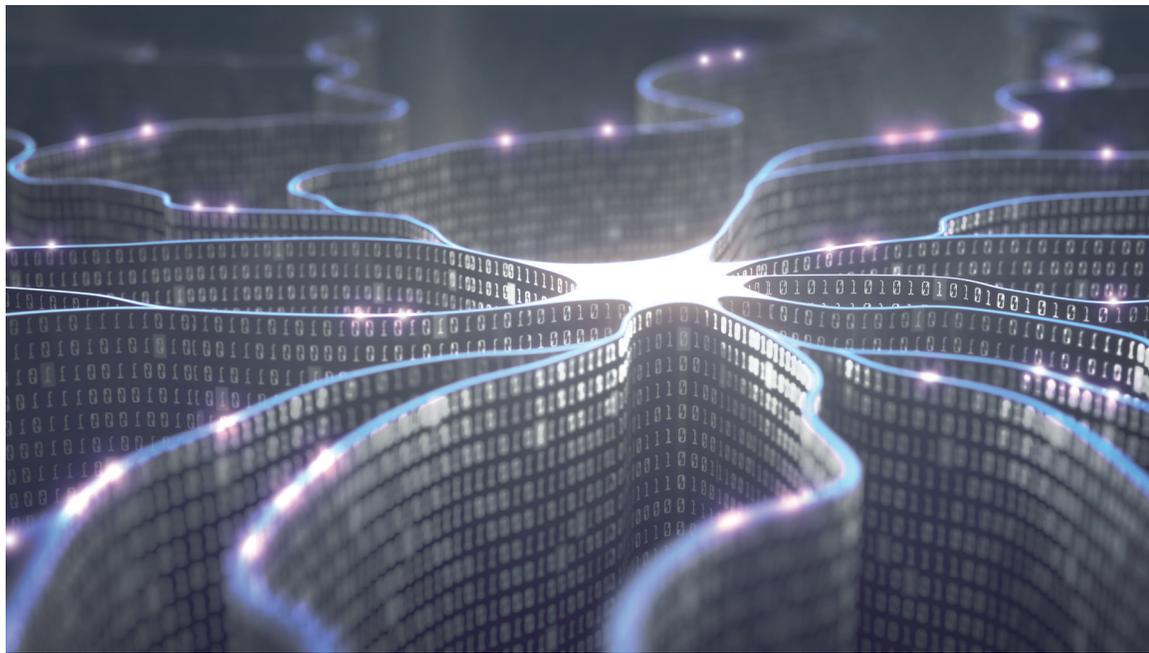


Ops 4.0: Fueling the next 20 percent productivity rise with digital analytics

Operations April 2017



Mercedes Goenaga
Philipp Radtke
Kevin Speicher
Rafael Westinner

Ops 4.0: Fueling the next 20 percent productivity rise with digital analytics

Business needs to raise productivity more than ever. Thanks to innovations in digitization and analytics, four new methodologies can yield the productivity breakthroughs organizations need.

Business is now in the midst of the most significant disruption in decades. This epochal transformation has been driven largely by technological changes—big data and advanced analytics, additive manufacturing, the Internet of Things, robotics, and artificial intelligence—collectively described as the fourth industrial revolution. Arriving at dizzying speed (see sidebar “Lewis Carroll on the pace of change”), its consequences are already evident across sectors: competition is intensifying not just within industries but also between them. Think of Apple assembling an autonomous-vehicle business or Tesla moving into power supply. And then there are the aggressive, agile start-ups, with business models that ignore conventional constraints.

Together, these pressures are both intensifying the long-standing imperative to raise productivity (see sidebar “What is productivity?”) and leaving much less room for error. Yet they also involve novel tools and methods—for example, vastly increased connectivity and the Internet of Things—

with a huge potential for realizing new levels of productivity across the entire value chain. In 2016, about 17.6 billion devices were connected to the Internet. By 2025, that figure will probably jump to about 80 billion, at a rate of 152,000 a minute.

