

# Big Data Maturity: An Action Plan for Policymakers and Executives

BAHJAT EL-DARWICHE

VOLKMAR KOCH

DAVID MEER

RAMEZ T. SHEHADI

WALID TOHME

Booz & Company

The total volume of structured and unstructured data generated by individuals, enterprises, and public organizations is multiplying exponentially; 90 percent of the total data stored today is less than two years old.<sup>1</sup> So-called big data has the potential to improve or transform existing business operations and reshape entire economic sectors. It can also pave the way for disruptive, entrepreneurial companies and allow new industries to emerge.

## THE BIG DATA IMPERATIVE

If they are to capitalize on this potential, organizations should avoid a common misapprehension. Much debate has focused on the need to develop the technology to store and analyze the deluge of data that threatens to drown companies. Although this technology is indeed necessary, it is not sufficient to enable big data to be exploited fully.

Organizations must instead remold their decision-making culture so that senior executives make more judgments based on clear data insights rather than on intuition. They must build the necessary internal capabilities, deploying the technical and human resources to interpret data in an astute manner. Moreover, because they rely on governments to provide the requisite environment, they must ask policymakers to create the regulatory framework and information and communications technology (ICT) infrastructure to remove external obstacles.

We propose a Big Data Maturity Framework that is based on the experiences of organizations that have undergone a big data transformation. This framework will allow organizations to assess their progress in this arena and determine what they need to do to extract greater business and organizational benefits from the vast volume of data. The framework incorporates three elements: (1) environment readiness; (2) internal capabilities; and (3) the various, steadily more sophisticated, ways to use big data that range from increased efficiency in existing operations to a complete change in an organization's business model.

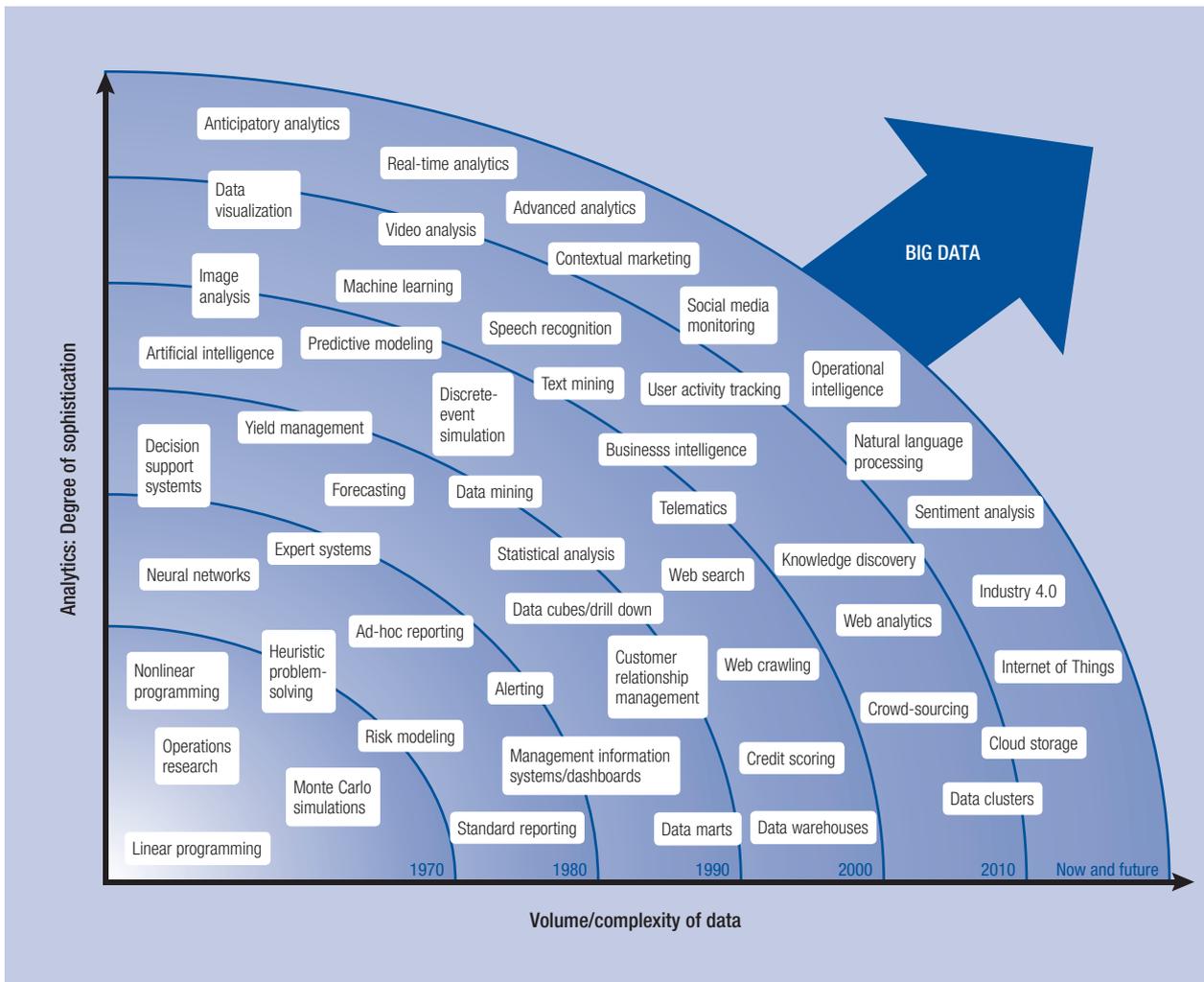
## WHAT IS BIG DATA?

