ORGANIZATION DESIGN CHALLENGES RESULTING FROM BIG DATA

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Abstract: Business firms and other types of organizations are feverishly exploring ways of taking advantage of the big data phenomenon. This article discusses firms that are at the leading edge of developing a big data analytics capability. Firms that are currently enjoying the most success in this area are able to use big data not only to improve their existing businesses but to create new businesses as well. Putting a strategic emphasis on big data requires adding an analytics capability to the existing organization. This transformation process results in power shifting to analytics experts and in decisions being made in real time.

Keywords: Big data, organization design, analytics capability, strategy and structure, new organizational forms

The subject of big data has burst on the scene in the last few years. Today, it is receiving more than its fair share of media hype. If we look beyond the hype, however, we can see some real substance underlying this phenomenon. Big data has been given legitimacy by reports from the World Economic Forum, the McKinsey Global Institute, and *The Economist* Intelligence Unit. In their recent book, *The New Digital Age*, Eric Schmidt and Jared Cowen (2013), executives and thought leaders at Google, have given us a balanced discussion of the entire digital landscape. Nonetheless, the digital age has its critics who warn of the dangers involved (Morozov, 2013). At the end of the day, I believe that privacy issues and other dangers will be resolved and big data – or whatever we eventually call it – will be a capability that is designed into all of our organizations. However, organizations will vary in the difficulties they experience in building their big data analytics capability.

As organizations attempt to develop a big data analytics capability, they will encounter obstacles as well as opportunities. In this article, I discuss how big data presents a company with the opportunity to start an entirely new business. To take advantage of this opportunity requires analytics capability that shifts power in the organization and dramatically increases the speed of decision making. (For a complete discussion, see Galbraith, 2014.) After first discussing the twin design challenges of power shifts and real-time decision making, I describe how Nike's creation of a Digital Sports Division has taken advantage of big data to build an entirely new business. At the end of the article, I summarize the impact of big data on organization design using the Star Model™ framework.

NEW ATTRIBUTES OF BIG DATA

Firms and other organizations have been using large databases and analytics for the last couple of decades. Transactions are stored in data warehouses and analyzed with data-mining algorithms to extract insights. What is new about big data today? First, there are more – and different kinds – of data. In the past, it was stored, structured data. This data was largely from transactions and was stored as rows and columns. Today, we store unstructured data from a variety of sources. The data could be photos from a mobile phone, maps from a GPS device, video from a surveillance camera, audio from a call center, e-mails, tweets, and text messages. All of this data can be digitized, analyzed, and stored.

Second, this new data is accessible in real time. Before, data in the data warehouse was historical and described outcomes that had already occurred. Now, we can receive data about events as they are happening and perhaps influence their outcomes. Historically, credit card companies stored all of their transactions in a database and analyzed them with fraud-detecting algorithms. Fraudulent transactions were then turned over to the police to investigate. The companies could distinguish chronically late payers from people who had lost their jobs. Customer service could then take the appropriate actions with each group. Today, a fraudulent transaction can be detected while the fraudster is still at the checkout counter. An algorithm operating in real time can determine that the transaction is a charge on a stolen credit card. The clerk at the checkout counter can be advised to delay the suspect. Store security can be informed to apprehend the person and confiscate the credit card. Thus, real-time data allow us to influence the outcome and prevent bad outcomes before they happen. This capability is new. However, this new capability is only possible if we have an organization that is designed to operate in real time. We need to design a decision process that uses real-time data, analyzes it to produce instant insights, and processes those insights to arrive at real-time decisions. Using real-time decisions, organizations can take quick action. We need much faster-acting companies in order to profit from big data.

POWER SHIFTS

Before an organization can make real-time decisions, it must get data scientists and analytics experts embedded into decision processes. This will require a shift in power from experienced and judgmental decision makers to digital decision makers. Every organization has an establishment, a power structure with a vested interest in the status quo. The establishment is currently making investment decisions, setting customer priorities, and deciding on new product features. These are the same decisions that new insights from big data can improve. But will the current leadership adopt or reject new insights? In order to be successful, the organization needs to execute a shift in power to the digital experts who generate new insights from big data. A shift in power is necessary to accomplish the changes that are needed to fully embed the big data analytics capability.

