Big data has the potential to revolutionize management. Simply put, because of big data, managers can measure and hence know radically more about their businesses and directly translate that knowledge into improved decision making and performance. Of course, companies such as Google and Amazon are already doing this. After all, we expect companies that were born digital to accomplish things that business executives could only dream of a generation ago. But in fact the use of big data has the potential to transform traditional businesses as well.

We’ve seen big data used in supply chain management to understand why a carmaker’s defect rates in the field suddenly increased, in customer service to continually scan and intervene in the health care practices of millions of people, in planning and forecasting to better anticipate online sales on the basis of a data set of product characteristics, and so on.

Here’s how two companies, both far from being Silicon Valley upstarts, used new flows of information to radically improve performance.

Case #1: Using Big Data to Improve Predictions
Minutes matter in airports. So does accurate information about flight arrival times; if a plane lands before the ground staff is ready for it, the passengers and crew are effectively trapped, and if it shows up later than expected, the staff sits idle, driving up costs.

So when a major U.S. airline learned from an internal study that about 10 percent of the flights into its major hub had at least a 10-minute gap between the estimated time of arrival and the actual arrival time — and 30 percent had a gap of at least five minutes — it decided to take action.

At the time the airline was relying on the aviation industry’s long-standing practice of using the ETAs provided by pilots. The pilots made these estimates during their final approaches to the airport, when they had many other demands on their time and attention. In search of a better solution, the airline turned to PASSUR Aerospace, a provider of decision-support technologies for the aviation industry.

In 2001 PASSUR began offering its own arrival estimates as a service called RightETA. It calculated these times by combining publicly available data about weather, flight schedules, and other factors with proprietary data the company itself collected, including feeds from a network of passive radar stations it had installed near airports to gather data about every plane in the local sky.

PASSUR started with just a few of these installations, but by 2012 it had more than 155. Every 4.6 seconds it collects a wide range of information about every plane that it “sees.” This yields a huge and constant flood of digital data. What’s more, the company keeps all the data it has gathered over time, so it has an immense body of multidimensional information spanning more than a decade. RightETA essentially works by asking itself, “What happened all the previous times a plane approached this airport under these conditions? When did it actually land?”

After switching to RightETA, the airline virtually eliminated gaps between estimated and actual arrival times. PASSUR believes that enabling an airline to know when its planes are going to land and plan accordingly is worth several million dollars a year at each airport. It’s a simple formula: using big data leads to better predictions, and better predictions yield better decisions.

Case #2: Using Big Data to Drive Sales
A couple of years ago, Sears Holdings came to the conclusion that it needed to generate greater value from the huge amounts of customer, product, and promotion data it collected from its Sears, Craftsman, and Lands’ End brands. Obviously, it would be valuable to combine and make use of all this data to tailor promotions and other offerings to customers and to personalize the offers to take advantage of local conditions.

Valuable but difficult: Sears required about eight weeks to generate personalized promotions, at which point many of them were no longer optimal for the company. It took so long mainly because the data required for these large-scale analyses was both voluminous and highly fragmented — housed in many databases and “data warehouses” maintained by the various brands.

In search of a faster, cheaper way, Sears Holdings turned to the technologies and practices of big data. As one of its first steps, it set up a Hadoop cluster. This is simply a group of inexpensive commodity servers with activities that are coordinated by an emerging software framework called Hadoop (named after a toy elephant in the household of Doug Cutting, one of its developers).

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ing it so that it can be analyzed. This change allowed the company to be much faster and more precise with its promotions.

According to the company’s CTO, Phil Shelley, the time needed to generate a comprehensive set of promotions dropped from eight weeks to one and is still dropping. And these promotions are of higher quality, because they’re more timely, more granular, and more personalized. Sears’s Hadoop cluster stores and processes several petabytes of data at a fraction of the cost of a comparable standard data warehouse.

These aren’t just a few flashy examples. We believe there is a more fundamental transformation of the economy happening. We’ve become convinced that almost no sphere of business activity will remain untouched by this movement.

Without question, many barriers to success remain. There are too few data scientists to go around. The technologies are new and in some cases exotic. It’s too easy to mistake correlation for causation and to find misleading patterns in the data. The cultural challenges are enormous and, of course, privacy concerns are only going to become more significant. But the underlying trends, both in the technology and in the business payoff, are unmistakable.

The evidence is clear: data-driven decisions tend to be better decisions. In sector after sector, companies that embrace this fact will pull away from their rivals. We can’t say that all the winners will be harnessing big data to transform decision making. But the data tells us that’s the surest bet.

This blog post was excerpted from the authors’ upcoming article “Big Data: The Management Revolution,” which will appear in the October issue of *Harvard Business Review.*

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Great synthesis of the biggest benefits to using big data. It’s true; data has the potential to drive informed, real-time, and accurate communications. —GaryZ
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