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A Guide to Manufacturing Transformation

Modernize // Collaborate // Evolve

Are you ready?

Are your enterprise systems?

Cindy Jutras / Jim Brown

 Mint Jutras

 Tech-Clarity

A Guide to Manufacturing Transformation

Introduction



The manufacturing industry is undergoing one of its most significant transformations in decades. The years of industrialized nations gaining significant economic advantages from shifting production to low cost, developing nations are coming to an end. Today's economic landscape and rising wages in formerly low-cost countries make offshoring less attractive.

Developed nations are now "right shoring" their operations and adopting "design anywhere – build anywhere" strategies that allow them to shift work across the globe and produce closer to raw materials or customers. Manufacturers in emerging economies are moving up the value chain to develop more innovative, high quality products. These shifts are causing many changes and creating many opportunities. They are also introducing new competition and new threats.

Manufacturers are turning to systems and automation to help them take advantage of the manufacturing transformation. Enterprise systems are enabling the transformation much the same way Enterprise Resource Planning (ERP) played a significant role in streamlining and re-engineering manufacturing enterprises in the 1990's. As the bar is raised on expectations from today's manufacturers, both ERP and Product Lifecycle Management (PLM) can play a significant role in helping companies stay ahead or leapfrog their competition.

The manufacturing transformation is underway. The enterprise systems ecosystem supporting manufacturing is changing as well. Are today's enterprise systems ready to support this more competitive environment? Will they be within the reach of companies that weren't able to take advantage of them in the past?

Can today's enterprise systems support the manufacturing transformation?

We asked the experts:



Cindy Jutras is a widely recognized expert in analyzing the impact of enterprise applications on business

performance. She is founder and president of Mint Jutras, an independent research and advisory firm. Utilizing over 35 years of corporate experience and specific expertise in manufacturing, supply chain and business performance management, Cindy has spent the past 8 years benchmarking the performance of software solutions in the context of the business benefits of technology.



Jim Brown is the founder and President of independent research firm Tech-Clarity. Jim is a recognized expert in software solutions

for manufacturers, with over 20 years of experience in application software, management consulting, and research. He has broad knowledge on the use of Product Lifecycle Management (PLM), Supply Chain Management (SCM), ERP, and other enterprise applications to improve business performance.

We asked them to weigh in on trends in the industry, the role ERP and PLM play in supporting transformation and the importance of Engineering and Manufacturing collaboration.

A Guide to Manufacturing Transformation

What trends do you see transforming manufacturing?

From the operations perspective



Cindy:

Of course change is a constant in any type of business, but the kind of change Manufacturing has seen in the past twenty years has been very dramatic. Automation has drastically changed the operational landscape; global competition has sprung from the most unlikely sources; leaner inventory, combined with complex supply chains, requires more visibility, better planning and increased collaboration.

The world is shrinking, yet depending on where in the world you look, the impact of these trends is different. If you haven't toured a manufacturing facility in a highly developed country like the United States in the past twenty years, the first thing you might ask when you step inside one today: Where are all the people? While many blame off-shoring and outsourcing for the loss of jobs, many disappeared because of automation. Of course this didn't eliminate all workers. But by eliminating workers whose jobs could be automated, the typical manufacturing worker profile changed. Gone are the assembly workers of the past concerned only with their own little island on the shop floor.

Those still employed are the knowledge workers, the decision makers, whose concerns include the design of the product, the quality of the manufacturing processes, as well as the product, and the satisfaction of the customer.

While automation accounts for a lot of the jobs lost in the manufacturing sector of developed countries, some of those jobs didn't disappear entirely, but instead moved offshore where labor was cheap. Yes, offshoring and outsourcing have become realities with many outsourcing whole segments of the manufacturing process and purchasing both components and subassemblies from low cost country sources. Partly as a result of opening up new markets for offshore services, competition started springing up, sometimes from the most unlikely places – the low-cost countries themselves.

Increased global competition also means customers become more demanding of price, quality and delivery. The answer used to be large buffers of inventory and added capacity. But high inventory and low utilization adds cost that most manufacturers simply can no longer afford to pay. Whether you are in a mature industry facing new competition or you are the new competition you require a whole new level of visibility to give you the decision-making power to respond with agility.