Competence-Enhancing

One factor that will determine the magnitude of the power shift is the amount of resistance that the big data proponents will encounter from the establishment. The amount of resistance will depend on whether this new capability is competence-enhancing or competence-destroying (Tushman & Anderson, 1996). For example, when e-commerce came along, Dell adopted it immediately. Taking orders over the Internet was competence-enhancing for Dell; it enhanced the company's direct sales to end-users business model. Hewlett-Packard's strength was its relationship with resellers and retailers. E-commerce was a competence-destroying innovation; it would disintermediate HP's resellers. HP was slower to adopt e-commerce, keeping the firm's resellers in the distribution chain at a higher cost. So, with respect to any particular big data initiative, companies need to determine where they are on the competence enhancing-destroying continuum.

Procter & Gamble is an example of a company for whom big data is competence-enhancing. P&G is a very analytical company and has had an analytics group since 1992. Plus, it will try anything that might increase its understanding of consumer behavior. As a result, P&G is adopting big data practices ahead of most other companies. The big data initiative is led by the CIO and supported by the CEO. P&G has adapted its hiring practices to bring in more data scientists. For the past five years, P&G and Google have exchanged teams of people annually. Google wants to learn about advertising, and P&G wants to learn from Google's digital acumen. At P&G, all managers are upgrading their digital skills. Moreover, every manager's digital and analytical performance gets assessed in the performance management process. The CIO and the business leaders have identified 88 business processes that are being redesigned and accelerated to operate in real time. So, P&G is a good example of a company that has embraced big data.

In contrast, a good example of a competence-destroying situation is the arrival of big

data in sports. Most of us have seen the baseball movie Moneyball. Billy Beane, the general manager of the Oakland Athletics, brings in "sabre-metrics" expert Peter Brand. Billy wants Peter to advise him on putting together the best team possible, but on Oakland's very low budget. Peter is 25 years old and an economics graduate from Yale who has never played the game. Of course, they run into the chief scout, Grady, and his grey-haired scouting team. Grady first tries to keep Peter out of the meeting. "Does Pete really need to be here?" Then he shifts to, "You can't put a team together with a computer." The meeting is a clash between Peter's data and Grady's opinions. Billy makes his decisions based on Peter's data, but then they run into the manager, Art Howe, who will not play a data-chosen player. He is insubordinate when Billy commands him to play the player. Billy then makes a trade so that Art has to play Billy's choice. Thus, the arrival of data and analytics at the Oakland Athletics destroyed or diminished the experience-based competence of Grady and his fellow talent scouts. Today, almost all American baseball teams and European soccer teams use big data and analytics to some degree.

Such scenes will play out in many companies where an analog establishment is making product and marketing decisions based on years of experience and historical data. The digital newcomers will clash with these old pros and lose if the leadership, like Billy Beane, does not support them.

Chief Digital Officer

Another example can be found in risk management in financial services. Risk management departments were created along with a Chief Risk Officer (CRO). Those departments had very sophisticated, quantitative risk models. Just prior to the financial crisis, risk managers were waving red flags and trying to be heard. The bankers saw them as the "revenue reduction department." When the CEOs backed the bankers, the CROs had little impact. Today, nearly all banks have CROs reporting directly to the CEO and the role is staffed with a talented person. The effectiveness of the CROs and supporting regulation are still being tested. Where the leadership actively considers risk data and recommendations, the CRO and risk experts will be integrated into the decision process. At that point, power will have been shifted.

The question now is whether big data needs its equivalent of the CRO. There are quite a few proponents for a Chief Digital Officer (CDO). However, the role can take several forms. At P&G, it is the CIO who has played that role. The IT function has always worked with the businesses to introduce new information systems and analytical approaches. Given P&G's analytical orientation, a separate CDO role is probably not needed. The CIO can wear two hats: CIO and CDO.

Intel is using a partnership between the CIO and the CMO to take the lead in implementing big data analytics. Intel has a history of "two managers in a box." Starbucks is reported to have a full-time CDO. IBM has made the biggest change with an Enterprise Transformation Head. She has been in that role for 10 years, and her task has been to transform IBM to grid computing and now to the cloud and big data. IBM wants all of its processes to be converted so that it can be a model for its customers. The transformation head was a star line manager who ran the server and storage businesses before taking the new role. The CIO and process design activities all report to her. She, in turn, reports to the CEO. So, IBM has put a lot of power and authority behind its equivalent of a CDO.

It seems that the amount of power and authority of a CDO should be matched with the relative amount of difficulty and priority of implementing big data. If big data is a competence-enhancing innovation, a CIO wearing a double hat like P&G could be sufficient. If a company is at the other end of the continuum and big data is competence-destroying, more power and authority will be needed. At the destroying end, a role like IBM's Enterprise Transformation Head will be required to adopt big data.

