Tech-Clarity

Issue in Focus:

Improving Engineering Decision-Making with PLM

Better Products through Information-Driven Decisions

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Introducing the Issue

Making poor product or portfolio decisions can lead to devastating impacts on fiscal performance, Likewise, making a poor engineering decision during product development can lead to catastrophic consequences. But truth be told, most decisions an engineer makes on a daily basis don't have life or death implications. In fact, no one decision will probably be the difference between product success and failure. The combined impact of all of the decisions required to develop even a simple product, however, has a significant impact on the performance, quality, reliability, cost, compliance – and ultimately profitability – of a product.

Engineering is essentially applying knowledge and science to create solutions to problems. In product development this means making decisions to address a set of requirements or needs. Engineers make thousands of decisions in product development, from big ones down to the small, everyday ones. For example, an engineering leader from GM explained at a recent conference that developing an automobile is a process consisting of over 25,000 decisions. Each of these decisions is important on its own, but more importantly the decisions are inter-related and decisions made early in product development can have a dramatic impact downstream.

Optimizing engineering decisions is ultimately about driving greater success and profitability of products.

Given the important role of engineering decision-making in product development, manufacturers should treat it as a core competency. Manufacturers must enable decision-makers to make better, more confident decisions. They should also enable engineers to make decisions efficiently and get them right the first time to optimize product development time, reduce time-consuming design rework, and improve time to market. Optimizing engineering decisions is ultimately about driving greater success and profitability of products.

What was a "good enough" decision ten or fifteen years ago will not suffice today.

Improving decision-making is even more important today as engineers face unprecedented complexity in product development. At the same time, competition is much more global and competitive advantages are easier to copy. What was a "good enough" decision ten or fifteen years ago will not suffice today. The bar has been raised. Companies are targeting "right the first time" decision-making to make more optimal, confident decisions based on better information. The engineering decision-making processes and tools of over a decade ago will not suffice either – they must evolve to enable data-driven decisions to optimize product designs.

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Increasing Challenge of Engineering Decisions

Making engineering decisions has simply gotten more difficult. Tech-Clarity's The Five Dimensions of Product Complexity report explains how developing today's products places higher demands on engineers. To start, increased mechanical complexity means there are more materials to choose from. For example, designing composite parts requires not just understanding the materials but designing mesh patterns and orientations.

While purely mechanical parts are more complex, those challenges are further complicated by the move to systems-driven product development. Today's "mechatronic" products require decisions to be made in the context of mechanics, electronics, and product software. Even more challenging is that companies have to decide early in design which capabilities will be driven by each of these disciplines. Now, each decision is more integrated with the rest because a decision in a mechanical characteristic may need to be accounted for not just in the physical structure but also in the controls.

In addition to product complexity, globalization drives it's own complexity while raising the bar on performance and cost.

In addition to product complexity, globalization drives it's own complexity while raising the bar on performance and cost. Today's products are frequently designed to meet global requirements or built on a common platform with variants for local markets. Globally dispersed design teams also complicate the issue, as does compressing global product launches requiring products to work in multiple geographies from the start instead of adapting them over time.

Decisions have to be made in less time to meet aggressive time to market goals.

Beyond these complexities is perhaps the biggest issue, time. The pace of product development has increased dramatically. Decisions have to be made in less time to meet aggressive time to market goals. In addition, the scope of decisions has increased as time has been reduced. Engineers now focus not just on performance and quality, but also on considerations like manufacturability, cost, compliance, sustainability, and serviceability to get products right the first time. This drives shorter time to market through concurrent design, but provides more considerations for each decision, requires more information from across the business, and calls for intelligent tradeoffs. Clearly, decision-making has become more complex for the modern engineer.

Addressing The Product Information Challenge / Opportunity

So what can we do to help engineers make better, faster, and more comprehensive decisions? We can give product developers efficient, effective ways to get the

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information they need from across the enterprise. The GM engineering leader estimated that engineers spend 40% of their time trying to find information. Manufacturers can't afford to waste time and precious engineering resources searching for data. Clearly this is a big opportunity to improve product development efficiency as companies try to do "more with less." Manufacturers must enable their decision-makers with the right information, at the decision-making moment, in the context of their design, and with an understanding of what else their decision impacts.