A Guide to Manufacturing Transformation

What trends do you see transforming manufacturing?

From a product perspective



Jim:

Over the past decade or two, competition centered around cost. Manufacturers improved efficiencies and supply chain performance in order to compete in global markets. While few manufacturers can afford to lose focus on cost, it is no longer enough to win. Cost and quality are now table stakes; they are simply expected.

Today, companies have to bring innovative products to market at a rapid pace if they want to differentiate. Incremental innovation no longer provides a sustainable business advantage. Instead, companies must innovate on products and services in order to deliver a product that stands out in the market. And because it is now much easier to be a “fast follower,” those same companies must be able to out-innovate themselves and bring their next product to market with very short cycle times to stay on top.

Manufacturers must be agile. Customer demands and market conditions change rapidly. Today’s lean supply chains provide an opportunity to shift quickly but also lead to risk of disruption. Companies should be able to shift design and/or production to take advantage of global capacity and conditions. Offshoring is giving way to “right shoring” where companies shift production closer to demand and to take advantage of local business conditions. This level of agility has caused

many to adopt a more global “design anywhere/build anywhere” strategy. Manufacturing automation plays a key role here as well. Manufacturers are leveraging automation and rapid commissioning to quickly change production to adapt to market changes and capitalize on opportunities.

Finally, products must be personal. Customers today expect products to be tailored to local market requirements and their own unique needs. This requires a larger number of product variants that must be designed and produced. Personalization creates additional complexity that must be managed.

Speaking of complexity, another trend that can’t be ignored is the move to smart products. My research shows that manufacturers are increasing the amount, importance, and innovation derived from software embedded in their products. This complexity must also be managed.

The manufacturing industry is changing, and those that can out-adapt and out-innovate their competition will take advantage over those that can’t.

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The Role of ERP and PLM



How do ERP and PLM support Manufacturing today in this transformation?

Jim: My research shows that PLM improves top- and bottom-line business performance. PLM enhances revenue by improving innovation and time to market, which offer competitive “first mover” advantages in market share and margins. PLM helps companies harness their capabilities to develop better, more innovative products. At the same time, PLM also helps reduce cost, both in terms of lower product cost and reduced product development costs.

Cindy: There is no doubt these trends place new demands on enterprise systems, and that includes ERP. Increased global competition makes customers more demanding of price, quality and delivery, yet high inventory and low utilization adds cost that put manufacturers at a competitive disadvantage. Leaner inventory and better utilization requires more visibility, better planning and increased collaboration. This is job #1 for ERP.

Cindy: Today’s ERP needs to manage more than just moving parts around the manufacturing facility. ERP must directly support a broader and more diverse audience. And that audience is evolving. By eliminating workers whose jobs could be automated, the typical manufacturing worker profile changed. Those still employed are no longer “commodities.” They are the knowledge workers, the decision-makers. This includes those designing and engineering products. It has always been easier to get data into ERP than to get answers out. That perhaps explains why some, including the Engineering functions, have

avoided engaging with ERP in the past. But modern systems provide new ways to engage, are more intuitive, easier to use.

Jim: PLM has expanded significantly beyond the Engineering department. As manufacturers transform, their need to coordinate and collaborate on product innovation and product development increases. PLM helps manage the complexity of designing in global teams and across an extended supply chain. It also allows more people to be involved early in the product lifecycle to enhance quality and reduce time to market. Centralizing and sharing information helps promote efficiency and reuse so product developers spend less time reinventing the wheel.

Jim: I would also argue that PLM adds value beyond just the product. PLM helps companies design products right the first time by getting input and validation from across the enterprise early in the design process. This ensures that products are designed for performance but also for supply, manufacturability, cost, serviceability, compliance, and sustainability. These factors are notoriously hard to change after they are locked in at design time. Optimizing products early improves products, increases efficiency, and helps drive better time to market. At the same time it enables product-oriented processes across the enterprise and supply chain that provide far-ranging benefits including sustainability, quality, and productivity gains.

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The Role of ERP and PLM



How do ERP and PLM support manufacturing today in this transformation? Cont'd ...

