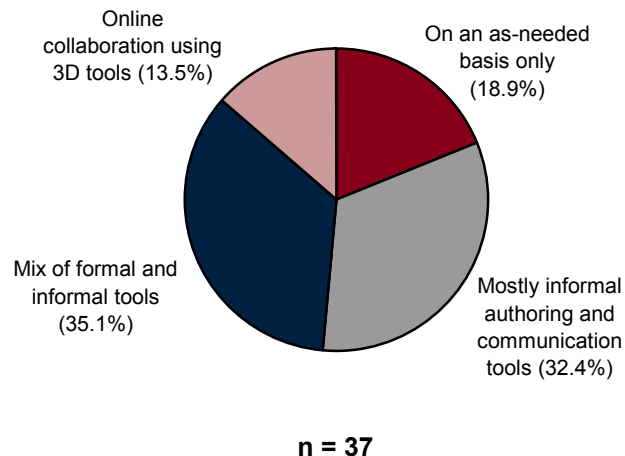
As shown in Figure 8, of the companies that have institutionalized a process to transition from design to manufacturing, only 13.5% manage this process fully electronically. Nearly 70% use informal tools or a process that, while mostly formal and structured, requires occasionally that individual documents be printed or incorporated as an email attachment.

A small group of manufacturers, less than 20% of the study participants, indicated that the collaboration between design and manufacturing takes place only when the need arises, such as when there is a manufacturability issue or a quality problem. It is safe to assume that in these instances, the lack of formal tools, coupled with the urgent nature of the issue, results in collaboration that is highly informal and unstructured.

FIGURE 8

Collaboration in Manufacturing

Q. Please select the statement below that best describes the collaboration and information-sharing activities between manufacturing and engineering.



Source: IDC Manufacturing Insights, 2009

FUTURE OUTLOOK

The research data presented throughout this document clearly depicts that the majority of manufacturers make extensive use of informal tools and processes to author, communicate, and manage key product information, such as market requirements, product specifications, product design, and manufacturing instructions. The absence of formal and structured methods inhibits effective collaboration and elevates IP and compliance risks.

The impact of these suboptimal practices is not lost on the manufacturing executives who have participated in this study. Moving forward, most product companies are aware of the critical role of effective collaboration, and forward-looking organizations will strive to improve their capacity to conduct efficient, effective, and secure collaboration with all stakeholders, within and outside the enterprise, and across all product life-cycle phases.

Improving Requirements Management

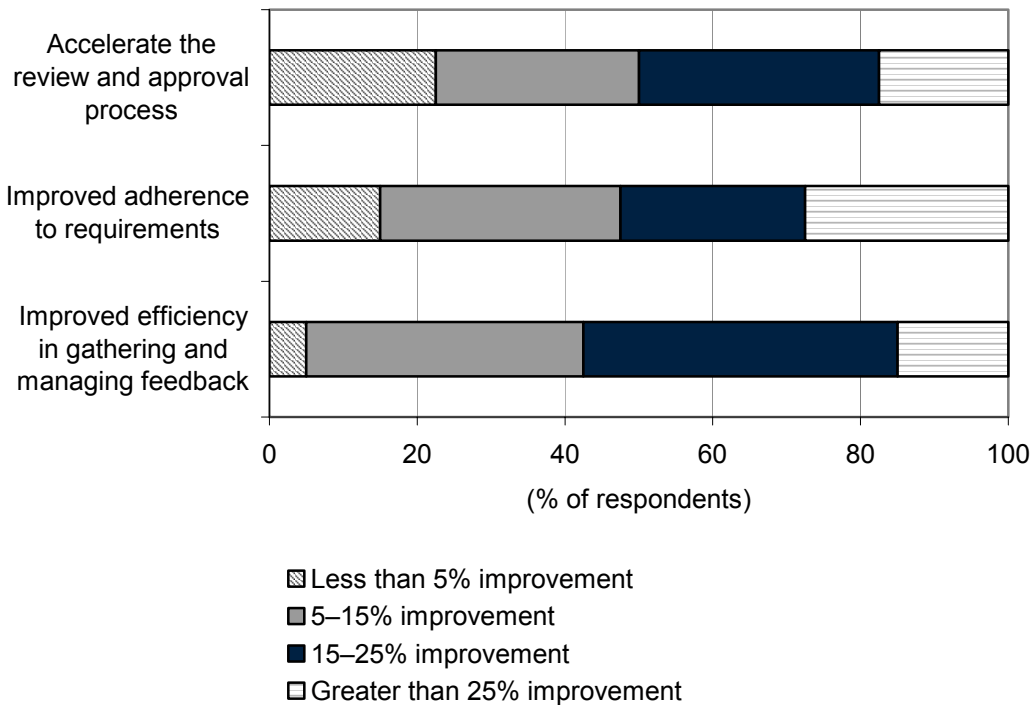
IT executives we interviewed believe that improving the tools and methods to manage the gathering, feedback, and approval of requirements will generate significant gains. As depicted in Figure 9, more than 50% of the participants in this study expect greater than 15% improvement in overall process efficiency and in adherence to requirements throughout the product development process. Forty percent of the interviewees expect similar improvements in the time it takes to review and approve requirements.

