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Fast and furious

How digital technologies are changing the way we work

By Robert J. Thomas, Alex Kass and Ladan Davarzani

Intelligent processes, enabled by digital technology, create a virtuous cycle of constant improvement fed by continuous feedback. And they are set to reinvent much of the way that businesses are run—in as soon as the next five years.

One way to trace human history is to follow the evolution of work.

First came the artisan, who labored over one pair of shoes at a time, basically an ad hoc process. Next came the Industrial Revolution, with its standardized parts and repeatable processes, vastly improving productivity but at the expense of variety. More recently, the norm has been adaptable processes, in which the same people and equipment can be adapted to provide more variety. But the adaptations often come slowly and are fraught with both process design and execution risk.

Now there is a new game in town: intelligent processes, which have been made possible by the explosion of digital technologies, and which are set to reinvent much of the way that businesses are run—in as soon as the next five years.

Intelligent processes create a virtuous cycle of constant improvement fed by continuous feedback. An intelligent process is studded with sensors that monitor every move and feed those observations into sophisticated models that allow people and software to make real-time adjustments and decisions. Digital technologies make it possible to identify opportunities for adaptation, analyze the trade-offs and then adapt faster and more efficiently.

By introducing the ability to continuously sense internal operations and external market conditions and to analyze variations quickly, digital capabilities allow intelligent processes to identify opportunities for improvement. And once an opportunity for improvement is found, other digital technologies, such as intelligent tools, advanced collaboration technologies and adaptive robotics, execute changes (even relatively complex ones) quickly.

Self-evolution

Intelligent processes make it possible to take advantage of fluctuations in the price of raw materials or spikes in the demand for specific products or services—and then respond in real time or, at a minimum, at a fraction of what it took even adaptable processes to do. By combining the ability to detect and analyze quickly with the ability to respond just as fast, intelligent processes are able to adapt and self-evolve.

Significantly, intelligent processes help companies break free from traditional approaches to the organization of work. In fact, over the next five years, Accenture anticipates that managers will have the opportunity to greatly expand the use of three critical work-design options.

First, they will be able to incorporate experiment-driven *rapid iteration,* in which people and technologies interact in new ways to accelerate the evolution of products. Second, they will be able to take advantage of *recombination*—the ability to shift work between boundaries, especially between humans and machines—to make work processes even more flexible. And finally, they will be able to pursue *edge-centricity* by pushing decision making away from corporate headquarters to the far corners of the enterprise—hastening the circulation of knowledge to the edges of the enterprise, around the perimeter and, ultimately, from the edge back to the core.

Rapid iteration

Fast and flexible. No, that's not the title of a popular Hollywood action movie franchise. Instead, it's at the core of an increasingly popular work-design option. What we call rapid iteration is a fail-fast, experiment-driven approach

that requires managers to rethink many tasks that, in the past, have followed a more predictable pattern.

Large retailers have been among the leaders in this practice, often testing prices and adjusting them rapidly to take account of changing market conditions. Today, some are using their vast amounts of stored data to make and fine-tune offers in real time, catering to "the nonstop customer."

In product development, auto companies and aircraft manufacturers have enthusiastically embraced the use of "nondestructive testing"—for example, computer-based simulations of crashes and other stress conditions—to replace the extraordinarily expensive and labor-intensive practice of building physical prototypes and destroying them to get data.

But iterative automobile design has also evolved rapidly in recent years. The focus is no longer solely on using simulated prototypes to predict a vehicle's durability. Increasingly, carmakers are competing on their engineers' ability to customize software components that are not only functional but also mirror rapidly changing consumer tastes driven by their experience with smartphones and tablet computers.

To this point, crowdsourcing initiatives are quickly changing the tempo and flow of the work done by design engineers. Take, for example, Audi's Virtual Lab. This online network, which automatically evaluated R&D prototypes based on crowdsourced responses from customers, was used to co-create Audi's software-based infotainment system. Customers were able to design their ideal in-car multimedia system based on how much money they were willing to spend, creating a simulated purchasing decision that mimicked what happens at a car dealership.