The difficulty, of course, is to take advantage of these technological breakthroughs in ways that lead to comparable performance breakthroughs. This has never been easy to do. In 1987—more than 30 years after businesses started using mainframes—Nobel Prize-winning economist Robert Solow famously noted, “You can see the computer age everywhere but in the productivity statistics.”

Businesses—indeed, societies—cannot afford another 30-year wait for significantly better productivity. They need gains on the order of 20 percent or more, and they need them much sooner. But the problem now, as a generation ago, is that organizations too often overinvest in technology while underinvesting in the human

Lewis Carroll on the pace of change

“Well, in our country,” said Alice, still panting a little, “you’d generally get to somewhere else—if you run very fast for a long time, as we’ve been doing.”

“A slow sort of country!” said the Queen. “Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!”

—Lewis Carroll (Through the Looking-Glass, 1871)

What is productivity?

Productivity can be a slippery concept. Of the several definitions the *Webster's Third New International Dictionary Unabridged* (Merriam-Webster) gives, the one we hear most often in an operations context is “the degree of effectiveness of industrial management in utilizing the facilities for production; *especially*: the effectiveness in utilizing labor and equipment.” This is admirably clear but enforces a narrow perspective on what productivity really implies.

We believe that a broader alternative—“output per unit of productive effort”—gives a better idea of what productivity can encompass. Everything a company does is productive effort that can be measured against output. Productivity therefore includes every aspect of operational excellence, from the generation of an idea for a product through its manufacture, sale, maintenance, and, potentially, dismantling and recycling once it becomes obsolete.

capabilities needed to make it useful. The real lesson from technology leaders is that they apply it judiciously, as part of a broader transformation of the way they do business, starting with their people.

How companies transform themselves depends, to a great extent, on the capabilities they need most. We see four primary structures, which collectively become Operations 4.0 (Exhibit 1).

- **Product driven.** For organizations whose strategic imperative is to design and launch products more effectively, advanced analytics combines with design to value, becoming analytics to value, or AtV.
- **Journey driven.** Many organizations have already seen a dramatic impact from applying lean management’s end-to-end perspective to their customer journeys. Digital technologies and agile processes let organizations make these changes more easily, quickly, and sustainably—and on a greater scale, with a bigger impact—than ever before. Together, the

technologies and processes form EdgeE, or end-to-end digital enablement.

- **Cost and budget driven.** Traditional cost-control measures have often been a blunt instrument at best, but a more sophisticated analysis required too much data and coordination to be practical. Now, sophisticated analytics techniques make zero-based budgeting, or ZBB, more feasible, flexible, and profitable than ever.
- **Manufacturing driven.** To help companies reach new levels of resource productivity and effectiveness, digital manufacturing connects novel and existing data sources with smarter machines and new process technologies.

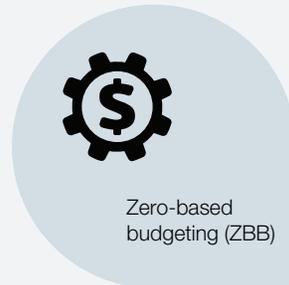
How digital analytics fuels the next 20 percent productivity rise

The fourth industrial revolution’s digital analytics can support a productivity leap because it generates so many distinct opportunities (Exhibit 2). Among the simplest is faster acceleration: changes happen

Exhibit 1 Operations 4.0 encompasses four approaches to achieve productivity breakthroughs.