As discussed earlier, complying with a host of sustainability imperatives, from environmental mandates to financial regulations, is top of mind for all corporate executives. Establishing a formal process to manage and communicate up-to-date regulatory information and establish proof of compliance will help these executives manage this complex process more efficiently.

FIGURE 9

Improvement in Requirements

Q. Please indicate your estimate for improvement if you could achieve a consistent, accurate, and timely process to exchange product information.



n = 40

Source: IDC Manufacturing Insights, 2009

Improving Manufacturing Ramp-Up

Manufacturing executives we interviewed also expect to realize benefits from effective collaboration with engineering during ramp-up time, ensuring that design information and work instructions are communicated effectively to manufacturing personnel. As shown in Figure 10, 45% of respondents expect an overall improvement of 15% or better.

While these figures reflect the views and expectations of the interviewed companies concerning direct improvement in ramp-up time, we believe that improved engineering-manufacturing collaboration can also reduce the number of iterations and engineering change orders (ECOs) that are issued and managed during ramp-up time, generating additional savings opportunities for manufacturing companies. Table 1 shows the typical savings that manufacturing companies can expect from ECO process standardization and improved information exchange.

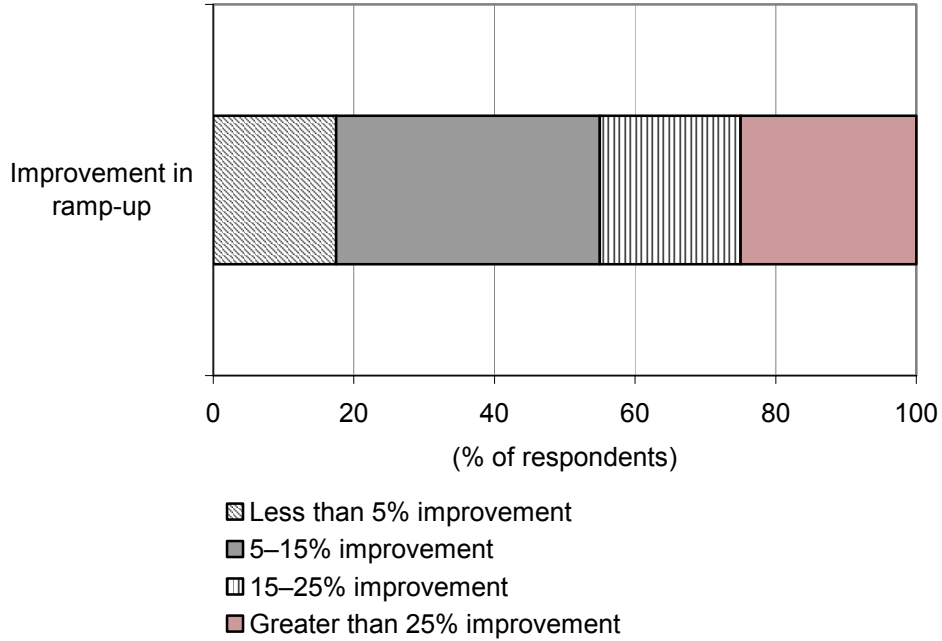
Administration overhead is one of more wasteful activities in managing ECOs. This involves collating various documents, tracking the documents through several review and analysis stages, and documenting the implementation of engineering changes. IDC Manufacturing Insights estimates that an effective ECO process can reduce administration overhead costs by as much as 60%.

Improving the ECO process can also yield inventory-related savings. Accurate and timely handling of ECO will result in timely action that reduces the costs associated with obsolete inventory and repair activities of incorrectly manufactured inventory.