Ideal products

This is where rapid iteration came into play: Audi's automated system intelligently adapted to consumer responses, using rapid data analysis (machine learning) to continually refine the questions it asked customers based on their demographic profiles, on their real-time responses and on existing virtual prototypes (developed by Audi's R&D team). The system then employed a "closest match analysis" to the prototypes already developed by Audi engineers. Ultimately, the system helped the engineers identify and distinguish between "must-have" and "nice-to-have" features based on customer demand, which then improved the next round of simulated prototyping.

The carmaker's iterative engagement with customers paid off: Audi recently won awards for its infotainment systems, including being named Connected Car of the Year in 2012 and 2013.

Audi's product development teams continue to explore new ways to involve customers in early-stage product development, including refining hardware prototypes. At a Milan furniture show in 2012, the company used thermal-imaging technology to collect data from nearly 1,500 people who tested out its R18 Ultra Chair. The data and customer feedback were fed into a proprietary algorithm and used to guide further iterations of the Ultra Chair. The net effect on design engineering is more data from a wider array of sources knitted together in faster and richer design cycles.

Carmakers aren't the only ones that see the value of rapid iteration. Pharmaceutical companies have turned to "combinatorial chemistry"—an iterative process of drug discovery that quickly synthesizes compounds and then tests and refines the drugs based on customer data. Pfizer, for instance, is investing heavily in combinatorial chemistry as part of its effort to develop medicines for people with neurological disorders, such as Alzheimer's and epilepsy.

Retail banks, public-sector service agencies and educational institutions are all experimenting with rapid iteration in an effort to better align themselves with customer needs, drive costs out of their development processes and gather valuable data that can accelerate their own evolution.

Process recombination

How do you feel about managing robots? The prospect isn't as far-fetched as it sounds and could be coming soon to a job near you, thanks to process recombination—reallocating work processes between people and intelligent tools or even robots. In other words, "teaming with machines" may become the norm.

Robotic devices have been transforming physical work since the 1960s. But only in recent years have robots moved beyond simple replication of human activity (such as welding or steadily placing microscopic parts) to include intensive interaction with—and learning from—human beings. The next five years promise dramatic changes in how work is designed to capture even more of their potential.

Advances in machine vision and software controls for robots are behind two approaches to work design that are growing in popularity and impact. The first is relatively familiar: Humans use remote control robots to "project" themselves into toxic or dangerous situations—bomb disposal, for example. Increasingly, another sort of guided robot is showing up in medical and even educational applications. With telerobotics, doctors can "visit" patients by maneuvering a robot equipped with a camera and video screen through hospital corridors. Homebound sick children can still attend classes through similar devices.

The intelligent warehouse

The second approach is more novel: Small, flexible robots interact with human workers by sensing and adapting to their shared environment in real time. This requires a more intensive exchange of information between people and machines. Sound too sci-fi for you? It's simpler than that. Consider, for example, what's behind your ability to receive mixed packages of books, clothes and vitamins from Amazon.com so cheaply and rapidly.

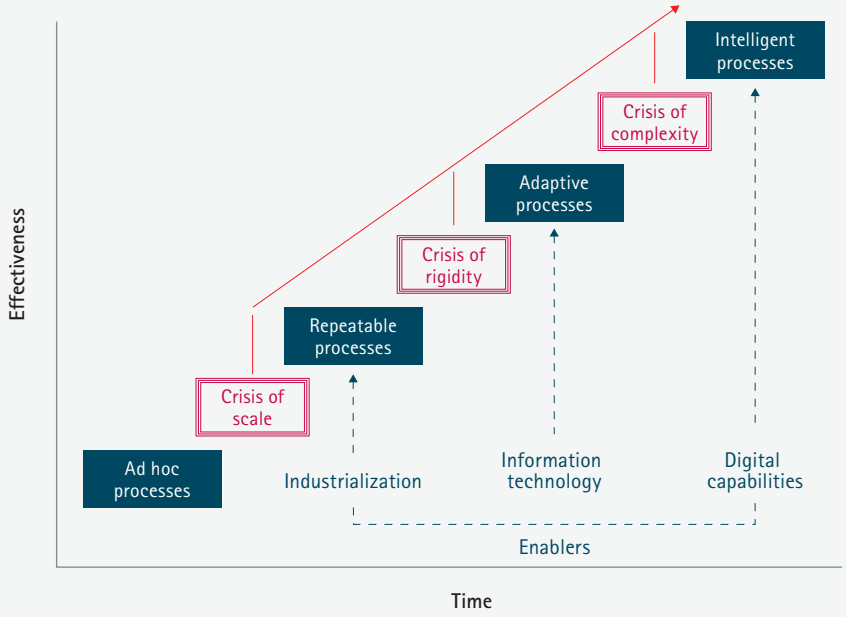
In 2012, Amazon, looking to overhaul its vast distribution facilities, acquired robot maker Kiva Systems for $775 million. For some observers, the high price and Kiva's low profile made this a head-scratching decision. But Kiva's robots have allowed Amazon to reshape a work process that had been arduous for humans alone: unpacking goods, storing them, "picking" them to ship for individual orders and then bundling them into boxes for actual shipping. Taking care of these tasks, a warehouse worker can walk between seven and 15 miles per shift.

