When Toyota met e-commerce:
Lean at Amazon

Marc Onetto

Amazon's former head of global operations explains why the company was a natural place to apply lean principles, how they've worked in practice, and where the future could lead.

The spirit of lean management was already at Amazon when I arrived in 2007. Since the day he created Amazon, Jeff Bezos has been totally customer-centric. He knew that customers would not pay for waste—and that focus on waste prevention is a fundamental concept of lean. The company's information technology was always very good at understanding what the customer wanted and passing the right signal down. For example, the selection of the transportation method for a given package is driven, first, by the promised delivery date to the customer. Lower-cost options enter the equation only if they provide an equal probability of on-time delivery. That's basically a lean principle.

As a technology company, Amazon initially had the belief that most issues could be resolved with technology, so it was not systematically engaging frontline workers in a process of continuous improvement. Part of lean is the strong engagement of the front line—with the *gemba*[1] workers—on continuous improvement. Amazon has more people working in the fulfillment centers and customer-service centers than it does computer-science engineers. We needed the engagement of all these people to succeed, since they are the ones who are actually receiving, stowing, picking, packing, and sending packages or responding to customers by phone, chat, or e-mail.

Earlier in Amazon's development, the company had been trying to automate almost everything in a fulfillment center. The automation was designed for books but did not work for new types of goods, such as shoes, as Amazon expanded its selection. When the shoebox reached the flip mechanism in the automated machine that was supposed to collect the shoes and bring them to the packing line, they went flying out of the box. As a consequence, we were limited to certain types of goods in the automated warehouses.

Given the business evolution of Amazon from a bookstore to the store for everything, we had to reinvent automation, following the lean principle of "autonomation": keep the humans for high-value, complex work and use machines to support those tasks. Humans are extremely creative and flexible. The challenge of course is that sometimes they are tired or angry, and they make mistakes. From a Six Sigma perspective, all humans are considered to be at about a Three Sigma level, meaning that they perform a task with about 93 percent accuracy and 7 percent defects. Autonomation helps human beings perform tasks in a defect-free and safe way by only automating the basic, repetitive, low-value steps in a process. The result is the best of both worlds: a very flexible human being assisted by a machine that brings the process up from Three Sigma to Six Sigma.

Another major dimension of the deployment of lean was the enforcement of "standard work." The problem at many companies, including Amazon, is that workers' assigned tasks are very vague; it's up to the worker to figure things out. So when we started to consider improving our workers' performance, we had to take a detailed look at their assigned tasks. We quickly realized that what was happening in reality was quite different from what was written down—and it was riddled with abnormalities. So we set a very well-defined standard process, tracked all abnormalities, and assigned *kaizen* teams to eliminate them.[2]

I saw this directly when I worked on the stow line in one of the fulfillment centers. Each worker on that line has a trolley full of products and a scanner. The job is to stow the products on the shelves and, at the same time, to scan each item and the corresponding shelf number so the computer knows where the product is located. The

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[2] Standard work combines the elements of a job into the most effective sequence, without waste, to achieve the most efficient level of production.

standard work-productivity target was 20 minutes per trolley. But when I started to scan products, I realized that I had to scan some things four times before the scanner recognized them. So instead of 20 minutes per trolley, it took me 45. I looked incompetent; I couldn't meet the target. But in fact I was affected by an abnormality: the bad performance of the scanner, which I learned later was due to a low level of charge in its battery.

At the end of the day we analyzed all the abnormalities reported by the workers. And in my case we looked for the root cause of the scanner issue. How many scans could be completed during the life of the scanner battery? Did we have a process to check and reload the scanner batteries? Frontline managers didn't have any of that information, so there were several hours of low productivity at the end of every scanner's battery charge. That root-cause analysis helped us put a whole process in place to load and monitor our scanners. Now workers will never miss productivity targets because their scanner batteries are low.

Kaizen in the fulfillment center

Kaizen[3] and the whole process of continuous improvement was, and continues to be, a powerful tool at Amazon. That's partly because for a long time Jeff Bezos has had all of senior management work in customer service at least one day a year. This allowed executives to see events on the front line, to understand the problems that came up, and to help find solutions.

Each *kaizen* is a very simple thing, but the accumulation of *kaizens* makes an enormous difference. On one of Bezos's days on the front line with me, he was staffed in Receiving, which is where all of the defects that come from the ordering process and the delivering process arrive, and you have to deal with all sorts of problems. At the

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[3] *Kaizen* is the philosophy of continually improving the products, processes, and activities of a business to meet or exceed changing customer requirements and the organization's standards in an effective and efficient way. Continuous improvement focuses on the elimination of waste or non-value-added activities throughout the organization.

[4] Fulfillment by Amazon is an option Amazon offers to its merchants, which can send the goods they are selling on Amazon to its fulfillment centers, so that the merchant's goods are shipped alongside Amazon goods.

time, Amazon had just started its Fulfillment by Amazon business.[4] Some of the merchants were not very disciplined, so they were sending products that were not labeled or packed properly.