A CDO role of some type is needed even in competence-enhancing companies. There are a number of corporate-led initiatives that are needed to embed the new analytics capability in the company's decision-making processes. First, companies need a strategy and plan. Where are the best opportunities for investment in big data? Companies also need to link applications with the requisite IT equipment and data architectures and, for the chosen applications, they

must provide training and tools to frontline people. It is the usual strategic choice of "where to play." With limited resources, companies cannot do everything at once.

Second, someone has to lead the shift in corporate mind-set to one that data and information are an important company resource. Data is becoming a valuable resource like talent and money. Data and analytics groups are becoming like HR and finance – matrixed throughout the company. At a minimum, there is a corporate leadership group (the head of data and analytics) and several embedded groups (data analysts) in the businesses that report both to the business heads and to the corporate head of data and analytics or the CDO.

Third, the company must work to integrate and unite the many islands of data and analytics that exist throughout the organization. A lot of value comes from combining data from different sources both inside and outside the company. Resistance to sharing and combining data often arises depending on the strength of the organizational silos. Corporate leaders must create norms and values concerning information sharing, transparency, and trust. Each company tries to arrive at a situation where organizational units will have the data they need to execute their charter, but that data is also available to the rest of the company. In addition, those units should have reciprocal access to company data.

Finally, someone needs to resolve disputes caused by the new capability. As mentioned above, people are already charged with making decisions about advertising and new product features. Data and analytics will generate insights that lead to different decisions than does the current process. Those differences can lead to Moneyball-type clashes over data versus experience. The desired outcome is a blend of data and experience; a CDO is needed to see that disputes are settled with the right blend for the company. Other disputes such as issues around channel conflicts will arise. The digital technology enables disintermediation. The insurance agent was always a sacred cow at insurance companies. Now, young people are willing to buy insurance online and circumvent the agent. Inside the insurance companies, managers argue about whether and how to go about this new direct-to-consumer sale. The CDO needs to play a mediating role. In addition, jurisdictional disputes crop up between functions like the CIO, marketing, supply chain, and finance about who "owns" one digital activity or another. Again, the CDO needs to see that these disputes are discussed and resolved. For all of these reasons, someone must play the value-adding mediation role in all companies implementing big data.

Summary

Companies will need a power shift in their structures if they are to capitalize on big data analytics capability. The data and analytics newcomers need to be supported and integrated into the company's decision processes. If not, big data and the CDO will be like risk management and the CRO before the financial crisis. Grady and the scouts will not invite Peter to the decision-making meetings, and Art Howe will continue to be insubordinate and not play the right players. But, once a successful power shift is underway, the next step is to speed up decision making.

REAL-TIME DECISION MAKING

Another major big data challenge is to increase the speed of decision making. This is often referred to as increasing the "clock speed" of the organization. A computer has a clock which synchronizes the speed of the input unit, output unit, arithmetic unit, and memory unit. Historically, computer designers have been increasing the clock speed at which the computer operates. Similarly, organization designers need to increase their organizations' clock speed. Units such as advertising, customer management, new product development, and supply chain management have to synchronize around increasing clock speeds. The ultimate target is the making of decisions in real time.

Advertising

Today's advertising is transitioning from a "campaign" model to a "newsroom" model (Shetty & Wind, 2013). Traditionally, advertisers started their ad campaign planning in September

for ads to be launched during the Super Bowl in February. They worked up a theme, shot many ads, narrowed them down to a few, bought time from the TV network, submitted their ads, and went to their Super Bowl parties to watch them. The media would report audience reactions to the ads on Monday morning following the game. The Nielsen ratings would arrive later that week on Friday. Coca-Cola and Audi went through this process for their 2013 Super Bowl ads, but unlike the other advertisers, they gathered in rapid response teams on the day of the Super Bowl. Then when their first ads were running they were looking at the Twitter feeds, the Facebook likes, and hits on their respective websites. Even before the first ad was finished playing, the teams were planning and making modifications to their second ads. Then the infamous power outage occurred. The brand teams that were already gathered in their "newsroom" jumped into action. The Audi team was quick to dig their rival, Mercedes Benz. The reason was that the blackout occurred in the Mercedes Benz USA Superdome stadium. Audi tweeted, "Sending some LEDs to the MBUSA Superdome right now", thereby plugging its own LED-laden vehicle. In order to respond in real time, these fast-response teams had to be supported by analytics to sift through all of the social media responses and make sense of them. Based on that data, the cross-functional team had to discuss insights, decide on a response, and post a tweet (an audio or video response). The blackout was indeed breaking news and the newsroom went into real-time action.