Cost and budget driven

ZBB data aggregation and analysis
Smart capital-expenditure optimization



Manufacturing driven

Big data-enabled predictive maintenance
Yield, energy, and throughput analytics
Experiential learning for digital manufacturing
Real-time performance management
Digital analytics diagnostics
Supply chain 4.0



Journey driven

End-to-end digitization of processes
Intelligent process automation/robotics



Product driven

Complexity management with big data
Digital analytics-enabled procurement
Advanced cleansheets
Design-based product optimization
R&D productivity through machine learning



Enabled by big data, digital, and analytics

more quickly and organizations can do more things in less time. Higher efficiency means that these changes require fewer resources, while enhanced effectiveness gives the changes greater effect. Increased predictability—achieved, for example, through more accurate forecasting based on unstructured data—lets organizations plan their moves more consistently and respond with greater agility. Finally, deeper engagement at every level yields denser, larger resource networks, which reinforce new behaviors and help build a transformation’s scale.

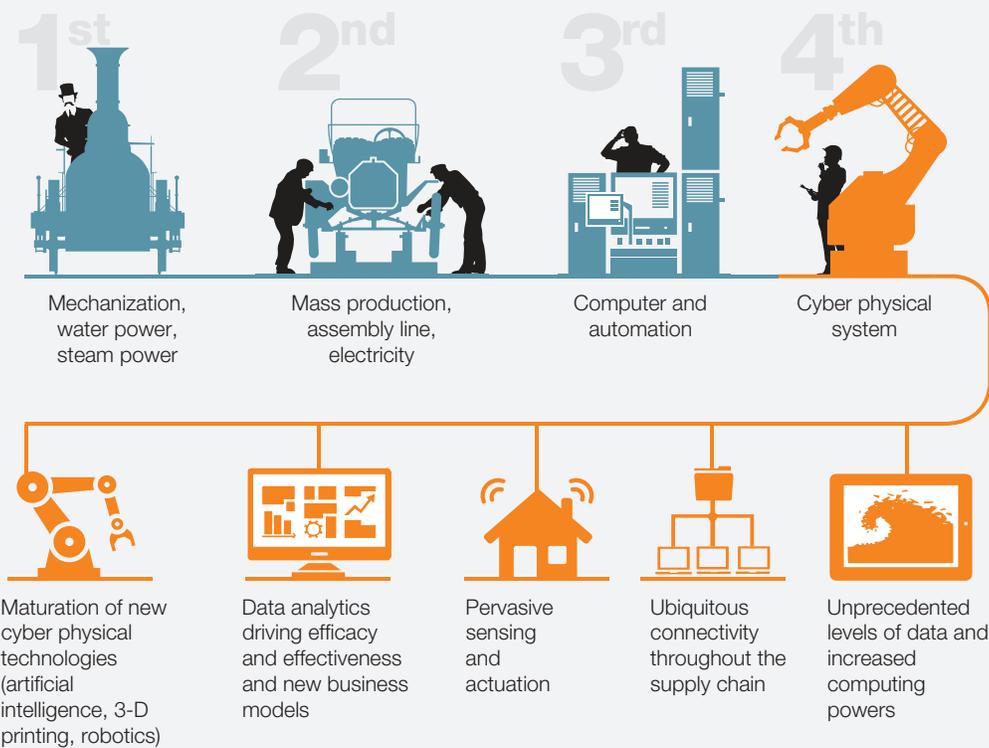
These areas of impact all combine in different ways, depending on an organization’s starting point and

the type of transformation it undertakes. Together, they make it more likely that the changes will keep performance improving year after year.

Product driven: From cost to design to analytics-to-value

Now that essential product functions have become increasingly commoditized, product design has emerged as a crucial source of differentiation. But the best companies have already extracted many obvious sources of advantage from this. The next level of product optimization therefore not only combines the latest design thinking with multiple sources of data but also exploits sophisticated advanced-analytics methodologies

Exhibit 2 In the fourth industrial revolution, digital analytics enables a new level of operational productivity.



Source: *Forbes*; World Economic Forum

to generate insights about potential cost and value improvements. For example, computer-aided design tools linked to vast pools of procurement data, social-media activity, and cost and complexity benchmarks can allow a company to quickly identify designs that maximize profitability while minimizing wasted time and effort.