Cindy: PLM and ERP support some common goals. You don't just need one or the other. You need both. ERP is all about efficiency, which translates to reduced costs, the ability to support growth with existing resources and full visibility to the business. My research shows world class ERP implementations reduce inventory by an average of 20% while also improving complete and on-time delivery, customer retention and profitability by 24% or more. Of course not all manufacturers produce this level of improvement, but even the average ERP implementation sees improvements in the 8-10% range, providing results are actually monitored and measured. And that is one of the keys to success. You can't achieve this without an effective combination of people, processes and technology. You won't see these kinds of savings without paying attention.

Jim: PLM helps companies transform to be more innovative, drive higher revenue and reduce cost. These benefits hit the top and bottom lines directly. PLM is also essential to manage rising complexity as manufacturers design more product variants, develop smarter products, and operate in more global environments. PLM is critical to allow manufacturers to introduce innovative new products and rapidly ramp up production so they can get to market quickly without sacrificing cost or quality. ERP complements PLM by managing the business of manufacturing to improve operational performance and better serve customers.

“The manufacturing industry is changing, and those that can out-adapt and out-innovate their competition will take advantage over those that can't.”

- Jim Brown

A Guide to Manufacturing Transformation Trends in Enterprise Systems



What trends do you see in the enterprise system ecosystem supporting Manufacturing?

Cindy: You can't pick up a magazine (either in print or online) today without being bombarded with some trending technology topics: cloud, mobile, big data and "social" top the list. And each of these has a direct impact on the enterprise systems ecosystem, but some are more "game-changing" than others. With plant automation, including sensors out on the shop floor, manufacturers were forced to deal with huge data volumes long before the concept of big data became fashionable. With respect to "social", manufacturers benefit enormously from improved collaboration, connectivity and transparency. But if you want to get a manufacturing executive's attention, you might not want to call it "social".

Jim: Innovation is a team sport. Whatever we call it, I believe that social computing is a very natural fit for product development and manufacturing. While sites like Facebook aren't developed for the intricacies of product development or enterprise processes, social concepts apply very well to the collaborative nature of product innovation, design, engineering, and production. From gathering the "voice of the customer" in early ideation to sharing feedback on an assembly design, sharing information and status across departmental and company boundaries is critical to succeeding in today's fast-paced, global environments. The key is opening up more real-time and broader communication among those that help design and deliver products.

Cindy: But manufacturing execs also tend to be a conservative bunch. That said, I agree: - Manufacturing can benefit from applying a lot of "social" concepts that are being embedded in enterprise applications today. Concepts like "friending" and "following." Yes Engineering and Manufacturing can be friends. But I'm not talking about following people. I'm talking about following business objects like customers and products. Follow a product and you will see the full activity stream associated with it including engineering changes, customer orders, completed production and shipments.

Cindy: Of course having all this data, and all these options for sharing, feeds the need to stay connected constantly. As a result, we're carrying more and more mobile devices, beyond the traditional laptop. With all our smart phones and tablets, the more unwired we become, the more tethered we are to the business.

We are always connected, whether we're in the plant, on the road or on a soccer field watching our children practice or play. Most of the data we're talking about resides in ERP. To maximize the benefit of this improved connectivity requires the ability to access ERP any time, from any place. And it also requires new ways of engaging with ERP.

A Guide to Manufacturing Transformation Trends in Enterprise Systems



What trends do you see in the enterprise system ecosystem supporting Manufacturing? Cont'd ...

Jim: I have written a lot about mobility and PLM. There are two important aspects here. The first is extending existing information and processes out to a broader set of people on a wider range of devices. For example companies might enable a service technician to raise a change request from a customer site or allow sales reps to access product specs and high quality graphics at a trade show. The other aspect is taking advantage of some of the unique capabilities of today's smart devices to extend the value of product-related information. For example, using augmented reality on a tablet device to superimpose simulated manufacturing procedures on the actual line. The possibilities are endless.

Cindy: Of course all this connectivity assumes that you can access systems any time from any place. The ability to access ERP and PLM anywhere, anytime, with less information technology (IT) staff, without the burden of servers and software to maintain, makes cloud deployment very attractive today. Sometimes Manufacturing gets a bad rap and many assume it lags in understanding and utilizing technology to support the business. It is true many would prefer to spend more of their technology budget automating their shop floors than supporting either front or back office processes, but that only increases the attractiveness of a Software as a Service (SaaS) deployment. And my research finds manufacturers more (not less) savvy about cloud-based options (like SaaS) than those in other industries.

