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How to utilize cloud computing, big data, and crowdsourcing for an agile enterprise

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a cloud report

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The world is undergoing unprecedented change with political instability, economic turmoil, technological shifts, globalization, and the demands of a new generation of workers. Every organization, regardless of industry, must continually reassess what it does in order to survive and prosper. This revolution will have profound implications, and all organizations need to consider how the cloud and big data impact their industry.

Rather than be drowned by the feeling of impending doom, however, organizations should look to cloud computing, the promise of big data, and new approaches for research and development such as crowdfunding to remain competitive, increase efficiency, and generate new business.

In times of change, opportunities for disruption abound. Using these new technologies as well as embracing a culture of agility will help ameliorate the risk of disruption for existing businesses and give new organizations opportunities to prove to be a disruptor in the marketplace.

Key highlights in the report include:

- Several technologies and macro trends threaten traditional organizations with disruption while offering new businesses ways to disrupt the existing vendor status quo. Examples abound of disruption occurring on an almost daily basis. This is both a threat and an opportunity.
- If organizations ignore the changes swirling around them, they will be threatened over time. Similarly, if firms don't leverage the newer technologies and approaches, they will find it increasingly difficult to gain traction.
- Big data, cloud computing, and crowdsourcing approaches give new as well as established organizations the ability to create new products, increase their efficiencies, and deliver better products, services, and outcomes for their customers. But while big data introduces opportunities, it also creates challenges that need to be overcome.
- Organizations need to increasingly be innovative and improve their agility. In order to do so there is a move toward large enterprises mimicking the way the lean startup works and introducing similar approaches to the way it creates ideas.
- At the same time, organizations are increasingly looking outside the firm for new innovations and ideas, and there are many examples of existing businesses moving much of their R&D outside the traditional organizational confines.

- All of these technology shifts create a multitude of valuable insights that are just waiting to be harvested. While facing a fundamentally new way of doing business may seem challenging at first, firms considering this a time of exciting opportunities will be well-placed to take advantage of the opportunities.
- By leveraging new technologies, creating a more collaborative corporate culture, and focusing on opportunities to differentiate, firms can remain relevant and prosper and meet the needs of their various stakeholders.

Thumbnail image courtesy of Maksim Kabakou/Thinkstock.

Scene setting: What are cloud computing and big data?

Cloud computing, a broad term describing a change in the way technology is delivered and consumed, is both a technology and a business model. As a technology product it has popularized the provision of shared services, software applications, and hardware resources delivered over the internet. From a business-model perspective, both a move to a utility model and on-demand access change the equation for consumers and producers.

Cloud computing is often described as a stack, as a response to the broad range of services built on top of one another under the moniker "cloud." In plain terms, end users can utilize parts of bulk resources that can be acquired quickly and easily.

A little-known buzzword only a few years ago, the cloud has created a massive industry transformation, in part because it enables a host of benefits more readily than traditional technology approaches do: Collaboration, analytics, mobility, and resource scaling are all generally easier in a cloud model than in a traditional one.

Although big data has been applied to almost every IT technology in existence over the past several years, it is a general term applied when data sets become sufficiently large enough that they need special tools and techniques to process them. With traditional-size data sets, regular database-management tools and processing applications were sufficient. With big data, additional challenges exist.

Traditional areas where big data techniques are required include meteorology, genomics, pharmaceutical research, and physics simulations. Increasingly, the challenges that big data creates in these spheres have also been apparent for other areas: internet search, financial calculations, and business metrics.

These data sets have grown significantly for multifold reasons. The rise of connected devices is one key driver. In recent research predictions, the internet of things (IoT) — massive amounts of data from built-in sensors on appliances, home alarm systems, and other machine-to-machine communications with a smart label — will grow to 26 billion units by 2020, a 30-fold increase from 0.9 billion in 2009. The increasing ubiquity of information-sensing devices creates a corresponding increase in the data captured by these devices.