Another example of real-time advertising is the Old Spice ad for Red Zone Body Wash (Morrissey, 2010). The original ad was shown on traditional TV. It showed a very attractive man wearing only a towel around his waist applying the body wash. The response on Facebook and Twitter was way above normal, so the advertiser and the agency decided on a social media approach. They gathered a large team of writers, art directors, producers, editors, the actor, and social media specialists. They started with a couple of videos on YouTube and distributed them over Twitter. They targeted known influencers. The social media team then scoured the web for comments on the initial ads. They fed the funny comments, or those that came from interesting sources, to their "creatives" who turned them into humorous videos. The team was able to release several new videos per hour. The ads became a trending topic on Twitter. The promotion lasted for two days and the team created 200 videos, all in real time in response to topics coming from their viewers. This example shows the cross-functional newsroom advertising team in real-time action.

Community Management

Many companies have created Internet communities. People become members of the community when they register at the company's website or follow the company on Facebook, Twitter, or other social media sites. Communities are a valuable source of data for companies – but they become even more valuable when companies interact with their communities and do so in real time.

Nike is a good example (Piskorski & Johnson, 2012). It has always been active on the Internet. Nike launched its first website, nike.com, in 1998. It experimented with YouTube, MySpace, and other media sites. In 2005, it introduced NIKEiD, an online store. In addition to online direct sales, one of its features was that customers could design their own shoes, much like they could design their own computer on dell.com. Sales reached $100 million in a few years.

The big change came when Nike launched Nike+. Nike engineers became aware that virtually everyone was using iPods. They approached Apple about a partnership. The idea was to embed a sensor in Nike running shoes which could link wirelessly to an iPod and eventually to the iPhone and Android devices. The sensor could record distance, speed, and calories burned. The iPod could record these data and provide running music and other audio features. At the end of a run, the iPod could be uploaded to NikePlus.com and viewed and stored. The NikePlus.com website offered running tips, comparisons with other runners, shared workouts with friends, both on the Nike site and on Facebook and Twitter.

NikePlus.com built a following and in 2007 became the largest online running destination. Additional functionality was added to the website. For example, members could use the site to gather for group runs in many cities, or they could meet and gather after the runs. A

Nike+ GPS app was added to allow runners to map their runs. Then a database was built that now contains the largest collection of running maps around the world. One can ask for a suggestion for a steep course in Sonoma, CA where it is possible to take your dog. Next came the Nike+ GPS SportWatch. By 2013, there were more than seven million members of the Nike+ community.

Nike, like most consumer goods companies, has added a group of social network people to manage their communities (*The Economist*, 2013). Their responsibilities and management tools are expanding constantly. Some of the group's activities are to monitor the conversations on the web, create sub-communities, launch initiatives, and continuously manage the communities. This group runs like a newsroom; a 24/7 team monitors the conversations across all social media. They use analytics to do sentiment analysis to sense positive and negative sentiments about the brand. If there's a positive or negative spike, the team swings into action. When a factory collapses in Bangladesh, the team is quick to communicate that Nike manufactures no shoes in that country. If a positive spike occurs, the team investigates to see if it can be accentuated. In either case, the team explores what is behind the spike. They then say, "What can we learn from it? Should we act on it now? Should we pass on the learning to others?" Pop culture trends start unexpectedly from anywhere and spread quickly, like Gangnam Style. Which Nike shoes would the newsroom team suggest for Gangnam fashion?

Most companies believe that they have only scratched the surface in engaging with their communities. Nike discovered that dialogues with the community generate an enormous amount of data about running. This data can be analyzed and become the basis of new ideas for initiatives and products. The next step is to actively solicit ideas from the community through crowd-sourcing techniques. Indeed, Harley Davidson bypassed its ad agency and used crowd-sourcing to create the theme for a recent advertising campaign. Can crowd-funding be far behind (Winsor & Wind, 2013)?

New Product Development

Another function affected by big data is product development. As has Nike, General Electric and Bosch have embedded sensors in their products. Data from those sensors and other chips can be uploaded to the companies' websites. So when runners upload their data to NikePlus.com, it can be analyzed and compared to other runners. With the addition of GPS features, Nike can create many more applications that runners can access through NikePlus.com. As a result, Nike and these other companies find themselves in the software business. The software development process moves at Internet speeds, which approach real time.