Such breakthroughs are not just for the consumer sector. One of the world's largest industrial conglomerates brings these ideas to life with products meant not for individuals but for

utilities—whose traditional business model has been upended by renewable (and increasingly customer-generated) energy sources and more sophisticated consumers. The conglomerate's improvement target: within four years, cut delivery lead times by more than half, defend and increase market share, and raise profit margins by about 30 percent.

Complexity management. In utilities, as in much of today's business world, decades of acquisitions have left many companies managing

dozens of systems—especially IT systems—that never get fully integrated. Meanwhile, product proliferation is a constant battle as small variants in specifications generate hundreds of mostly overlapping SKUs. Standard methodologies for combating this complexity not only take vast amounts of time and effort but also may not even identify the right changes. Yet with new digital analytics tools, the conglomerate completed an analysis, in just two weeks instead of several months, that identified specific commonalities the company could use to reduce variations among product families, subsystems, and components.

Analytics and automation. Analytics has made procurement a much more promising target for savings by tapping a previously impractical data source: the procurement and engineering department’s own bills of materials. New tools can upload thousands of records, held around the world in dozens of local languages and part-numbering structures, to find potential commonalities and opportunities to negotiate better pricing. An early step toward artificial intelligence, robotic process automation, can then allow software “robots” to take over tedious processes, such as collating information from disparate systems for complex forms, and thus frees people to focus on work that uses their judgment and experience. Finally, combining multiple data streams—such as on actual spending, product cost structures, sales, and so forth—into a data “lake” allows sophisticated algorithms to engage in optimization dynamically, enabling constant adjustments as conditions change.

Powerful portfolio analysis. Together, techniques such as these can generate a much more detailed analysis of an entire product portfolio. With slight modifications, the conglomerate found it could eliminate 15 to 80 percent of product variants within a category. Already, costs have improved by approximately 30 percent.

Journey driven: Minimizing the middle

First in manufacturing, and later in virtually every sector from banking to government to warehousing, the disciplines collectively known as lean management have enabled organizations to focus ever more tightly on doing only whatever creates value that customers are willing to pay for. New technologies are making these disciplines more critical and powerful than ever. An insurer, for example, reduced its time to market for new products from 18 months to 3, and a government body replaced 50 legacy platforms with a new enterprise-resource-planning system delivered on time and on budget.

Understanding the complete journey. First, technologies are making it easier and faster for organizations of all kinds to see their processes as their customers (or constituents) do—not as a series of departments, but as journeys that have a start, a middle, and an end. The trouble is usually in the middle, as customers struggle with redundant steps, poor communication, and delays because a company’s functions don’t coordinate their activities.

Analytics tools let organizations see exactly how customers move from one point to another, both within and between channels. Those insights can help a company fix really basic issues—such as simplifying online registration forms or reminding customers to bring a government ID when they pick up products in person—that make a big difference in the customer experience.

Speeding the journey with digital. Next, the organization starts thinking about where technology can change processes more fundamentally. The goal is to ensure that digitization fits in with the way today’s customers actually behave rather than the way companies might have built processes in an analog world. Links among back-office systems, for example,

help prepopulate forms for existing customers—or eliminate the forms entirely because the information is already available and robotic process automation has already brought all of it together.

Building agility for the future. Last year’s breakthroughs quickly become this year’s table stakes. To keep up, organizations must behave as tech leaders do, by learning how to refine a moving target: ruthlessly trimming ideas to their “minimum viable product” core, testing and improving them, and then adding new features in the same cycle.

One global financial institution has already transformed customer journeys covering about 80 percent of its interactions with clients. Its culture is changing, as well. Faster decision making and a higher level of comfort with the build–test–revise cycle is helping improve customer experience, while increasing sales conversions in highly competitive product categories by between 4 and 8 percent.