Alongside IoT, we also see an increasing general use of technology by consumers. Publicly available estimates suggest that Google receives over 2 million search requests per minute, Facebook users post a million or so pieces of content in the same time, and online consumers spend nearly half a million dollars in the same 60-second time scale.

All of these actions create both primary data (the transaction itself) and metadata (contextual data).

A dive into Facebook statistics, with some thought about the metadata that is created by those activities, illustrates this point. According to some figures that Facebook released in 2012, its big data statistics show that:

- 2.5 billion content items are shared per day.
- Items receive 2.7 billion Likes per day.
- 300 million photos are uploaded per day.
- 70,000 queries are executed on Facebook databases per day.
- Over 500 terabytes of new data is ingested into various Facebook databases every day.

Global data-storage capacity has increased hugely over time. The challenge for organizations then is to make sense of this information and to derive meaningful insights from it.

Why does big data create problems?

It's easy to assume that if information is power, then greater amounts of information would be even more powerful. The difficulty is the difference between raw data and meaningful information.

In the past, organizations were hampered by a dearth of information, and data was stored simply for compliance purposes. Today the problem is reversed: Organizations are hampered by the large amount of data that needs analyzing so that some meaning can be derived from it.

Not only is there an issue with the difficulties in dealing with the quantity of data from a storage and processing perspective, but traditional relational database and visualization systems also aren't optimized to scale to the level required for big data analysis. Organizations need to find new methods for capturing, accessing, storing, processing, and visualizing this data.

How are the cloud and big data disrupting traditional industries?

Examples abound of organizations using the cloud to disrupt the status quo. Perhaps the best example is Netflix, which leveraged cloud computing to scale its business at a rate that would have been impossible in a traditional IT model. By leveraging cloud computing and its related themes of analytics, mobility, and customization, Netflix helped the incumbent business, Blockbuster, fall into oblivion. The Netflix-Blockbuster example may seem a specific one, but we see it replaying in other industries. Uber and Lyft are disrupting traditional cab companies, Kickstarter is causing large companies to reassess product development, and Amazon and eBay are reinventing book sales and retail, respectively.

Given the examples that exist of big data in a social media or consumer setting, it's logical to conclude that big data doesn't create significant problems or opportunities for traditional industries. This is not the case. Almost every industry must now reevaluate itself in the context of big data.

GE is a good example. One of the world's largest industrial manufacturers, GE produces jet engines, turbines, and medical scanners. Despite being in a traditional sector, GE believes that big data and analytics will be a major part of its future.

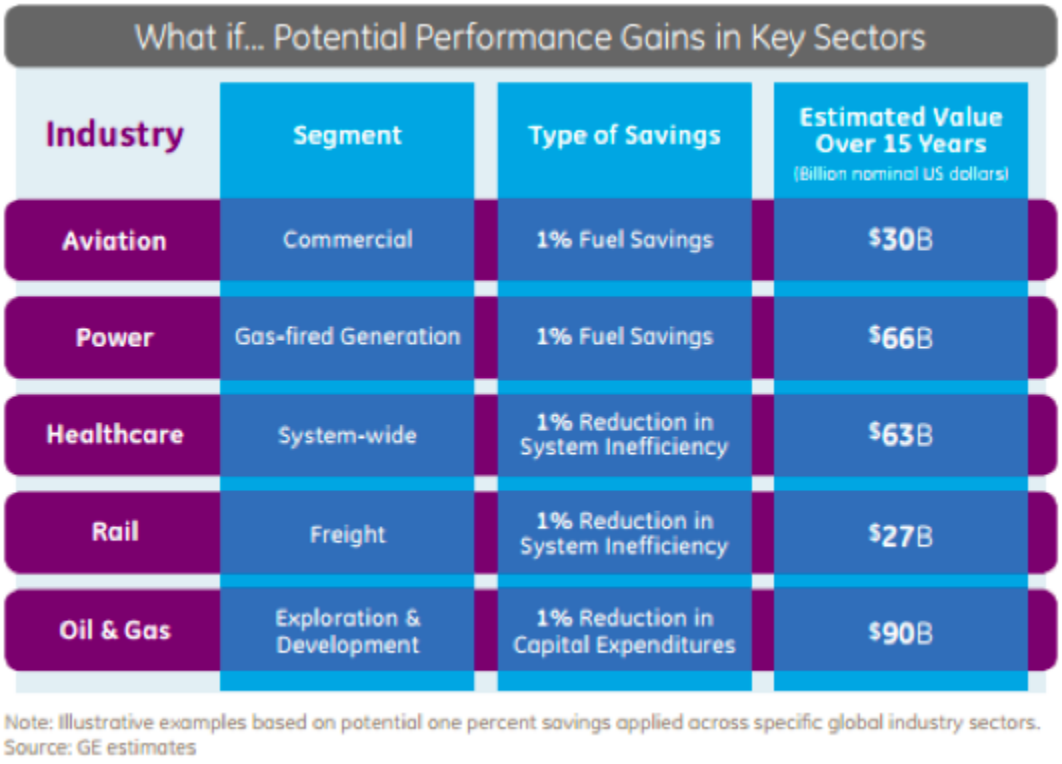
Data from sensors that the company embeds in the machinery it makes is massive; a typical GE gas turbine generates 500 gigabytes of data daily, and with tens of thousand of them in service (not to mention sensors in the other types of machinery the company makes), a significant pool of data is being amassed.