The development of a new running shoe at Nike takes place over about an 18-month period. In contrast, the software development process is continuous and users co-develop the products. For example, LinkedIn and eBay launch new products and features several times a day. The new software development process, called the agile software development process, is a continuous and iterative cycle. The development team first creates a minimally featured product quickly and puts it on their company website. They invite users to try the products and report back on their experiences with it. The next day the team modifies the product based on the users' experiences. Through this continuous, iterative process, a new software product is created and available to users. The development teams expand and contract with the magnitude of the changes, but there is always a team evolving the product.

Another feature of software is that many companies are not just creating software products but rather software platforms. That is, Nike opens up the software code for NikePlus.com and makes it available to software developers. These developers then create running apps, which are accessible through NikePlus.com. Companies like Nike hire evangelists who go out and recruit software developers to write apps for Nike. For the good developers, Nike will share its vast data on running if they write apps exclusively for Nike. In January 2013, Nike partnered with a venture capitalist to create an incubator for startups that write software or create devices for running, which Nike can use for its customers and community (Banjo, 2013). So in addition to its user community, Nike is creating an ecosystem of device and software developers that will work with Nike and NikePlus.com to promote running

and exercise. Nike engages continually with its communities of runners, developers, and suppliers to generate enormous amounts of data and ideas that can be analyzed for the shoes, software products, devices, or advertising ideas.

Organizing for Real-Time Decision Making

The question naturally arises about how to organize these real-time activities. There are a number of new units that must be integrated into the structure. Data and analytics talent must handle all of the incoming data and make sense of it. Software developers create new applications, and web designers regularly update the NikePlus.com site. Hardware engineers, who understand sensors and embedded chips, select and manage hardware vendors who make products like the SportWatch. Software evangelists recruit and manage partnerships with outside software vendors. Business managers run e-commerce websites, and social media experts manage the various communities. And, finally, digital marketing experts manage the process of taking real-time data to the analytics group, which produces real-time insights for decision makers, who then make real-time decisions. How should a company organize to implement its digital strategy that further differentiates its products and creates value?

One alternative is to integrate the software and hardware engineers into the product development function, and the digital marketing and social media experts into the marketing group. This alternative maintains the current functional structure and tends to be favored by the current managers. Another alternative is to combine all of the new talent into a digital unit and keep that digital unit intact. The company could add it as a new function in the business unit structure.

There are two arguments for a semi-independent unit. Operating independently, the unit can control its own activities and prove itself to the other units. As a new unit, it has to build its own capability and prove itself to others while earning credibility. In addition, a new unit always has a lot of trial and error until it discovers its success formula. Moreover, a new unit is fragile, and it needs independence as well as nurturing and developmental help from higher management. The second, related argument is that the unit is not just new; it is very different. It contains different specialists, each with their own language. But the real difference is the speed at which it has to operate. If it is a separate unit, it can operate at its own and faster pace. If it is embedded in other organizational units, it will have difficulty increasing its speed of decision making.

The new unit cannot be completely separate, however, because it is interdependent with the other functions. It must participate in the new product development process and pass ideas and information to Consumer Insights and Brand Advertising. As a result, the organization design must be more nuanced. The digital organization structure, along with Marketing, is shown in Figure 1.
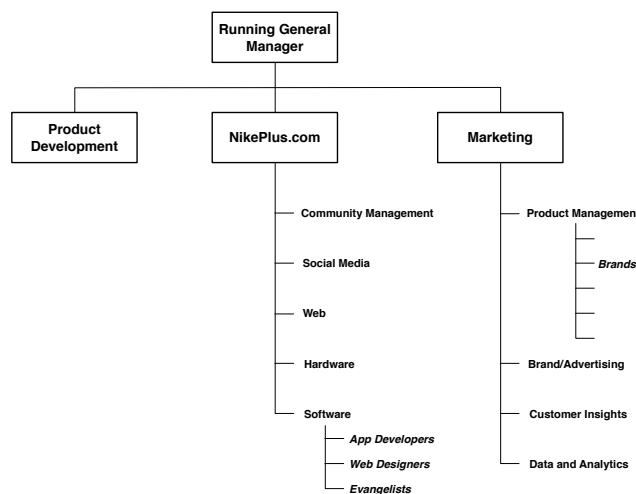

Fig. 1. Nike's Digital Functional Structure

The digital function consists of a community management unit, social media and mobile specialists, website management, hardware engineering, and a software function. These are all activities for which the digital unit is responsible. The units that operate in real time are the software, web, data analytics, and community management groups.