“The ability to access ERP and PLM anywhere, anytime, with less information technology (IT) staff, without the burden of servers and software to maintain, makes cloud deployment very attractive today.”

- Cindy Jutras

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The Cloud: An Important Trend in Enterprise Systems

Cindy: And this savvy-ness translates into a change in perception about traditional deployments. When we asked Mint Jutras 2013 ERP Solution Study participants to select all the different deployment options they would consider in a future purchase of ERP, we saw a precipitous drop in those that would consider the traditional on-premises deployment prevalent in the majority of manufacturers today.

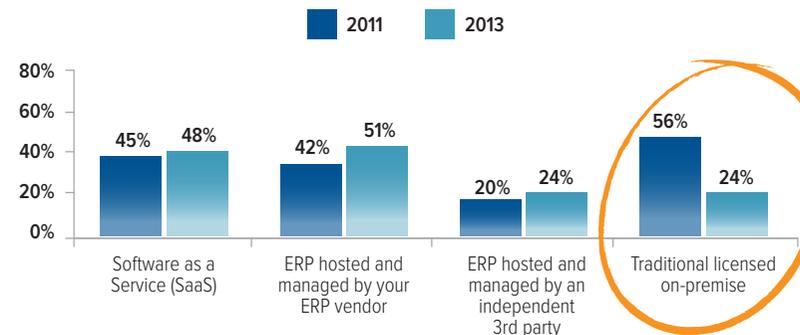
Jim: The unfortunate fact is that not everyone has been able to take advantage of PLM (or ERP for that matter) because of cost, complexity, and resource constraints. For many, their businesses are small and they simply don't have the IT staff to support an on-premise solution with the complexity of adding servers and other infrastructure. For others, they can't get the attention of over-burdened IT staff. Perhaps more importantly, though, is they have not been willing to take the risk of implementing a solution. With cloud applications, many of the barriers to implementing enterprise systems fall away. They offer a low risk, rapid way to improve their business. These benefits are compelling, as my *Assessing the Cloud PLM Opportunity* report points out "Cloud offerings and business models reduce time and cost dramatically by eliminating waste and redundancy."

Cindy: And if you think this is only an option for small companies, think again. We actually see the interest level in SaaS solutions increase with company size. More and more multi-divisional companies are developing standards for ERP implementations across distributed environments and what better way to implement (enforce?) these standards than a SaaS-based solution delivered through the cloud?

Jim: While many companies investigate cloud offerings to reduce cost my research has uncovered other benefits as well. Cloud-based enterprise offerings can provide benefits more rapidly due to ease of implementation, increase business agility, simplify access for remote employees or partners, support a broader array of devices, enhance scalability, and offer companies access to shared resources with highly specialized skills to achieve higher levels of systems performance. As the *Cloud* report says, "Large and small companies alike are using cloud solutions to simplify their IT infrastructure. These companies are taking advantage of lower costs, faster time to value, and increased agility available from Internet-based applications."

Which deployment options would you consider for ERP in the future?

Source: Mint Jutras 2011 and 2013 ERP Solution Studies



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The Cloud: Perceived Benefits and Lingering Concerns

Cindy: I've done a lot of research to investigate what drives manufacturers to consider SaaS deployment of applications. Cost remains at the top, by a significant margin, while other factors are clustered together more closely. Upgrade issues (which include the cost and disruption associated with upgrading on-premise solutions) are second, followed by support of distributed and/or remote environments. The fact that no hardware purchase is required, nor the ongoing maintenance associated with that hardware, is marginally more important than the need for less Information Technology (IT) expertise and staff required. But these two go hand-in-hand, although managing and maintaining the hardware is only one of the functions performed by IT staff. Most companies moving from on-premise to SaaS are not trying to eliminate IT staff, but are more interested in allowing them to play a role that is more strategic to the business. That said, many that never had any on-premise solutions often point to not having to hire IT staff as a significant benefit of SaaS, particularly in remote areas where IT talent might be hard to come by.