The company is building analytics engines that allow it to ingest the massive quantities of data captured through machinery sensors in order to tailor the design and operation of those machines to gain the highest levels of efficiency. GE believes that even a modest 1 percent savings across the sectors that buy its machinery (aviation, power, health care, rail, and oil and gas) would amount to $300 billion in customer savings over 15 years.

GE believes this new way of doing things, which it calls the "industrial internet," will cover three key elements:

1. Intelligent achiness
2. Advanced analytics
3. Connecting people to ensure better design, operations, maintenance, quality, service, and safety

Performance gains that GE assesses will be created over its different customer sectors



What if... Potential Performance Gains in Key Sectors

Industry	Segment	Type of Savings	Estimated Value Over 15 Years (Billion nominal US dollars)
Aviation	Commercial	1% Fuel Savings	$30B
Power	Gas-fired Generation	1% Fuel Savings	$66B
Healthcare	System-wide	1% Reduction in System Inefficiency	$63B
Rail	Freight	1% Reduction in System Inefficiency	$27B
Oil & Gas	Exploration & Development	1% Reduction in Capital Expenditures	$90B

Note: Illustrative examples based on potential one percent savings applied across specific global industry sectors.
Source: GE estimates

Source: GE

But GE isn't the only traditional player looking to big data as a driver of massive benefits. Bechtel, one of the largest engineering, construction, and project-management companies in the world, is thinking about how big data applies to its situation. In a recent report, Christian Reilly, the manager of demand management for Bechtel, explained how the company is using tools to expose its previously siloed data sources. The company is able to expose this data via visualizations and to analyze and react to the insights the information generates.

Agriculture is another area where big data is being applied to disrupt the status quo. John Deere uses sensors added to its latest equipment to help farmers manage their fleets and decrease downtime of their tractors, saving on fuel. The information is combined with historical and real-time data regarding weather prediction, soil conditions, crop features, and many other data sets. John Deere sees both internal and external benefits from the use of big data. Internally it gets an ongoing stream of data from machinery in the field, and,

rather than having to wait for regular service calls to see how machinery is wearing, it can gain insights in real time that can help it design better-performing equipment.

From an external perspective, big data allows John Deere to create products that add value for its customers. A good example is the FarmSight services that are built around three distinct areas, all targeted to improve farmer productivity:

1. Machine optimization monitors the productivity of the machines and tries to figure out how they can be made more efficient. It uses proactive diagnostics on service issues, such as filter changes and other maintenance items, to help reduce downtime, monitor its health, keep the machine up and running, and make it more efficient and productive.

2. Farming-logistics data helps farmers control the growing farms and the ever-expanding machine fleet. The objective is to improve machine-to-machine communications and have the machines talk to one another. This will allow farmers to control an entire fleet with one person.