Cost and budget driven: Zero as hero

First developed almost half a century ago, zero-based budgeting has already proved its power by achieving billions of dollars in lasting cost reductions. Several of the most high-profile examples involve companies in the consumer sector, where slow growth called for drastic action. But in other sectors, skepticism remains common; executives fear that these ideas will take up so much time and attention that the organization will be left doing little else—and that as a result, ZBB will become a one-time exercise.

Yet today, some companies are already putting simple ZBB-based digital analytics tools in the hands of virtually every employee with budgetary responsibility. In this way, they are building speed, scale, and sustainability throughout the ZBB process and realizing cost savings of

10 to 25 percent in the first year, with additional savings thereafter.

Making better trade-offs. The proof is in the budgeting. Historically, applying ZBB meant developing detailed templates and collating hundreds of spreadsheets with different data structures and different levels of quality and granularity. Today’s integrated planning platforms build in the required data—including, in some cases, detailed benchmarks stretching back years or even decades. Managers can readily make complex trade-offs that balance policy considerations (say, a preference for nonrefundable tickets) with variables such as fares, average lodging costs, time of year, country, and traveler seniority. The integrated platform makes it easy to iterate individual budget-plan components in any direction: top down (from executives to planners) and vice versa, in a tight cycle. The result is a budget rooted in detailed insights, with clear personal responsibility for each item—an immense cultural change.

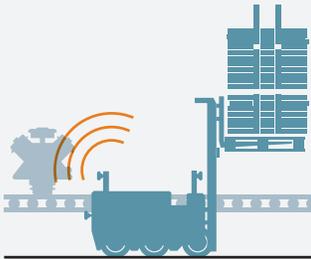
Sustaining a new culture. These improvements can easily keep going year after year. One global company built a center of excellence where ZBB analysts work with cost-category owners to update categories and prices so that each year’s budget update uses the latest optimized data. That human investment helps ensure that the company’s continuous improvement extends to ZBB itself.

Manufacturing driven: More value with less waste

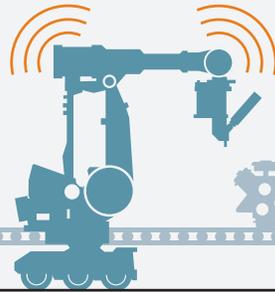
The final major set of opportunities—how companies manufacture goods—arises from the shop floor. Much of the business world’s attention has focused on new manufacturing technologies, such as 3-D printing. What promises to have an even greater impact is the way these innovations combine with less dramatic but equally far-reaching developments, such as the emergence of cheap Internet-linked sensors (a highly pragmatic

Exhibit 3 The factory of the future combines technologies that are available today.

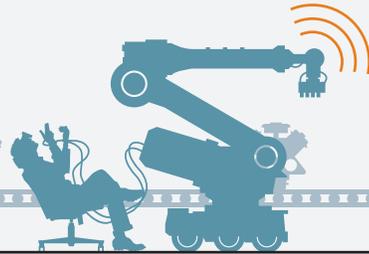
1. Automated in-plant logistics handle inventory and warehousing



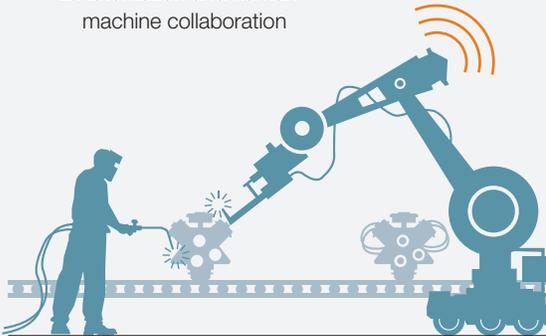
2. Data collection across the supply chain