Another feature is needed to complete the design of the digital function. The governance feature is a steering committee chaired by the running business head. It consists of the heads of marketing, product development, sales, and digital. In the beginning, they meet weekly. The purpose of the committee is to see that all of the cross-functional linkages are working, and if not, to fix them. Once its initial growing pains are dealt with, the committee meets every other week or so to review plans, budgets, issues, and initiatives. This process links the new digital unit to the rest of the functions.

Supply Chain Management

The final function to be accelerated by big data is the supply chain. At P&G, the supply chain function meets in what is called the "control tower." Within the control tower, a cross-functional team meets in a special room called a "decision sphere" (see Figure 2). P&G has 42 decision spheres located throughout the company. These are specially designed rooms with video screens on the walls and computer access to various databases. The rooms are designed to foster real-time, cross-functional decision making. So when a paper machine's embedded sensors at the Pampers' plant in Wisconsin indicate that it requires maintenance, a plant shutdown is scheduled. If it looks like the machine will be down for a while, then the decision is made to supply Wal-Mart from the Albany, Georgia plant. The analytics capabilities are used to determine (and see) the best way to reroute trucks and still meet other delivery commitments to customers. This is an example of how big data facilitates real-time decisions in managing supply chains.

Fig. 2. A Procter & Gamble Decision Sphere

Summary

With the proper analytics capability, companies can make decisions in real time. They can involve their customers in dialogues about brands and gather ideas about new products and how to market them. Companies can use cross-functional teams that are in constant contact in a newsroom-like control tower and decision sphere to respond to real-time inputs. Such companies have increased the clock speed of their decision processes.

GENERATING REVENUE FROM BIG DATA

The third organization design feature triggered by big data is both a challenge and an opportunity. The changes in power and decision making described above will improve Nike's existing business – that is, Nike will sell more running shoes because of the added features of NikePlus.com. But the data, analytics, and insights can be revenue-producers themselves;

they have the potential to create entirely new businesses for Nike.

Companies such as Bosch and General Electric are putting sensors and microprocessors into all of their products. These companies anticipate that the services and software sales from the embedded devices will be a major source of growth in the coming years. Bosch has created a central unit, Bosch Software Innovation, which is to lead many of the new digital initiatives. One project is the design, installation, maintenance, and operation of an electric vehicle-charging infrastructure for Singapore. This huge project will provide software and data analysis for the government, retailers, fleet operators, utilities, and parking operators. The infrastructure will generate revenue from a range of services available through Bosch Software Innovation's Internet service platform.

In another example, large U.S. banks like JP Morgan and Wells Fargo provide reports on consumer trends to clients and other institutions that want to buy them. These banks have vast amounts of data from consumer use of credit and debit cards, checking accounts, ATM transactions, mortgages, and loans. The banks combine all of that data with publicly available data from governments. Then they apply their analytical capabilities to develop proprietary insights into consumer trends. In just a few hours, the banks can generate customized reports that slice the data into smaller and more narrowly defined market segments and geographies according to the specific demands of their clients. Such services generate increasing amounts of revenue and profits for the banks.

Citibank can provide this kind of data and insights on an international basis. It operates as a bank in 100 countries. That is, it takes deposits and makes loans in the local currency. The next largest bank is HSBC, which operates in 56 countries; no other banks are even close in size. So, Citibank has a competitive advantage that cannot be matched from a global perspective. It has the consumer data globally that Wells Fargo has nationally. Plus, it is one of the world's two largest foreign exchange providers. It is the largest cash management provider and number two in custody (securities safekeeping). That's in addition to its commercial lending operations in the 100 countries. Citibank can detect changes in trade patterns and economic conditions from an analysis of the basic (big) data. It says it can detect the new "silk roads" in emerging markets. Citibank sells its insights to companies like Zara and H&M to help them locate new stores and factories. Thus, banks see future growth coming from data and insights more than from their basic financial transactions businesses.

Nike is still the best example for the organizational design implications of big data. The Nike development history follows the Chandler (1962) model in which a new strategic emphasis is manifested in the organization's structure via a process he called "concatenation." Nike's recent strategy and structure transition show that big data is not just a new revenue source; it may be the start of a new organizational dimension. Let us briefly review the stages through which Nike has progressed.