Here's where the robots come in: A central computer system controls an army of robots that do all the heavy lifting of retrieving and bringing the stock to a workstation, where a "pick worker" (a person, not a robot) puts the correct item into a box. The design increases the speed and accuracy of order fulfillment, and frees up some workers to focus on process improvement for customers.

Warehouse operations benefit from this intelligent process, as software commands are continuously improved. Kiva's robots are designed to interact autonomously in the warehouse environment, traveling the most efficient path and even knowing when to recharge themselves. The contributions of mobile, flexible robots, at Amazon and elsewhere, are only likely to increase over time.

The path to intelligent processes

The evolution from ad hoc to intelligent processes is not unlike the way experts in everything from chess to basketball develop mastery: from a hit-or-miss beginning, to the repetition of basic moves that lead to a greater sense of mastery, to the variations based on having absorbed the basic moves, to developing the ability to improvise and actively experiment—and, finally, to creating breakthrough innovation.



Source: Accenture analysis

Swiss robotics maker ABB, in response to customer input, developed the ABB Dual Arm robot (formerly known as FRIDA, for "Friendly Robot for Industrial Dual-Arm"). A team from MIT created an algorithm for this concept robot, which would enable it to learn an individual's preference for a certain task and then adapt so that it could help complete the task. As a test case, the researchers looked at spar assembly, the process of building the main structural element of an aircraft's wing; in the future, the Dual Arm (which is not a commercial product as of this writing) may be programmed to help with spar assembly.

Boston-based Rethink Robotics has gone even further. Its next-generation robot, the Baxter, has a variety of sensors that effectively allows it to see with its hands. What's more, it not only interacts with humans—it can learn from them. If Baxter is shown part of a specific task, the robot can figure out how to perform the rest of that task.

Such human-robot collaboration is just the beginning. When humans and robots have time to learn from one another, the results get better. A recent study on human-robot cross-training—in which a human and a robot perform a task together but frequently switch roles—found that productivity improved in both humans and robots when each side learned how the other works. Rodney Brooks, cofounder of iRobot—maker of robots for everything from military operations to the Roomba vacuum cleaner—suggests that robots have huge potential to revitalize and

sustain small manufacturers. This can be seen in Rethink Robotics' Baxter, which can be up-and-running in an hour—a profound improvement over the 18 months it can take to integrate an older industrial robot. Sounds pretty manageable.

Edge-centricity

Centralized corporate managers now command terabytes of data. As masters of the data, they should control decision making—right?

Well, yes, up to a point. But technology that gathers localized data can empower local decision making in a process we call edge-centricity. With edge-centricity, information and decision-making authority are pushed out to the most customer-facing points in the organization, where the information can be put to the best practical use.

A case in point is convenience grocer 7-Eleven. The company's retail information system—a technology that collects data from point-of-sale terminals and transmits it in real time to a data repository—has brought about a reimagined work process of inventory management on a store-by-store basis. By embracing an edge-centric mindset, the company has given local managers considerable leeway in deciding what to stock—shifting crucial responsibilities from senior executives to store managers in thousands of locations.