Bezos opened a box of shampoo and all of the bottles were broken. They spilled all over him and he nearly cut himself. No customer is going to buy shampoo if the bottle is broken, and we can't risk the health of the worker opening the package. So we agreed that we had to implement a "three strikes" packing process for merchants using our fulfillment services: the first time there is a problem we explain the packing rules, the second time we give the merchants a warning,

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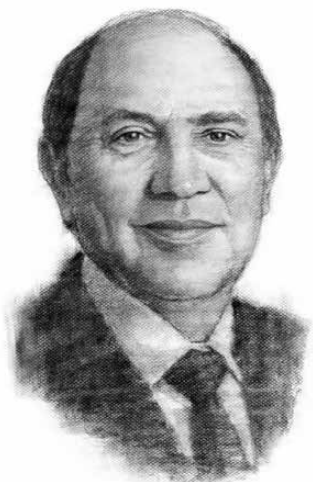
Vital statistics
Born September 3, 1950, in Paris, France

Married, with 2 children

Education
Graduated with an MS in engineering in 1973 from École Centrale de Lyon and with an MBA in industrial administration in 1975 from Carnegie Mellon University's Tepper School of Business

Career highlights
Amazon.com (2006–13)

Senior vice president of worldwide operations and customer service

Solectron, now Flextronics International (2003–06)

Executive vice president of worldwide operations

GE (1988–2003)

Corporate vice president of European operations (2002–03)

GE Medical Systems, now GE Healthcare (1988–2002)

   Vice president and general manager, Global manufacturing and supply chain (1998–2002)

   General manager, Global quality (1997–98)

   General manager, Global tubes and detectors (1993–97)

   General manager, Europe services (1989–92)

Fast facts
Awarded the title of Chevalier de l'Ordre National du Mérite

Named "2002 French-American Executive of the Year" by Chicago's French-American Chamber of Commerce

Serves on the board of advisers for Carnegie Mellon University's Tepper School of Business

and the third time we end their relationship as merchants with Amazon. That was one of the most memorable *kaizens* for me.

We also used *kaizen* at the workstation level to reach new productivity objectives for stowing products. Our goal has always been to stow products within a certain time period and with a certain number of frontline staff, because stowing accounts for about 20 percent of the costs in our fulfillment centers.

The challenge was that the productivity of our carts was very unpredictable: stowing a small book does not take the same time as stowing a computer screen. We spent time on the front line recording the time to stow different products, and we decided there were three types of carts. We defined products for each type and the time to stow those products. We then tested that idea and revised the process. We used *kaizen* to improve the standard work by reducing stowing times, so we solved things bottom-up on the front line to achieve the top-down goals for productivity.

Our ideal *kaizen* teams are a combination of frontline workers, engineers, and a few executives who are going to ask questions and have no preconceived ideas. You put these people together and you say, "Here's a problem; we're going to improve it." Then you raise the bar on improvement. The *kaizen* team should be judged on results that will be meaningful for the company in the long term. You have to ask people to use their brains and their imaginations to solve problems.

Pulling the *andon* cord

Soon after I started at Amazon, I discussed implementing the *andon*-cord[5] principle in customer service. Bezos was enthusiastic about it right away and we implemented it in about six months. The process begins when a service agent gets a phone call from a customer explaining that there is a problem with the product he or she has just received from us. If it's a repetitive defect, we empower the customer-service agent to "stop the line," which means taking the product off

[5] The *andon* cord is a Toyota innovation now common in many assembly environments. Front-line workers are empowered to address quality or other problems by stopping production.

the website until we fix the defect. The objective is to start the line again with the defect resolved. We created an entire background process to identify, track, and resolve these defects.

The *andon* cord has had an amazing impact; it eliminates tens of thousands of defects per year. The other wonderful thing is that the *andon* cord has empowered frontline workers. The authority to stop the line is an enormous proof of trust for customer-service agents, who usually have no real authority to help irate customers over the telephone. With the cord, the agents have been able to tell customers that the product has been placed in the lab for quality problems until the defect can be resolved. At the same time, they offer customers a new product or reimburse them. Customers can see products pulled for quality issues on the website in real time. This has created incredible energy and motivated our frontline people to do great work for our customers. Our frontline people's assessments are almost always correct: 98 percent of the time, the *andon* cord is pulled for a real defect—proof, if it were needed, that when you set up a good process, you can trust people on the front line to use it well.

Next frontiers

Perhaps the biggest challenge I see is the application of lean-management principles to software creation, which is highly complex, with numerous opportunities for defects. Software engineers have not yet been able to stop the line and detect defects in real time during development. The only real testing happens once the software is completed, with the customer as a beta tester. To me, this is unacceptable; we would never do that with a washing machine. We would not ask customers to tell us when the washer leaks or what's wrong with it once it has arrived at their homes. I've tried to address the problem, and some of Amazon's computer-science engineers have looked at it, but it is still one of the biggest challenges for lean.

On the other hand, I'm extremely excited about 3-D printing. I don't completely know what it means on a larger scale. Right now, Amazon is selling 3-D printers, but to my knowledge it has not yet expanded to actual products on demand. Perhaps some manufacturers are beginning to distribute 3-D printed products. It's not science fiction anymore, but it is still experimental.

It's fascinating because it's the concept of print on demand extended to absolutely any product. Today, in some fulfillment centers, there is printing equipment that allows Amazon to print and ship a book within four hours of a customer order for it. 3-D printing is just an extension of this concept to all sorts of goods other than books. The idea of making a product for the customer at the time the customer actually orders it is fascinating because that's what the creators of lean always dreamed about. It's the ultimate just in time. ○

Marc Onetto, a senior consultant at Amazon.com, was the company's senior vice president of worldwide operations and customer service from 2006 until 2013. Previously, he had been head of operations at GE Medical Systems, where he pioneered various lean initiatives. This commentary is adapted from an interview with **Allen Webb,** editor in chief of *McKinsey Quarterly*, who is based in McKinsey's Seattle office.