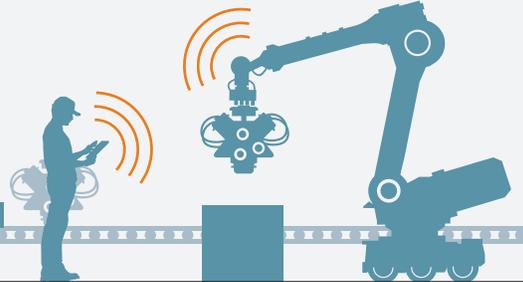
3. Data-driven predictive maintenance



4. Automation and human-machine collaboration



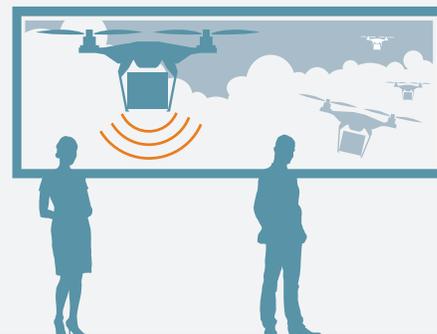
5. Digitized quality system and advanced process controls



6. Digital performance-management system working with enablers and IT infrastructure



7. Smart planning and agile operations deliver products directly to customer using latest technologies and tracking



Source: McKinsey Global Institute analysis

application of the Internet of Things) and user-friendly advanced-analysis tools. Together, these technologies, which give human beings an unprecedented degree of understanding and control over forbiddingly complex processes, have an enormous economic effect.

Finding opportunity—fast. One large high-tech manufacturer illustrates the potential of combining these tactics. Facing heightened competition and eroding margins, the leaders of the company knew that it needed the improvements promised by digital technologies and advanced analytics. The first step was a 48-hour diagnostic: specialists gathered data on the company’s most important production equipment, revealing many gaps in basic manufacturing hygiene. Equipment downtime was unacceptably high, production quality uneven, and overall efficiency much lower than what competitors had achieved. Until the company addressed these issues, adding new technologies would be a waste.

Upgrading the supply chain. Within operations, demand planning and supply-chain logistics have long been at the forefront in applying digital technologies. Now the bar is rising still higher: customers increasingly expect the quality and service breakthroughs that Operations 4.0 technologies make possible. No-touch order processing and real-time, reliable replanning, for example, enable a better customer experience. But they also mean erasing the traditional boundaries between the supply chain, manufacturing, and fulfillment, as 3-D printing reconfigures logistics and advanced robotics support smart warehouses.

Changing people first. But the root causes of the challenges centered not on equipment but on people—especially managing performance. A new digital system now does so all the way from the factory floor to the CEO level, allowing everyone

to see and fix gaps at all times. The company quickly made the equipment about 20 percent more effective, with corresponding increases in quality. Most important, it could then start restructuring about 50 percent of its manufacturing processes to enable technologies such as data-driven predictive maintenance (reducing downtime by an additional 30 percent), a digitized quality system, advanced process controls, robotic in-plant logistics, and automation, as well as human–machine collaboration (Exhibit 3). Throughout the initiative, human capital has been preserved, subject only to natural attrition and redeployment of people to other areas of the company.



Combining people, novel digital technologies, and advanced analytics can yield a new breakthrough in productivity if companies learn to weave them all together. Doing so will require sustained commitment across the entire organization: to coordinate stakeholders with diverging agendas (IT leaders struggling with legacy systems, business heads controlling “their” data), to help people change their mind-sets (from intuition to reasoning, or from easy generalities to hard specifics), and to create entirely new capabilities (in extracting insights from data, and crafting actions from insights). But with the right support, the power of Operations 4.0 becomes far too great for leaders to let it pass by. ■

Mercedes Goenaga is a specialist in McKinsey’s Paris office, **Philipp Radtke** is a senior partner in the Munich office, **Kevin Speicher** is a senior partner in the Chicago office, and **Rafael Westin** is a partner in the Madrid office.

The authors wish to thank Joao Dias, Manuela Mareva-Forsell, Yogesh Malik, Abhishek Shirali, Jan Wüllenweber, and David Zhu for their contributions to this article.