3. Decision support helps the farmer make better decisions that prevent mistakes and increase efficiency.

Over time, and as John Deere increases both the breadth of the data it captures and the quantity of data in totality, it will be positioned to further drive efficiencies for itself and add additional value for its customers. Once purely an equipment-manufacturing organization, it is now an information organization, giving it protection from competition as well as economic advantages and additional potential revenue streams.

GE, John Deere, and Bechtel are but three examples of companies that are delivering huge benefits to their operations and, by extension, huge benefits to their customers by looking at the totality of data that exists inside and outside the organization and thinking of it as an asset that can be analyzed and create value.

Developing an analytical approach to agile enterprise

Many pressures on organizations today result in their having to be agile and innovative:

- Economic pressures
- Demand for employee mobility
- Rapidly increasing competition
- A global workforce
- The rise of a new generation of workers less inclined toward hierarchical approaches

Toyota originally developed the lean methodology to create the most efficient manufacturing operation possible. Since its development, however, the lean methodology has expanded across all types of organizations and has now become the rallying call for startups as well as large organizations wanting to emulate the pace of innovation that startups exhibit.

The lean startup methodology that Eric Ries popularized is intended to be a scientific approach to creating and managing startups with a view to getting a product into customers' hands as quickly as possible. In developing the methodology, Ries had several canons that can be applied to both startups and existing businesses.

- **Eliminate uncertainty.** This exists when a methodology is put around the creation of a product that provides a way to test the core hypotheses on a regular basis. This canon seeks to apply analytics to an inherently uncertain process.
- **Work smarter, not harder.** This exists when the development of a product goes beyond simply asking "can this be built" to analyzing "can we build a sustainable business around this product." This canon aims to avoid products being built in a silo without market and customer validation.
- **Develop a minimum viable product (MVP).** The MVP is the minimum product that is sufficient to create a build-measure-learn feedback loop. It is the smallest component that is able to be tested with users.
- **Validated learning.** Part of the build-measure-learn feedback loop, this canon aims to develop a rigorous method that demonstrates progress toward a goal.

While the lean methodology might sound like something that is mainly applicable to startups, the technology industry is full of examples of companies using agile product development and iterative development as innovation tools.

Google is one of the better-known examples of a company that is strongly focused on iteration through analytics. Looking at how Google develops products and manages the process for development is informative. The company starts by soliciting ideas from a wide range of stakeholders; these ideas are then ranked using a number of different criteria.

Once a product enters the iteration stage, it is created by a small team that aims to launch a product as early as possible in order to get user feedback and develop it further. Much of this feedback is obtained through automated analysis of user interactions. Google is a significant user of A/B testing, a methodology whereby two variants of a product, A and B, are randomly tested on users. With A/B testing, changes to a page or product design can be tested against the existing design. Measuring the impact of even tiny changes helps Google ensure that the products it creates have the highest possible levels of engagement and conversion. Seemingly tiny differences like the background shade of a website have been found to make a difference to customer conversion.

This A/B testing methodology isn't restricted to websites. A/B testing is used extensively to trial different pricing strategies, interaction approaches, and marketing to tailor messages to increase their efficiency. A/B testing is an analytical approach that organizations use to tailor the impact of their products and services.

Another approach that online companies, including Google, use to analyze their products is user tracking, a method whereby the origin of a customer's interaction with a product, the journey the customer goes through when using a product, and the destination the customer heads to afterward are all stored for analysis.

By analyzing patterns across many users, analytical tools can intuit customer intentions, correlations, and propensities to take a certain action. All of this data can then be utilized to tailor a user's experience to encourage an end result that analytics has indicated is likely.

Finally, agile organizations use sentiment analysis as an analytical tool. Sentiment analysis uses natural language processing, text analysis, and linguistics to identify subjective information from an individual's interactions. Sometimes called "opinion mining," sentiment analysis is used by technology companies to tailor the user experience to the user's mood and sentiment. Sentiment analysis is also analyzed, measured, and sold to various interested parties that want to gauge mood trends. For example, during a

political campaign a candidate might want to know the mood of people who mention her name on social media.