Nike was founded in 1964. During the next several years, it became a fully functional, single-business company designing, manufacturing, marketing, and selling running shoes. The company went public in 1971. By the 1980s, two important developments occurred in its organizational structure. First, Nike diversified into other types of athletic footwear including basketball, tennis, soccer, and fitness shoes. It retained its functional structure but introduced lateral processes, such as cross-functional product teams, for the new types of footwear. Second, it expanded internationally by establishing sales, local marketing, and distribution subsidiaries. The organization became two-dimensional, with functions and regions reporting to the CEO. In the 1990s, it evolved into a three-dimensional organization by diversifying into sports apparel and sports equipment in addition to athletic footwear. Nike formed profit centers for footwear, apparel, and equipment, plus a separate business for golf. The supply chain, marketing, finance, and HR functions reported to the CEO in addition to the regions. In 2006, Nike made a big change to focus on customer groups. It created five categories: running, men's training, women's fitness, basketball, and soccer. Each customer category was a profit center and responsible for footwear, apparel, and equipment for its customer set. Nike thus created integrated solutions for customers who found them valuable. These categories were added to the previous structure, which still retained products, regions, and functions reporting to higher management. It is important to note that the categories were not just add-ons. The products were matrixed across categories. Women's fitness was still

dependent on the apparel product line to determine fashion trends and help design this year's collection. All categories are still dependent on the latest footwear technologies. This change to categories, or customer segments, made Nike a four-dimensional organization. Then, in 2010, Nike created the Digital Sports Division.

The current Nike organization structure is shown in Figure 3. As indicated, Digital Sports is a profit center and has a number of responsibilities. First, it works with the categories in establishing Nike+ activities like the one in running described earlier. Nike has also added Nike+ Football, Nike+ Basketball, and Nike+ Kinect Training within the various category profit centers. Digital Sports supports the categories in creating and managing their communities and with new products like the GPS app. It is an example of another dimension being added to the Nike matrix, a manifestation of the strategic emphasis being placed on big data. Second, the division is developing its own products and its own sources of revenue. Nike+ FuelBand is a wristband that records distance traveled in a day, the number of steps taken, and calories burned. The stored results can be uploaded at the end of the day and compared with others in the user's age group. The division has its Nikefuel.com website, apps, apparel, and community. It has recently introduced a wristwatch with similar features. Now, Nike is competing in the wearable medical device market. More products are on the way. Third, the division takes the lead in building the Nike incubator described earlier. Thus, it is responsible for establishing an ecosystem of companies around the devices.
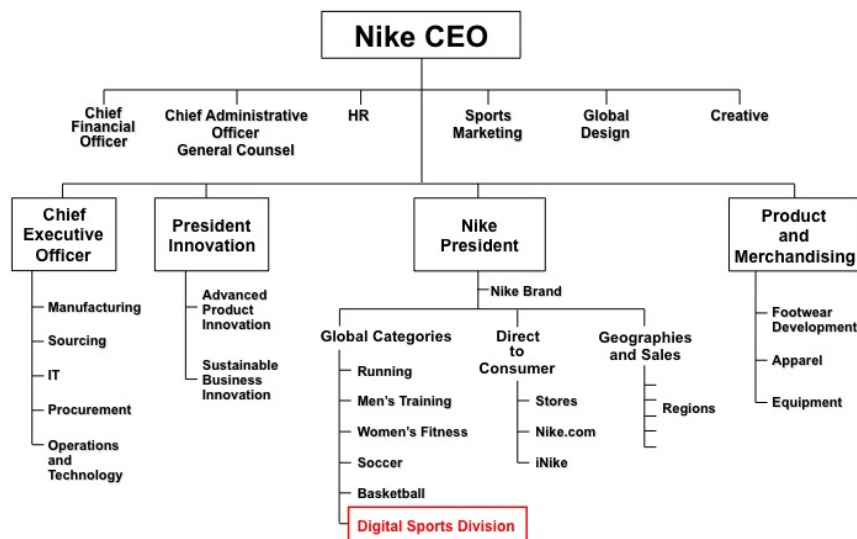

Fig. 3. Nike's Organization Structure (July 2013)

At the moment, the Digital Sports Division is small, but it may grow into a fifth dimension of strategy and organization. Digital Sports is not just an added product line; it is responsible for building digital capabilities in the other Nike units as well as growing its own revenue. It is similar to the Disney Interactive Division and the Bosch Software Innovation group. These companies are all following similar models of strategy and organization with respect to big data capability.

USING THE STAR MODEL TO ILLUSTRATE THE IMPACT OF BIG DATA

To summarize the impact big data has on an organization, I will use the Star Model (Kates & Galbraith, 2010) shown in Figure 4. I will describe how big data impacts each major element of an organization: strategy, people, structure, rewards, and processes.