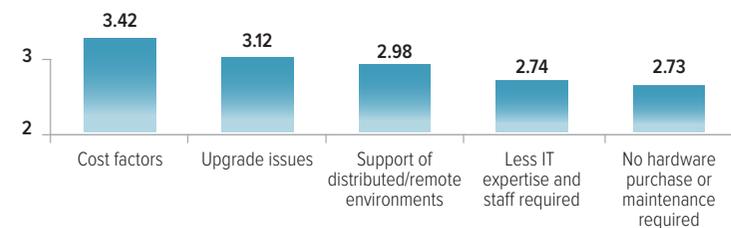
Jim: There are benefits to cloud offerings but my research points out that manufacturers have concerns as well. Some of these concerns are misplaced but all should be investigated with potential cloud providers. The first concern that I usually hear is about security of intellectual property (IP), particularly for PLM. These concerns are often emotional rather than factual. My report *Modernizing Manufacturing Systems with the Cloud* shares a number of interviews with companies that have transitioned to the cloud, one of whom explained to his management that a cloud provider can provide "500 times" the security he could

himself. Others are concerned with performance and reliability. While these are legitimate concerns, most manufacturers will find that the shared resources employed by their cloud provider significantly improve the security and performance of their IT infrastructure. Other considerations include integration and data access, which should be evaluated with their cloud vendor of choice. As *Integrating Cloud PLM* concludes "The good news is that integrating cloud solutions is proven in other applications like CRM, and integration solutions are evolving to support connecting cloud systems with hosted and traditional, onsite systems. Integrating cloud PLM with other cloud solutions or on-premise is achievable, and integration solutions are ready and available."

Relative Importance of SaaS Benefits

Source: Mint Jutras Understanding SaaS Study

Numbers denote the relative order of importance. The higher the number, the more important the perceived benefit of the cloud



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Collaboration: Manufacturing & Engineering



Why do Manufacturing and Engineering need to work more closely?

Jim: First and foremost manufacturers need to improve the handoffs between Engineering and Manufacturing. Engineering was not included in most “*reengineering*” efforts and interactions were never streamlined when other cross-departmental processes were addressed. Many companies struggle with the release to Manufacturing and change processes that require Engineering and Manufacturing to work in harmony. In the past, the luxury of time allowed manufacturers to work out the differences as they built prototypes and slowly ramped up production volumes, but today Manufacturing must be able to hit the ground running when new products or changes are introduced.

Cindy: I assume the reference to “*reengineering*” efforts is related to the initial process evaluations undertaken when a new ERP is implemented. You’re right in that historically Engineering was largely under-served. Unfortunately, in spite of improved capabilities, this has continued to be the case in many manufacturers. You often hear about different functional “silos” within a manufacturing organization. Nowhere has this separation and potential for contention between departments been more visible than between Manufacturing and Engineering, as evidenced by early implementations of ERP. Parts, products, bills of material were developed to support the manufacturing process, but the engineering functions were largely ignored. Often Engineering set off on an end run to by-pass the IT department, purchasing and implementing

its own solutions. This created an added requirement for interfaces that may or may not have resulted in full integration and support for effective collaboration.

Jim: Manufacturers must minimize the time it takes to ramp up production. Instead of waiting until a product is fully designed, manufacturing engineers should concurrently design processes to optimize manufacturing procedures, equipment, and tooling early in design.

Manufacturers can now digitally simulate how a virtual product will be produced on a virtual assembly line to avoid expensive and time-consuming problems. In this way they are designing an optimal Bill of Process (BOP) instead of throwing a Bill of Material (BOM) over the wall and hoping it can be produced effectively and efficiently. This also allows production personnel to provide feedback on manufacturability to influence the product design when it is still flexible. We might disagree on whether Engineering was left out or opted out, but it’s clearly time to iron out processes to help get products right the first time.

Cindy: The ultimate goal of a collaborative relationship is to eliminate contention when products are not designed for manufacturing or serviceability. When a design is simply thrown over the wall, Manufacturing takes it upon itself to revamp and revise it to get the

A Guide to Manufacturing Transformation Collaboration: Manufacturing & Engineering



Why do Manufacturing and Engineering need to work more closely? Cont'd ...

product manufactured. And of course those changes may never circle back to the design engineers. So when it is time for round two of product improvement, the engineers aren't working from the same page and the problem may just escalate out of control. The levels of automation we're seeing today only serve to make it much easier to make a lot of "bad" or "wrong" product faster. Collaboration and communication ensures product can be efficiently manufactured, and that it is manufactured as designed.