These different examples rely on the capture, processing, and visualization of big data, but they do so for well-understood use cases. Imagine the value these techniques can bring if these examples were extrapolated and applied to the manufacturing, transportation, construction, and agricultural worlds of GE, Bechtel, or John Deere.

Go another step and imagine what insights could be obtained if refrigerators, washing machines, cars, and even toothbrushes were connected to the internet and streaming data about themselves and their owners' use of them. This is the future of big data: a ubiquitous, pervasive, and automatic capture and processing of mass data of all types.

Crowdsourcing innovation: agility from the outside

In an environment in which the creation of differentiated growth is hampered by the increasing homogenization of products (caused, in part, by globalization), crowdsourcing is increasingly being utilized as a way to increase the pace of innovation and develop new products and services efficiently and effectively.

Crowdsourcing is the practice of obtaining product ideas by soliciting contributions from the wider public rather than just from employees or suppliers. It's a simple concept, but it is sometimes a difficult notion for existing enterprises to embrace, as they are often concerned about IP ownership.

As the cost of research escalates and the ability to deliver research quickly from within the organization is reduced, crowdsourcing is increasingly seen as a smart direction, even for the most traditional organizations.

Proctor & Gamble, the multinational consumer goods company, embarked on a crowdsourcing project when it needed to find a way to print images onto Pringles cans. P&G's search led it to a small Italian bakery that had found a way to print images onto baked goods. P&G licensed the technology and was able to roll the concept out to the marketplace in under a year.

This approach toward R&D was so compelling that P&G greatly broadened its crowdsourcing initiative and now uses crowdsourcing for 50 percent of the innovations it brings to market. The P&G move has been mimicked by others in the consumer-goods space. Clorox, 3M, and Johnson & Johnson all have significant crowdsourcing initiatives in place.

Another example is Kimberly-Clark, which gained a 30 percent reduction in the time it took to introduce a new product through the use of crowdsourcing.

Cloud computing and big data both enable crowdsourcing in a number of ways. Cloud software is perfectly suited to distributed use and access from outside the firewall. The cloud provides the ability to work with customers, partners, and vendors, and it's not bound by the firewall. Big data helps organizations surface the relevant data, assess different options, and gain insights into the mood of customers and the marketplace more generally.

Key takeaways

- A number of technologies and macro trends threaten traditional organizations with disruption on one hand while offering new businesses ways to disrupt existing players on the other.
- As is often the case in a changing paradigm, companies can view change as an opportunity or a threat. Organizations that ignore changes will be threatened, and newer firms that don't leverage new technologies and approaches will have difficulty gaining traction.
- Big data, cloud computing, and crowdsourcing approaches give both new and established organizations the ability to create new products, increase their efficiencies, and deliver better products, services, and outcomes for their customers.
- All of these technology shifts create a multitude of valuable insights that are just waiting to be harvested. While it may at first be challenging to face a fundamentally new way of doing business, if firms consider this a time of exciting opportunities, they will be well-placed to take advantage of the opportunities.
- By leveraging new technologies, creating a more collaborative corporate culture, and focusing on opportunities to differentiate, firms can remain relevant and prosperous and meet the needs of their various stakeholders.

About Ben Kepes

Ben Kepes is a technology evangelist, entrepreneur, commentator, and business adviser. Kepes covers the convergence of technology, mobile, ubiquity, and agility, all enabled by the cloud. His areas of interest extend to enterprise software, software integration, financial-accounting software, and platforms and infrastructure as well as articulating technology simply for everyday users.

He is a globally recognized subject-matter expert with an extensive following across multiple channels. Kepes currently writes for *Forbes*. His commentary has previously been published on ReadWriteWeb, Gigaom, the *Guardian,* and a wide variety of publications, both print and online. Often included in lists of the most influential technology thinkers globally, Kepes is also an active member of the Clouderati, a global group of cloud thought leaders, and is in demand as a speaker at conferences and events all around the world.

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