Figure 4 shows that companies are adopting a dual strategy for implementing big data analytics capability. The first is to build a digital capability to make better and faster decisions, and to enhance existing products. Disney has developed a digital capability called Watch. Customers can sign up for Watch through their cable company. It will allow a viewer to watch any program from ESPN, the Disney Channel, and ABC on any device. The purpose

is to sell more advertising on these Disney channels. The second strategy is to use data and analytics to create insights and custom reports that can be sold to customers and become a new profit center. Bosch, for example, supplies electrical components on many automobiles. It can take data from anti-rollover software, engine controls, anti-lock braking systems, and other sensors, analyze them and offer insights to drivers about safety, maintenance, and so on. It can offer these insights to the car owners directly or through the automobile dealer.
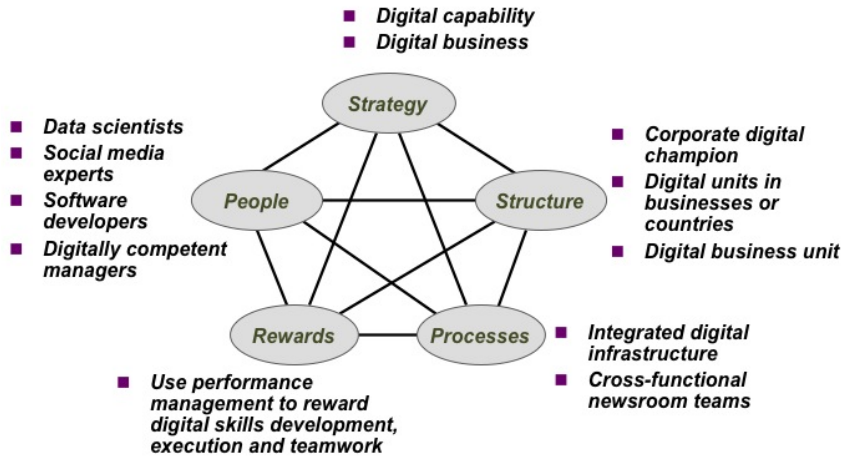

Fig. 4. Big Data's Impact on the Organization

In order to implement these strategies, companies must, of course, modify their organizations. Let's walk through the various changes that a company will have to make when it pursues a big data strategy. First, the company will need a champion for data and analytics on its leadership team. Whether it is a Chief Digital Officer (CDO), the CIO, or a digital division head, the digital leader needs to promote data as a strategic asset that can help grow the company and make it more successful. In addition, each business unit, customer segment, and country will need a digital unit to support its activities. Those digital units will report to both their respective profit center heads and the Chief Digital Officer. Such structural changes will constitute a shift in power to the digital units, and the company will need to rebalance its power structure and prepare for faster decision making. Finally, there will be a digital business unit (or group of business units) that will earn revenue and become a profit center. A new profit center and the subsequent matrix of digital capabilities will constitute a new dimension of organizational structure, much like functions, businesses, customer segments, and regions.

The aspiring big data company will also need to create information and decision processes to support the structure and strategy. First, the company will need to harness its information infrastructure to combine its various databases. For example, a bank will need to combine data from credit and debit cards, transaction accounts, mortgages, home equity loans, investments, and so on to paint a complete picture of a customer. Using this information, the bank can combine the data, perform analyses, and generate insights about financial trends among retirees, high net worth individuals, and Hispanic families with young children. Teams with representatives from the relevant product lines and functions (such as marketing and risk) can combine the bank's internal data with social network, customer relationship management, and other types of data and process them in real time. These teams are the equivalent of newsrooms or digital acceleration teams (DATs) as used by Nestlé. In all cases, the teams act on real-time insights to execute in real time.

In order to execute real-time decision processes, the organization needs the people and talent who are skilled in digital tools and who work effectively in teams. The human resource practices at Procter & Gamble are good examples. P&G has shifted its hiring practices to bring in digitally skilled experts, software developers, social media experts, and managers who are comfortable with quantitative decision practices. Each manager's progress is evaluated through the performance management system. In this way, the company can think holistically about the transition to the digital enterprise. The organizational change is not just

deciding whether the company needs a CDO or not. It requires changes in all elements of the Star Model, which are aligned not only with each other but with the company's environment as well.

CONCLUSION

Big data is often portrayed as a potential opportunity for business firms and other types of organizations. Firms skilled in the use of big data, however, are already using their analytics capability to create strong competitive advantages. Those firms are now making many important decisions in real time and are able to keep pace with the rapidly changing environments of the digital age. Their experiences can be instructive for other interested organizations because the organizational, managerial, and cultural changes required by a big data analytics capability are considerable.

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