

# The perils of ignoring software development

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Software is a key to market differentiation and value creation for an increasing number of products and services.

As digital technologies relentlessly reshape competition, products and services increasingly depend on software for differentiation and performance. Software is behind smartphones and other interfaces that guide consumer interactions; algorithms orchestrate productivity-boosting process automation; wearable devices loaded with software monitor the health and performance of athletes and patients alike. Despite the mission-critical nature of software, it gets surprisingly little attention in the C-suite. Most often, it is relegated to functional managers, several levels down the organization, who manage teams of programmers.

New research suggests, however, that companies pay a price when they undervalue the strategic importance of producing excellent software. We examined three core measures of software-development performance at 1,300 companies of varying sizes and across all regions of the world.<sup>1</sup>

We found not only stunning differences between the highest- and lowest-performing organizations but also sizable differences between the top and average performers (exhibit). Top-quartile companies developed software upward of three times more productively than companies in the bottom quartile. They had 80 percent fewer residual design defects in their software output. Our research also shows that the companies benefited from a 70 percent shorter time to market for new software products and features. This performance gap means that top companies can speed up the flow of new products and applications at much lower cost and with markedly fewer glitches than other companies can.

## The coming revolution

Such performance leverage will become even more important as the transition from hardware- to software-enabled

products accelerates. Today's shift resembles what occurred in the 1970s, when digital electronics began replacing the mechanical and analog technologies that underlay products from calculators to TV sets. The number of top 100 product and service companies that are software dependent has doubled, to nearly 40 percent, over the last 20 years. Value is shifting rapidly as hardware features are increasingly commoditized and software differentiates high- from low-end products. And ever more miniaturized computing power means that the value of embedded software in products is expected to go on growing.

Already, software enables an estimated 80 percent of automobile innovation, from entertainment to crash-avoidance systems, according to automotive-software expert Manfred Broy (an electric vehicle may have 10 million lines of code, and a typical high-end car can have many times that).<sup>2</sup> Interfaces will become even more sophisticated—and critical—as a growing variety of products, from home appliances to mobile medical devices, are designed around smart screens. As software-enabled customer interactions become the rule, revenues from digitized products and channels are expected to exceed 40 percent in industries such as insurance, retailing, and logistics. The software-led automation of manufacturing and services has generated rising output while reducing costs. And companies with consistently high-performing software experience less operational downtime and develop

products with fewer glitches that mar the consumer experience. In a recent letter to shareholders, General Electric CEO Jeffrey R. Immelt offered a view of where things are headed: “We believe that every industrial company will become a software company.”<sup>3</sup>

### **Raising the profile of software development**

CEOs need to determine whether they have the right organization and capabilities to compete in an environment where software continues to change the game. Asking three questions can help start the process:

**What are the strategic stakes?** CEOs and their top teams should quickly get up to speed on how software could be differentiating or disrupting their current businesses and industries. Scania creates a competitive edge for its trucks through advanced software features that give drivers real-time information on how to optimize fuel use and maximize safety. Semiconductor maker MediaTek invested in software-based reference designs<sup>4</sup> in the wireless chips it produces for smartphone manufacturers. The new offerings upended competition in the high-volume, low-end smartphone industry, leading to a tenfold increase in MediaTek's sales of wireless chips within a single year, as customers benefited from lower development costs, faster times to market, and increased design flexibility.

## Exhibit

## Software-development performance varies significantly across development groups and companies.

Index: average performance = 100

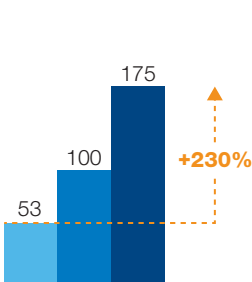
■ Bottom quartile

■ Average

■ Top quartile

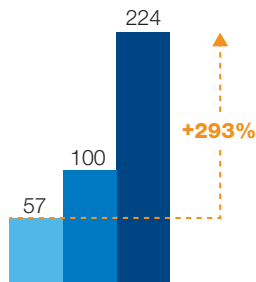
### Productivity

Complexity unit per person-week



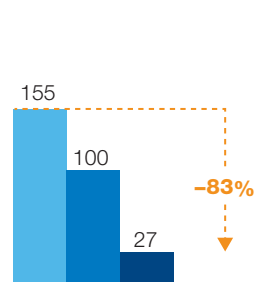
### Development throughput

Complexity unit per week



### Quality

Residual design defects



Source: Numetrics-embedded software project (a McKinsey Solution), October 2013, including data on software-development projects at 1,300 companies across global markets

### Where does our software power reside?

Outside the technology sector, senior software leaders are rarely in the top-management hierarchy. Many companies manage software strategy three to five levels down in the organization, within scattered departments often dedicated to designing and building hardware platforms. Siloed software expertise makes it difficult to assemble a strategic core of software leaders who can think cross-functionally about innovation or productivity.

One path forward is to give a software-development executive a seat at the top-management table. Companies can do so by establishing an office—chief of software development—that reports to the CEO, much as companies have done in recent years with the role of

chief digital officer or chief information-security officer. Such an executive is well positioned to help high-ranking executives understand how the software-development performance of their company stacks up against that of its peers, the risks of substandard processes, and the strategic importance of improving software-development performance by overhauling organizational structures, development methods, and metrics.<sup>5</sup>

**How do we build the required software-development muscle?** In many industries (again, apart from high tech), hardware and mechanical engineers dominate the engineering leadership, so it is difficult to attract the talent needed for cutting-edge software R&D teams. Companies can break through

in two ways. The first is mounting an effort to change the organization, developer by developer: building a software powerhouse organically, from existing internal organizations, while targeting top software companies to get strong contributors, who will become software champions and talent magnets. A second option is acquiring a software company to break into new technology areas and get a higher level of software capability. Walmart followed this approach, acquiring a number of smaller start-ups to strengthen its position in e-commerce as well as social and mobile retailing.

In either approach, companies need to follow through with software-friendly operating models that incorporate agile working methods, flexible hours, and motivational tactics (such as internal competitions) that spur developers to engage with innovative and challenging projects. Unconventional hiring processes (coding contests or testing online gaming skills, for example) may be needed to screen candidates and identify top talent—as some top digital players already do. There’s no escaping the competitiveness of today’s software-talent marketplace, which is particularly challenging for large companies seeking to build their capabilities. As digital technologies continue reshaping markets, though, there’s little alternative. Embracing the rising strategic importance of soft-

ware, and viewing its development as a crucial competitive battlefield, are keys to success for an ever-growing number of companies. ○

<sup>1</sup> During 2013, we examined software-development projects at 1,300 companies (ranging in size from fewer than 50 employees to more than 5,000) around the world. We looked at six development methodologies and used proprietary analytics to assess the complexity of designs.

<sup>2</sup> Robert N. Charette, “This car runs on code,” *IEEE Spectrum*, February 1, 2009, spectrum.ieee.org. See also *Digits*, “Chart: A car has more lines of code than Vista,” blog entry by Brian R. Fitzgerald, *Wall Street Journal*, November 11, 2013, blogs.wsj.com.

<sup>3</sup> Jeffrey R. Immelt, “Letter to shareowners,” *2013 GE Annual Report*, ge.com.

<sup>4</sup> A technical architecture for a system that can speed up customized software development.

<sup>5</sup> Locating diverse software-design teams in the same facility and using analytics to predict quality levels are ways top companies are getting more leverage from advanced design methods and setting ambitious but realistic goals for teams.

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