Jim: The ultimate goal, and one that surprisingly few manufacturers have achieved, is closing the loop back to Engineering. Manufacturing gains a wealth of knowledge that can improve product designs. Service technicians understand how the product performs in the field. Customers can provide insight into how they use the product. Unfortunately, this knowledge is largely untapped. Too few companies capture this information and feed it back into the requirements for new or revised products. Instead, engineers continue to design the same flaws into products and others have to fix or work around them. Bidirectional communication is the only way to improve this.

“You require a whole new level of visibility to give you the decision-making power to respond with agility.”

- Cindy Jutras

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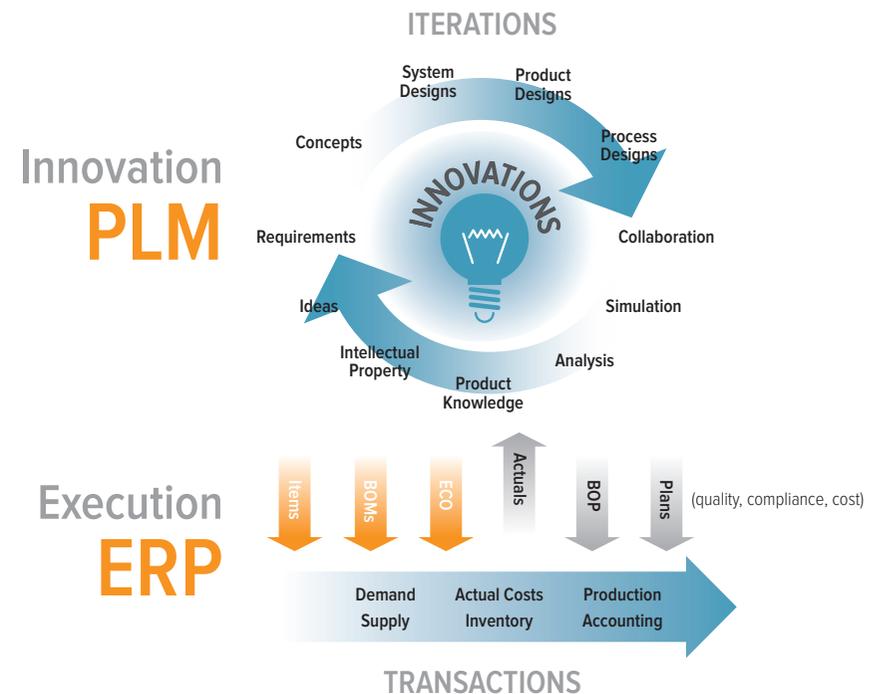
ERP/PLM Integration

Why is integration between ERP and PLM important?

Cindy: The need for Manufacturing and Engineering to work more closely together only accentuates the need for tighter integration between supporting systems. While communication is paramount, reliable production of product can't be dependent on individual conversations. Just as ERP is the transactional system of record of your operations, bills of material, routings, drawings and documents must become the system of record of design. But none of these elements can afford to be static and as they become more dynamic, all different views must be synchronized.

Jim: There is too much at stake to continue today's "swivel chair" integration where information from PLM is re-entered in ERP. When products are launched the Bill of Material (BOM) and Bill of Process (BOP) need to be transformed for ERP to manage planning, production, and costing. This is a time-consuming and error-prone process. It is also one that automation can help. Ideally the data defining the product should flow directly into downstream systems. The Tech-Clarity ERP-PLM integration frameworks (see diagram) provides a starting point for companies to develop their integration strategy.

Jim: The good news is that integration has become much easier with the introduction of cloud applications and cloud integration infrastructure. As Tech-Clarity's *Integrating Cloud PLM* concludes "Today's modern applications and integration tools make integration much easier than in the past."