Using analytics software, the system sifts the data for clues about customer demand, pricing and possible product innovations. Managers receive daily, weekly and monthly sales figures. For fresh-food items, managers base their daily orders on that day's sales from the previous week, taking into account other factors.

Take, for example, one simple but unusual key to the retail system's value: Since retail sales depend on the weather, the company provides weather forecasts to help managers gauge demand. As, say, a hurricane develops, 7-Eleven managers are able to assess conditions and adjust inventories to meet changing demand.

Localizing responsibility

Humans remain very much in the loop. In fact, through this technology, managers and employees are now operating in analytical roles—monitoring daily activity in an effort to harness and capitalize on data as it surfaces. They are also responsible for noticing and documenting such variations as shifts in the weather, local or neighborhood social events, political demonstrations and the like.

The process pushes responsibilities to those who truly understand the clientele, using technology that relays crucial information at a rapid pace. In the past, it was nearly impossible for a convenience chain to operate with a localized mindset, yet digital innovations have enabled 7-Eleven to return to its initial formula for success—pinpointing local consumer preferences through groundwork instead of taking a one-size-fits-all approach.

The benefits of edge-centric work design aren't limited to improving consumer choices. Bill Ruh, vice president at General Electric Co.'s global software and analytics center, told us how the company is building edge-centricity into industrial operations. For example, power plant operators need to know immediately if they can ramp up turbines during times of peak demand without causing breakdowns or damaging the machinery. Right now, they have to get someone to model the situation for them—and that can take days.

Similarly, GE Transportation is designing technology to improve railroad operations. Using sensors to track some 250 different variables, operators can constantly monitor equipment, determine schedules and plan for locomotive servicing. This technology also helps push decision making to the edge. Train operators can work in close contact with a help desk to monitor changes and make quick decisions about routes, schedules and maintenance.

Choose wisely

What are the major implications of intelligent processes and the attendant work-design options for the skills of managers and workers?

First, managers and workers alike need to adopt an experimental mindset and skills. A firehose of data won't put out a fire if managers don't know how to direct it. Managers and workers will need to get more comfortable using data to design experiments that lead to meaningful results.

They will also have to live by rules that appear exotic now—along the lines of Facebook's admonitions to "move fast and break things" and "done is better than perfect."

They will need to reward experimentation and foster a culture that encourages resilience in the face of inevitable failures. Companies have a steep learning curve ahead of them.

Second, managers will have to recognize that their real value-added contribution will increasingly take the form of judgment rather than knowledge creation. Knowledge work won't disappear completely. But much of what is currently referred to as knowledge work—the formulation of plans, completion of forms and coordination of data files—will soon be done by software guided by algorithms. What remains is judgment work: balancing opposing views and stakes, crafting a plan of action and making decisions. But judgment requires insight drawn from experience, and experience often involves a form of experimentation.

Third, managers and professionals (whether they are in engineering, medicine, marketing, business strategy or operations) will need to get accustomed to taking advice from machines. No one disputes the value of contextual knowledge and human judgment, but it is a limited perspective—being able to see only what's out your own window—that has most often prevented managers from seeing and exploiting opportunities for great gain.

Finally, managers need to understand that the pursuit of intelligent processes is a choice. They can choose conventional approaches, but if they do, they shouldn't expect the powerful results that can come from intelligent processes. Capturing the benefits of new technology will not be automatic.

Leaders—in business as well as in operations—are going to have to prepare their organizations by investing in new skills and by thinking hard about how they want to restructure the way the company works. That means they will have to become students of technology, not just passive observers, and advocates for change, not just consumers of tools and software. This may bring confusion and uncertainty for business leaders who are not prepared to change. But for those who are ready to adapt, it is going to be a very exciting next few years. ■

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For further reading

"Serving the nonstop customer," *Outlook* 2012, No. 3: http://www.accenture.com/us-en/outlook/Pages/outlook-journal-2012-serving-the-nonstop-customer-marketing.aspx

"Strategy at the edge," *Outlook* 2011, No. 2: http://www.accenture.com/us-en/outlook/Pages/outlook-journal-2011-strategy-at-the-edge.aspx

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