

internship programs with local universities and liaison programs to “borrow” talent from leading technology vendors.

New cultures. Manufacturing smart, connected products requires far more coordination across functions and disciplines than traditional manufacturing does. It also involves integrating staff with varied work styles and from more-diverse backgrounds and cultures—which can be challenging. For instance, the “clock speed” of software development is generally much faster than that of traditional manufacturing. HR organizations will have to rethink many aspects of organizational structure, policies, and norms.

New compensation models. Manufacturers will also need new approaches to attracting and motivating talent. Perks like job flexibility, concierge services, sabbaticals, and free time to work on side projects of personal interest are the norm in high-tech firms employing the type of talent manufacturing companies will increasingly require.

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Implications for Organizational Structure

The shifting nature of work throughout the value chain is ushering in a historic organizational transformation of the manufacturing firm. Jeff Immelt, the CEO of General Electric, once said that every industrial company must become a software company. This statement reflects the fact that software is becoming an essential part of products. Beyond this, software firms have already moved in directions

essential to competing in smart, connected products, such as evergreen design, remote upgrading, and product-as-a-service models. (See the sidebar “Lessons from the Software Industry.”)

Yet the transformation of the manufacturing firm will be even bigger than what software companies have undergone. While incorporating software, the cloud, and data analytics, manufacturing firms must continue to design, produce, and support complex physical products.

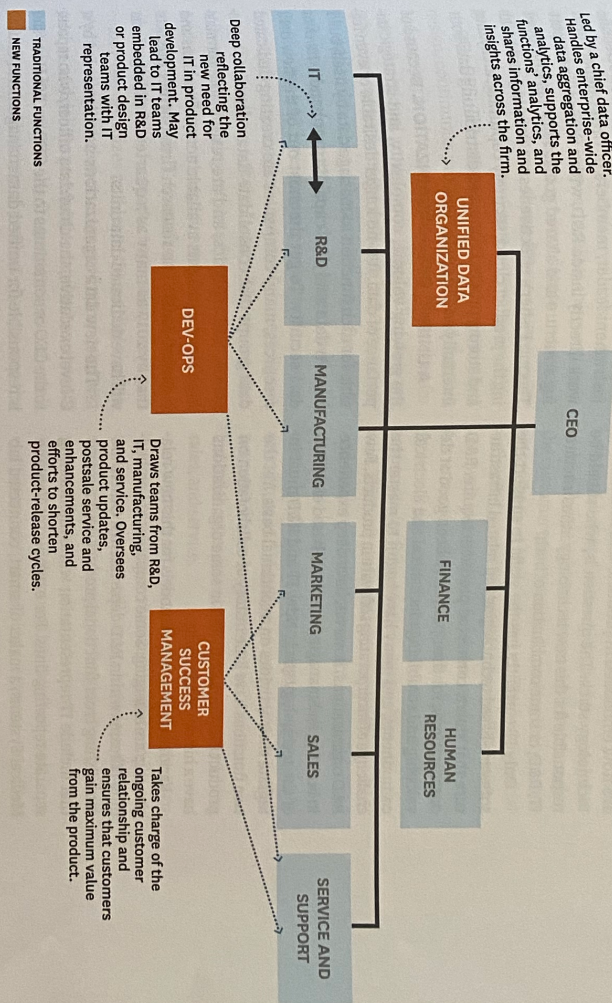
Which aspects of the organizational structure will be affected? As Jay W. Lorsch and Paul R. Lawrence argued in the classic work *Organization and Environment*, every organizational structure must combine two basic elements: differentiation and integration. Dissimilar tasks, such as sales and engineering, need to be “differentiated,” or organized into distinct units. At the same time, the activities of those separate units need to be “integrated” to coordinate and align them. Smart, connected products have a major impact on both differentiation and integration in manufacturing.

In the classic structure, a manufacturing business is divided into functional units, such as R&D, manufacturing, logistics, sales, marketing, after-sale service, finance, and IT. (While there is also a geographic dimension of organizational structure, which adds a layer of complexity, it is less affected by smart, connected products per se.) These functional units enjoy substantial autonomy. Though integration across them is essential, much of it tends to be relatively episodic and tactical. In addition to achieving alignment on the overall strategy and business plan, functions need to coordinate to manage key handoffs in the product life cycle (design to manufacturing, sales to service, and so on) and capture feedback from the field that will improve processes and products (information on defects, customer reactions). Integration across functional units happens largely through the business unit leadership team and through the design of formal processes for product development, supply chain management, order processing, and the like, in which multiple units have roles.

With the emergence of smart, connected products, however, this classic model breaks down. The need to coordinate across product design, cloud operation, service improvement, and customer engagement is continuous and never ends, even after the sale. Periodic handoffs no longer suffice. Intense, ongoing

smart, connected products require functions within manufacturing firms to collaborate in new ways. As a result, firms’ structures are rapidly evolving. A new functional unit focused on data management is starting to appear. Though rare, units focused on ongoing product development and customer success are also beginning to be recognized.

A NEW ORGANIZATIONAL STRUCTURE



coordination becomes necessary across multiple functions, including design, operations, sales, service, and IT. Functional roles overlap and blur. In addition, completely new and critical functions emerge—for instance, to manage all the new data and the new open-ended customer relationships. At the broadest level, the rich data and real-time feedback from smart, connected products challenge the traditional centralized command-and-control model of management in favor of distributed but highly integrated choices and continuous improvement.

On top of this, manufacturers must keep producing and supporting conventional products, and that’s not likely to change—in some cases, for decades. Even in today’s progressive, established manufacturing companies, smart, connected products represent less than half of all products sold. The continued coexistence of the new and the old will complicate organizational structures.

What will the new manufacturing organization look like? Organizational structures are in rapid flux, even among the leading makers of smart, connected products. However, a number of important

shifts are becoming evident. The first is more and deeper collaboration and integration between IT and R&D. Over time those units—and others—may start to merge. In addition, companies are beginning to form three new kinds of units: unified data organizations, development-operations groups (or dev-ops), and customer success management units. (See the exhibit “A New Organizational Structure.”) Meanwhile, product and data security activities are rapidly expanding and now cut across multiple units, though it remains unclear what structure will eventually emerge. Ultimately, virtually every traditional function will also need to be restructured, given the dramatic realignment of tasks and roles taking place.

COLLABORATION BETWEEN IT AND R&D. Traditionally, R&D created products, while IT was primarily concerned with companywide computing infrastructure and managing the software tools the functional groups used, such as computer-aided design, enterprise resource planning, and customer relationship management. With the development of smart, connected products, however, IT must assume a more central role. IT hardware and software