Source: Tech-Clarity

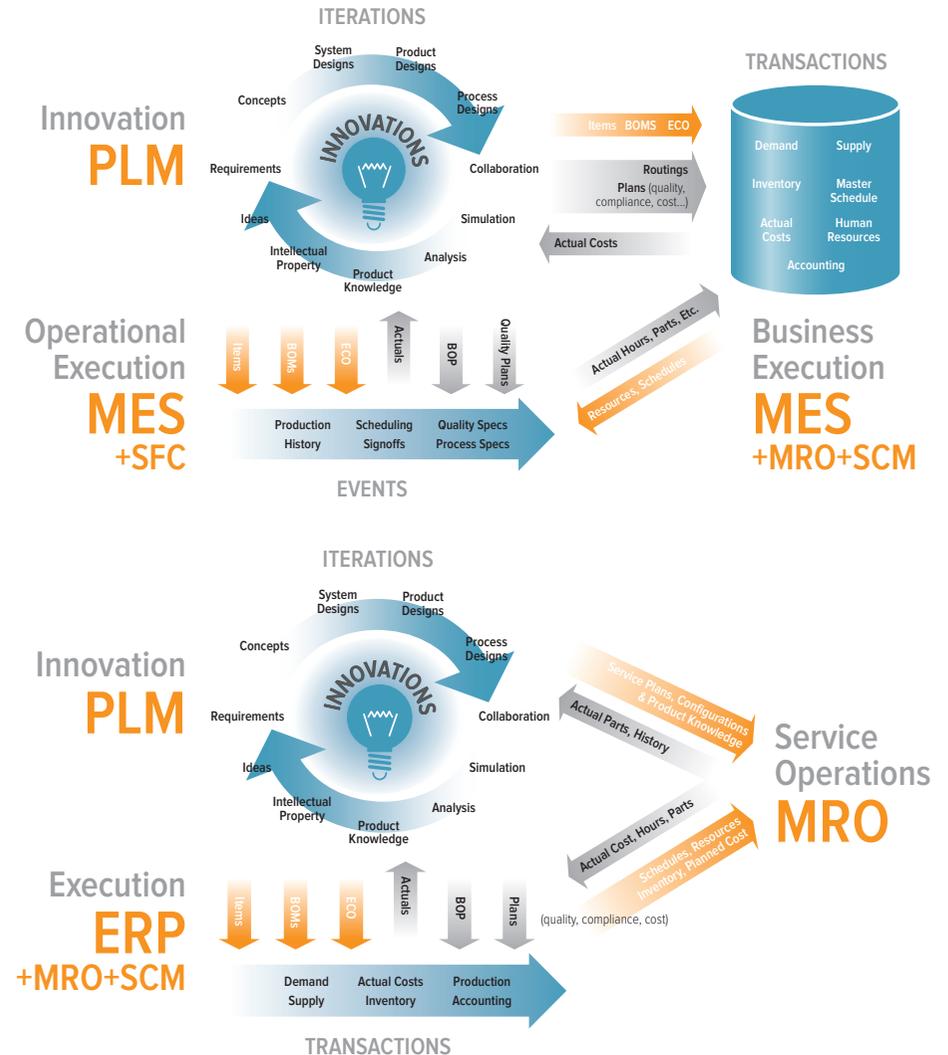
A Guide to Manufacturing Transformation Expanding the View of Integration



As ERP expands, integration is no longer linear. It must be multi-dimensional.

Cindy: The touch points between ERP and PLM used to be quite linear. The Bill of Material (BOM) was really the central focal point, developed in PLM, maintained in ERP along with routing and costs. It was traditionally sourced from ERP where suppliers were managed and maintained. But the footprint of ERP solutions has grown quite steadily over the past two decades to the point where it is often hard to tell where ERP ends and other applications begin. This adds another dimension to the integration between the functions of product lifecycle management and other parts of the organization and these new dimensions carry over into the integration of systems.

Jim: PLM actually touches many systems including CRM, Service Lifecycle Management (SLM), and Manufacturing Execution Systems (MES) in addition to ERP (see related diagrams). Modern integration techniques can blur the lines between these systems. For example a customer issue could be entered into CRM which might kick off a return process in ERP and an engineering change request in PLM. As the change is evaluated, designers have to take into account supply and demand information and other ERP data to make the right decision. Then, a proactive service requirement could be added to SLM in order to correct existing products in the field. Of course each business needs to examine which process improvements and integrations will help them the most, and the touch points might be different based on individual needs or industry. Of course vendor partnerships may provide the most common integration needs. As *Evolving Roles of ERP & PLM* points out there is a lot of value in “Pre-integrated solutions where the vendors have worked out the semantics, data models, and workflows between the systems.”