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Before we start creating ways to store more information, however, let's recognize that the real problem is not too *little* information – but too *much* information. The amount of electronic information available is growing rapidly. This is true in all walks of life and is having a big impact on (and offering a potential opportunity for) engineers. Trends to get more feedback from customers, suppliers, and others during engineering further escalate the information challenge. Collecting and sharing these insights, in some cases including social computing techniques like crowdsourcing, offers tremendous value but also adds to information overload.

The real problem is not too little information – but too much information.

This may be the tip of the iceberg, though, because data overload is about to explode with the emerging opportunity to collect and leverage "big data." As if the engineering and product information we already have isn't overwhelming to navigate, companies can now access massive data sources internally and on the Internet to take into account information that was previously unimaginable. This includes real-time data on markets, customers, and even feedback from products themselves as smarter products communicate feedback via embedded sensors. Leading companies are trying to understand and leverage this emerging opportunity.

Searching for the right information is challenging and time-consuming.

Unfortunately, even today searching for the right information is challenging and time-consuming. The result is that people frequently bypass important information or end up reinventing the wheel because information and knowledge are too hard to find and retrieve in a timely way. This leads to additional cost, poor quality, and delayed time to market in addition to sub-optimizing decisions. These cost, quality, and time penalties can't be sustained as companies try to design for compliance, manufacturability, and cost earlier in the design cycle. Instead, manufactures need to make the right information

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accessible any time, regardless of the data source, across the spectrum of product-related information, but all in an easy to retrieve way so it is actually used.

Enabling Engineers to Make Timely, Optimal Decisions

Every engineering challenge starts with what you know and the problem you want to solve. Then, engineers apply their know-how, experience, and problem-solving skills to come up with alternatives and ultimately decisions. Today, because we have the ability to access so much more information, the obligation to make an optimal decision is higher. Because let's face it, the competition has this opportunity too. Information technology provided the means to gather all of the data required. Now, it must offer the right tools for decision-makers to leverage the information at the point they need it. What is most frustrating to engineering leadership is that in many cases the information is there but it is not readily available to the decision-maker at moment they need it.

Providing fast, meaningful search results from across data sources is a must.

Better search tools are an obvious place to start. Providing fast, meaningful search results from across data sources is a must. As Tech-Clarity's Product Data Accessibility report explains with search-based applications "*manufactures today have an opportunity to improve product data accessibility, and extend accessibility to all of their product data*." Advanced search capabilities can intelligently group information, allow easy filtering of information, and provide rapid access to information based on data indexes. They can even proactively suggest information based on the user's role and the task they are performing, understanding context and data relationships in addition to search terms.

Systems should provide rich information visually in the context of the product, and more specifically on the portion of the product the designer is working on.

Text-oriented search, however, is only a part of what a design-centric information system should offer. Engineers work visually, so why should their information be returned in a large blocks of text? Instead, systems should provide rich information visually in the context of the product, and more specifically on the portion of the product the designer is working on. Layering business and technical information onto the digital product itself gives context to decisions. For example, systems could overlay cost, status, weight, or other critical information on a 3D product model. From there, the engineer can visually navigate and drill down to the information they need.

Layering business and technical information onto the digital product itself gives context to decisions.

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In addition to displaying information in the context of the digital product, systems can display visual representations of data relationships. For example, component status could be put into the context an engineer is familiar with, such as a bill of material (BOM). Even more broadly, systems can display data relationships to visually communicate how information fits together, so engineers can easily see how decisions will impact other things. In essence, it is important for systems to display information in a logical view that provides meaningful information, in an easy to consume format, in the context of the task at hand.

