Planning for All... and Planning for One

As the twin forces of globalization and personalization stretch products into more regions targeting more customers, manufacturers must transform their development processes. Speed and agility in manufacturing planning are now more critical than ever.

By Matthew Sheridan
PLANNING FOR MANUFACTURING REMAINS A CENTRAL challenge in the product development process. The manufacturer’s goal is, and probably always will be, to produce higher-quality products faster and less expensively. Call it production efficiency. This has been a primary focus for practically all manufacturers for the past half-century at least.

Yet, in recent years, most manufacturers have been finding that their leverage from these production-centric product development strategies has begun to diminish. A big reason is that the proven practices of production efficiency have become so commonplace.

Oxford Economics, the global forecasting and quantitative analysis firm, recently surveyed 300 manufacturing executives worldwide about the impact of shifting markets and their organizational priorities as they look to the future. Most of the executives expressed the belief that their companies have already implemented the necessary changes to stay in the game. They have re-examined their basic business models—in manufacturing planning and elsewhere. The products themselves have become more and more sophisticated, with differences. This happens even as products become more and more sophisticated, with embedded software and electronics, and as competitive pressures require manufacturers to be more and more competitive.

Some of the forces have long been evolving; others are just emerging. Individuality, the forces are disruptive; together they are transformational. But, most importantly, these forces point to where manufacturers’ greatest challenges—and greatest opportunities—are likely to come from in the near and not-so-distant future. Manufacturers must reckon with all of these forces if they are to put themselves in position to succeed:

- **Digitization**—replacing analog product and service information with a fully accurate visual representation that can be easily leveraged across the value chain (engineering, factory floor, service)
- **Globalization**—the general shrinking of the world driven by technology that eliminates economic and geographical divisions and opens new markets
- **Regulation**—enforcement of governmental rules, nongovernmental organization policies, and industry standards related to environment, health, safety, and trade
- **Personalization**—efficiently tailoring products and services to accommodate regional and personal preferences
- **Software-intensive products**—integrated systems of hardware and software capable of sophisticated human- and machine-to-machine interactions, diagnostics, and service data capture, with additional value delivered through enhancements
- **Connectivity**—pervasive networks of “things,” often mobile, embedded with sensors, and individually addressable to enable sophisticated monitoring, control, and communication
- **Servitization**—a fundamental business model shift in which products evolve to integrated bundles of services capable of delivering new value continuously throughout the customer service lifecycle

Two of these forces in particular—globalization and personalization—greatly complicate the challenges of manufacturing planning. Manufacturers today must plan production for all customers, everywhere in the world, while also planning production for any single customer, in any specific region. These unprecedented forces, which may seem somewhat in opposition at times, require capabilities in manufacturing process management (MPM) that enforce global standards, yet account for flexibility in local plant production.

**How Regional Needs Add Complexity**

In the practice of MPM, manufacturing planners take in digital product specifications from engineering, consider the capacities of internal plants and external suppliers, and determine how to best produce the product. Planners also take feedback, based on preliminary run-throughs of the manufacturing plan, and share it with engineering to update designs for improved manufacturability. Process information must also be communicated with other production systems—enterprise resource planning and/or manufacturing execution systems—to deliver optimized routings, manufacturing bills of materials (BOMs), and work instructions for supervisors and operators on the plant floor.

Globalization adds layers of complexity to MPM processes. The products themselves need to be highly configurable to meet customers’ distinct needs and preferences in particular locations. Local plants must be able to adapt to these regional production differences. This happens even as products become more and more sophisticated, with embedded software and electronics, and as competitive pressures require manufactur-
This can shrink the time from design to planning to production. Why? Because the manufacturing plan can proceed even as engineering continues to define the product specifications. Then, when an engineering team in a specific region needs to repurpose the product design for their specific market, they can repurpose the manufacturing plan at the same time. The plan and the design have been coordinated to easily update both.

Create a “master” manufacturing plan.
Products intended to be similar, but adaptable from plant to regional plant, still require production consistency. A master plan can ensure shared standards for quality, skills, testing, and other metrics, while also allowing for variations in the local product configuration and production process.

Centralize information to feed ERP systems.
As OEMs continue the trend of global expansion, the number of sites and factories will likely increase. Even for companies that are adopting the reverse “on-shoring” trend of bringing manufacturing home for certain new products, existing remote facilities and plants remain in operation to fulfill ongoing product demand.

To manage these various plants and facilities, companies often institute specific ERP instances. The manufacturing BOM is “passed,” often times manually, to these instances. Once passed, the information becomes disconnected from the original manufacturing plans as well as plans at other locations. Process updates and changes are not necessarily shared across locations. Improvements are not passed to all sites.

Many organizations are reversing this trend, setting up a centralized manufacturing BOM, based on a master that is communicated and traced to each singular ERP instance. This connected approach drives traceability and adherence to manufacturing standards.

With MPM processes optimized and connected both globally and regionally, companies can better leverage engineering information in manufacturing plans. This avoids data duplication. Standardized production processes and resources can be similarly reused and adapted. Work instructions are dynamically generated, requiring less time to create and update.

“The importance of personalization cannot be overstated.”