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Change Management



Who should drive the ECO process?

Jim: Another important area to consider is change management. Clearly there are technical aspects to a change derived from Engineering analysis. But there are also change requests driven by the supply chain for issues such as obsolete parts or part shortages. Change requests can come from anywhere, but they should be validated against product intent and requirements before they are put in place. Much of the information required to evaluate the impact of a change comes from outside of Engineering. ERP has supply and demand information that is critical to the decisions. Making a change requires a collection of information from both ERP and PLM.

Cindy: Regardless of the motivation for the change, the change order needs to be driven by Engineering. While the request for the change might come from other sources – as Jim mentioned, Manufacturing might request a change to improve manufacturability, field personnel might ask to improve serviceability, or a customer might request innovation – pushing it through Engineering provides valuable feedback to the design engineers and encourages collaboration.

Jim: So I think we're really saying the same thing. The bottom line is Engineering needs to drive the process but the process needs to be collaborative. Integration can help streamline the process and make sure people are working from the same information. Otherwise you spend more time arguing about which data is accurate than making a good business decision.

What about costs?

Cindy: Costs belong in ERP. First of all, that is where standards are developed and actual costs are captured and operational teams (e.g. Manufacturing and Procurement) are measured against these standards. And Engineering should also be measured on profitability. Of course costing methods may vary (standard cost, average actual, project-based, etc.) but the more accurate the cost estimates, the more manageable the profit margin. And costs need to account not only for materials but labor and overhead as well.

Jim: Neither ERP nor PLM have all of the information to develop costs. ERP has important historical information and may have quotes from different sources of supply. ERP is built to view costs that include transportation, logistics, and corporate burden rates. ERP understands the intricacies of procurement including volume discounts, lead times, and more. But many estimates say that 80% of cost is locked in at design time. ERP does not have costs for new parts. As parts are being designed, engineers may explore different designs, materials, and more. Costs must be considered and optimized early. ERP is not the place to develop costing for experimental materials or calculate a "should cost" for a new part based on design parameters. This is another example where PLM and ERP should work closely together to play their respective roles.

Cindy: This is a perfect example of why the integration between ERP and design systems must be bi-directional. While designs flow from PLM to ERP, costs must flow from ERP to PLM in order to best assess the cost impact of engineering changes before they hit ERP. Yes, there might be a need for a timely estimate for new materials, but the best answer does not involve the engineers doing an end run. OK, I "buy" that ERP is not the place to develop costs if you are truly experimenting, but you can't force fit an unreasonable "should cost." The better answer is to work collaboratively with Procurement and Manufacturing for initial cost estimates.

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Last Words



We've talked a lot about transformation and the role systems play in supporting the needs of product design and manufacturing. Any last words?



Cindy: There's no stopping it. Manufacturing is undergoing a transformation. The pace of business is accelerating, requiring more and better responsiveness. You either keep up with these changes or you lose any competitive advantage you once had. As Manufacturing becomes more globally competitive, competing on connectivity and collaboration are just as important as price, delivery and quality. But all these require new and better tools that allow people, process and technology to work collaboratively in that transformation. Both ERP and PLM play important roles. Yet most manufacturers are capital-constrained even as they attempt to expand and grow. Technology-enabled, cloud-based solutions can help all businesses, including those that are capital-constrained, to compete in ways that have never been possible before.



Jim: The bar has raised on Manufacturing performance. Streamlining processes and improving collaboration between product developers, the rest of the enterprise, and the supply chain will help manufacturers introduce more innovative products in shorter timeframes leading to growth and increased profitability. PLM and ERP help manufacturers optimize products early, manage complexity, and deliver the right products at the right cost and quality. By integrating product-related processes and data between business systems such as ERP, PLM, CRM, and SLM (and to underlying automation such as MES) companies can achieve agility and operational excellence. Today's enterprise systems are ready for the challenge, and manufacturers can now implement them with much lower effort and risk due to new architectures such as cloud computing. The time is right to act to take advantage of the opportunities created by the manufacturing transformation.



A Guide to Manufacturing Transformation Next Steps ...



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