FIGURE 10

Improvement in Ramp-Up

Q. Please indicate your estimate for improvement if you could achieve a consistent, accurate, and timely process to exchange product information.



n = 40

Source: IDC Manufacturing Insights, 2009

TABLE 1

Benefits of Using Engineering Management Tools

Category	Benefit
Overall improvement	40-50% efficiency improvement through process standardization
Administration costs	60% reduction in administrative expenses
Inventory-related costs	10% reduction in obsolete inventory
	5% reduction in repair cost due to incorrect inventory

Source: IDC Manufacturing Insights, 2009

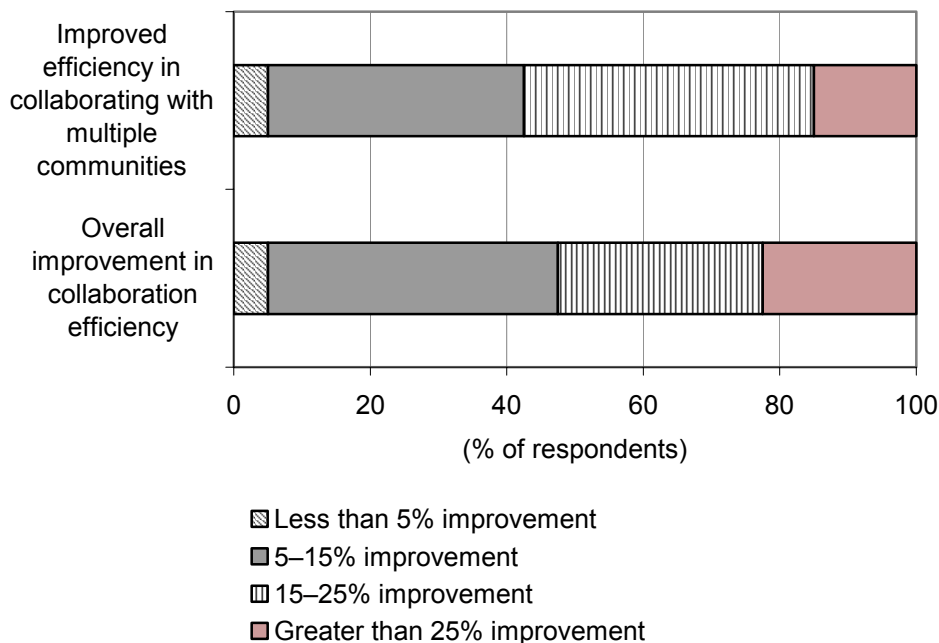
Improving Collaboration

Given the criticality of effective communication and collaboration for better decision making, it is not surprising that manufacturing companies expect to reap significant benefits when using a consistent, structured, and secure collaboration environment. More than 50% of the participants in this study expect better than 15% improvement in overall collaboration efficiency, in particular when dealing with multiple communities of practice throughout the product development process (see Figure 11).

FIGURE 11

Improvement in Collaboration

Q. Please indicate your estimate for improvement if you could achieve a consistent, accurate, and timely process to exchange product information.



n = 40

Source: IDC Manufacturing Insights, 2009

ESSENTIAL GUIDANCE

IDC Manufacturing Insights believes that effective collaboration throughout the product development process is a critical business capability. Manufacturing organizations must excel in collaborating across all product development phases and harmonizing the perspectives of multiple stakeholders into cohesive and reliable decisions.

The majority of product companies already employ information technology to help in creating and managing information. Tools that include document management, requirements management, product life-cycle management (PLM), and so forth are essential to the business and will continue to serve as the foundation for PLM practices. However, as we have shown in this study, organizations are compelled to augment those tools with other, less structured and often less capable information tools that range from garden-variety email attachments to loose paper documents.

Manufacturing companies should strive to create a collaboration environment that provides the efficiency and security of a single uniform platform, yet allows the flexibility and scalability demanded by the realities of the global economy. For example, such adaptability could prove highly valuable when communicating with external stakeholders who do not have direct access to a data repository and when the owner of the information needs to ensure the integrity and security of information being exchanged. This environment should be able to connect to and synthesize information from multiple sources and communicate it to the point of consumption in the most appropriate format and delivery mechanism, guaranteeing information security and IP protection.

It is also necessary to recognize the heterogeneous nature of the communities in the product development environment. Therefore, higher levels of collaboration call for nondisruptive and familiar workflow that can be implemented selectively and gradually, without the need for massive rearchitecting of the IT infrastructure or retraining users. Manufacturers that adopt this approach will see significant improvement in the efficacy of their decision-making activities.

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