Cultural anthropologists know that for every societal trend, there is an opposite trend. For example, as some people move outward to suburbs and exurbs, others are electing to repopulate our central cities. While more and more shopping gets done in chain stores and online, the “buy local” movement continues to grow.

Something similar is happening in the manufacturing world. Even as manufacturers extend their products and services globally, they see the concurrent demand to more tightly tailor their offerings to individual customer needs. Personalization of products, then, is not only a regional and local phenomenon; in many cases, it can practically be a matter of one-to-one customization.

The importance of personalization cannot be overstated. Manufacturing leaders today recognize that efficiently producing standardized products is no longer enough to sustain competitive advantage. Yet they also see high risk in the move to mass customization.

In the same Oxford Economics study previously cited, 57 percent of C-level manufacturing executives identified fragmenting customer demands as a major concern. Keeping up requires smart ways to serve these customers. The goal is diversity with scale. And this only starts with product variability for different regions and markets. Customers who have become conditioned by the increasing personalization of
their favorite consumer products are coming to expect it from their industrial products as well. Here are a few examples:

Think of how Nike lets buyers build their own sneakers online.

Nike’s production process reuses standard product designs and information, but in ways that let customers choose the features and finishes that best suit them.

Think of the iPhone.

Users download applications and functions (flashlight, maps, and music) based on personal preferences. It would not be surprising if no two iPhones were alike as each is configured by the individual end-user.

Think of 3D printing.

To date, manufacturers have likely only scratched the surface of their potential in product globalization and personalization. Look at how 3D printing is challenging long-held assumptions about how and where products can be produced. Looking ahead, the best practices in manufacturing planning must prepare for these possibilities as well. Will the final stages of production someday be handled mostly by local dealers? Or, depending on the products, by customers—in their homes or offices—their manufacturing process can come from the customers themselves? It is the customer, not the manufacturer, who completes the product. Yet, the manufacturer must successfully plan for the customer’s central role in this process.

The Manufacturing Plan in a “Just for Me” World

To address the growing need for product personalization, here are a few approaches:

An MPM system that manages the customer’s choices and the logic behind them

Such a system enables planners to configure the bill of materials and corresponding manufacturing BOM right down to the specific steps involved. Planners may even create an overloaded manufacturing BOM, including all options, from which the customized nBOM can be filtered. Information about options and logic can be shared with other systems, such as sales configurators, for efficiencies throughout the supply chain.

Manufacturing plans based on software-driven products

Smart products typically rely more than traditional products on upfront design for manufacturing. Are particular product functions, once delivered only via mechanical systems, now easier to implement, update, and maintain through smart mechatronic alternatives? How much can be saved in manufacturing by converting mechanical features to software and electronic functions? Questions like these drive the increasingly coordinated realms of manufacturing planning and product design.

Consider: The dashboards on Tesla’s electric vehicles have no knobs, dials, or needle gauges—only touch- and voice-activated panels. What quality tests must be implemented to account for both the physical components and the functional results driven by software? MPM planners need access to a full view of the product definition so processes, testing, and skills are aligned to these new design options.

3D printing—as part of the manufacturing planning?

In the envisioned world of do-it-yourself, one-at-a-time production, manufacturers will need to provide geometric files and step-by-step instructions for printing components and assembling products. This will surely take the challenges of design for manufacturing in new directions. There may even be hybrid designs, where the OEM produces and sells only part of a product, while the end-user prints and assembles the rest. Having systems that connect manufacturing plans to customer service information may be another need that manufacturers will have to address. Whatever approach proves right for the particular manufacturer—maybe a mix of all of these approaches or even other approaches that will soon emerge—this much can be assured: Manufacturing planning must optimize for a new, more complex, and increasingly software-driven standard for globalized and personalized products.

Software Drives the Product

In a 2011 piece for The Wall Street Journal, Marc Andreessen put forth that “software is eating the world.” He showed how product after product, in industry after industry, is increasingly driven by embedded software. This new reality requires practically every major manufacturer to count software development among the core competencies they now cultivate. No surprise, really, since the software in smart products is key to enabling manufacturers to meet customer demands for personalized performance worldwide.

Continental AG, a tier-one automotive supplier with over 120,000 global employees, now has more software engineers than mechanical engineers in some departments. They work in cross-discipline collaboration to develop software-intensive components, such as rain-sensitive windshield wipers and window control systems, for automotive OEMs.

Sensors signal software when varying volumes of rain call for windshield wipers to activate. The same sensors and software can also combine to determine when a car’s windows, sunroof, or convertible top should close. Continental must account for these sensors and software at all stages of design and production to ensure the complete system’s proper operation. No longer can just mechanical tests suffice. So Continental’s MPM system must include procedures for sensor and software testing as well.

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Readers who now feel the need to take a deep breath are excused. It isn’t as if the current world of manufacturing planning weren’t demanding enough. The future will simply bring new, different, and bigger-than-ever MPM challenges.

But hasn’t the need to stay ahead of rapid industry change always been the case? Those who act quickly to begin transforming their manufacturing planning processes—in forceful response to the seven market forces—can realize a huge opportunity to create meaningful differentiation in the marketplace. They will increase product and service value for their customers, and build product and service advantage for their companies. Smart investments made now to improve manufacturing planning, with the right manufacturing process management solutions, promise to pay off with a sustainable competitive edge.