Taking it to the Next Level - Supporting NPD

Beyond making tradeoffs and optimizing product decisions, PLM can provide an immersive decision-making environment to optimize the product development process as a whole. PLM can add structure and enable best practices, going beyond supporting discrete decisions to orchestrate the collection of decisions that go into developing a profitable product. PLM does this by supporting the "What, Who, When, Where, and Why" of new product development:

- **What –** What decisions need to be made in order to develop profitable products? How are they organized? Is there a consistent process or methodology across the business?
- **Who** – Who needs to make decisions? Who should be involved? Who needs to approve? Who should have access to sensitive information?
- **When** – How do people know it is time to make a decision? Are they notified? How does that fit into the overall project?
- **How** – How will they make the decision? What is required in order for Engineers to make good decisions? What data do they require? What tools, templates, or standards do they need? How do they access them? How do they understand the impact of their decision in context of the entire project?
- **Where** - Where do Engineers find the information needed to make an informed decision? What data is provided to them, or how do they find it?
- **Why** – Why was the decision made, and what was the result? How is that knowledge communicated and documented for future reference and reuse?

An information-driven approach helps engineers make optimal, timely decisions in the context of a comprehensive new product development project, resulting in high profitability products.

By managing the process and information related to engineering and new product development, PLM helps raise the bar on engineering and product development. Improved efficiency can help manufactures bring products to market faster or provide

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engineers with more time for studies, tradeoff analysis, collaboration, and innovation. An information-driven approach helps engineers make optimal, timely decisions in the context of a comprehensive new product development project, resulting in high profitability products. Given today's increased complexity, shorter development periods, and increased expectations companies need the capabilities of PLM more than ever.

Conclusion

Bringing products to market has never been more complex. The time has come to provide engineers with an environment that helps them take advantage of all of the information and expertise available to them. Having the right information, in context, in a timely manner improves decisions and leads to better products. Manufacturers have to take advantage of this opportunity to improve product cost, quality, compliance, and overall performance as the bar is raised across the globe on engineering decisions.

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Improving the ability to make decisions also improves engineering efficiency. In turn, efficiency leads to more time to make decisions so more alternatives can be explored and more optimal decisions can be made. In addition to improving engineering cycles and time to market, allowing engineers to make faster, more confident decisions allows more time to iterate and innovate. Allowing engineers to get decisions right the first time further improves efficiency through fewer late changes and reduced rework.

PLM enables better engineering by making the right information available in the right context.

In aggregate, better decisions ranging from design, to sourcing, production, and service impact product performance, quality, compliance, cost, and other factors that ultimately drive product profitability. Improving engineering decision-making capabilities holds the potential to increase the success rate of new products and bring higher levels of innovation to market sooner. PLM enables better engineering by making the right information available in the right context. Beyond that, PLM software can help communicate and enforce process (**what**), identify responsibilities (**who**), manage workflow and project timelines (**when**), provide the right information and tools in the context of the product and the project (**how** and **where**), and document how decisions were made (**why**). Today's complex products and engineering environments require this level of support to compete in challenging, global markets.

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Recommendations

Based on industry experience and research for this report, Tech-Clarity offers the following recommendations:

- Recognize engineering as a decision-making process
- Make information readily accessible, providing fast, simple search tools to retrieve information in different ways (shape, text, filters, saved queries, etc.) across multiple data sources
- Allow engineers to quickly develop a workspace that provides the right context and information for the decision they are making, filtering out unnecessary complexity
- Offer data in rich, visual formats representing data and data relationships in meaningful ways to help decision-making
- Overlay information in the context of products and provide more natural navigation in the context of the 3D product
- Provide information proactively to decision-makers based on their activities, roles, and projects
- Provide these capabilities in an immersive decision-making environment that allows engineers (and others in the product development process) to harness all of the information and expertise available to them to make better decisions
- Leverage PLM to orchestrate engineering decisions in a comprehensive, holistic product development approach to drive faster time to market and greater product profitability

About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the true business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries, with a broad background including roles in industry, management consulting, the software industry, and research. His experience spans enterprise applications including PLM, ERP, quality management, service, manufacturing, and others. Jim is passionate about improving product innovation, product development, and engineering performance through the use of software technology and social computing techniques.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere that he can engage with people that are passionate about improving business performance through software technology.

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