Big data represents the newest and most comprehensive version of organizations' long-term aspiration to establish and improve their data-driven decision-making. It is characterized by what are known as the "three Vs"—large data *volumes*, from a *variety* of sources, at high *velocity* (i.e., real-time data capture, storage, and analysis). Besides structured data (such as customer or financial records), which are typically kept in organizations' data warehouses, big data builds on unstructured data from sources such as social media, text and video messages, and technical sensors (such

---

The authors wish to thank Dr. Andreas Deckert for his contribution to this chapter.

Figure 1: Evolution of data-driven decision-making



Source: Booz & Company.

as global positioning system, or GPS, devices)—often originating from outside the organization itself.

The magnitude and complexity of data being produced far exceed the typical capacities of traditional databases and data warehouses for the purposes of storing, processing, analyzing, and deriving insights. Usage statistics emanating from social media sites illustrate the sheer volume of unstructured data. For example, in 2012 Facebook reported that it was processing around 2.5 billion new pieces of content daily.<sup>2</sup>

Big data has the potential to infuse executive decisions with an unprecedented level of data-driven insights. However, research indicates that many organizations are struggling to cope with the challenges of big data. For example, in 2012 the Aberdeen Group found that the proportion of executives who reported that their companies were unable to use unstructured data, and who complained that the volume of data was growing too rapidly to manage, had increased by up to 25 percent during the previous year.<sup>3</sup>

### EVOLUTION, NOT REVOLUTION

Despite the rapid growth of big data, organizations should keep its influence in perspective. Although remarkable, the big data phenomenon is merely the continuation of a journey in which ever-more-elaborate data have influenced decision-making. From organizations' first attempts at data analytics in the 1960s and 1970s, this journey has proceeded through various stages, described by buzz words such as *data mining* and *business intelligence*, all of which sought to transform raw data into meaningful information for business purposes (Figure 1).

The latest development, big data, may appear all-enveloping and revolutionary. However, the essential principles for exploiting its commercial benefit remain exactly the same as they were in previous moves toward increased data-driven decision-making. Executives must harness this recent data explosion by focusing on carefully formulating the business questions that enable the swift and accurate identification of those nuggets of data that they believe can improve their organization's

performance or allow them to gain access to new revenue pools.

This continuation of a trusted managerial approach does not, however, imply an endorsement of inertia. Rather, organizations must foster a new decision-making culture to exploit the opportunities presented by big data and prepare their own internal capabilities to handle this new era. At the same time, they must encourage governments to nurture an environment conducive to the exploitation of big data.

### THE BUSINESS IMPACT OF BIG DATA

Many organizations are still in the early stages of reaping the benefits of big data. Writing in the *Harvard Business Review*, Andrew McAfee and Erik Brynjolfsson explored the impact of big data on corporate performance. The authors interviewed executives in 330 publicly traded companies in the United States. They then examined relevant performance data, enabling them to measure the extent to which corporate attitudes toward big data correlated with how the respective companies were faring.

McAfee and Brynjolfsson's conclusions were remarkable for establishing a connection between big data and performance: "The more companies characterized themselves as data-driven, the better they performed on objective measures of financial and operational results." The advantage gained by these companies over their rivals was also marked: "In particular, companies in the top third of their industry in the use of data-driven decision-making were, on average, 5 percent more productive and 6 percent more profitable than their competitors."<sup>4</sup>

Despite these findings, broad adoption of advanced big data practices has not yet materialized. A 2013 Gartner survey found that less than 8 percent of companies surveyed have actually deployed big data technology.<sup>5</sup>

Investment in forthcoming projects is much more widespread; the research firm IDC has forecasted that the market for big data technology and services will reach US\$16.9 billion by 2015, up from US\$3.2 billion in 2010. This represents a 40 percent annual growth rate, seven times the rate for the overall ICT business.<sup>6</sup> This trend is affecting all regions. For example, over 40 percent of chief information officers in the Middle East, according to IDC, are considering big data technology investment in 2013. Although few have actually undertaken large-scale big data or analytics programs to date, IDC forecasts investment in this area to grow at a compound annual growth rate of over 20 percent over the coming five years.<sup>7</sup>

Both expenditure and implementation vary substantially across regions, industries, and functional domains. For example, highly digitized industries such as telecommunications and travel still tend to spend substantially more on big data projects than the energy

sector, and there is far more implementation of big data initiatives in the United States than in the Asia Pacific region. Meanwhile, the Economist Intelligence Unit found that big data is most frequently enlisted to assist financial management and marketing/sales, and deemed least valuable in human resources management.<sup>8</sup>

### How big data is used

The big data maturity stages (Figure 2) depict the various ways in which data can be used, from selective adoption to large-scale implementation. Depending on the maturity of an organization's big data capabilities, big data can significantly increase top-line revenues and markedly reduce operational expenses. The path to business model transformation, the highest level of maturity, promises potential high returns but often involves major investment over many years.

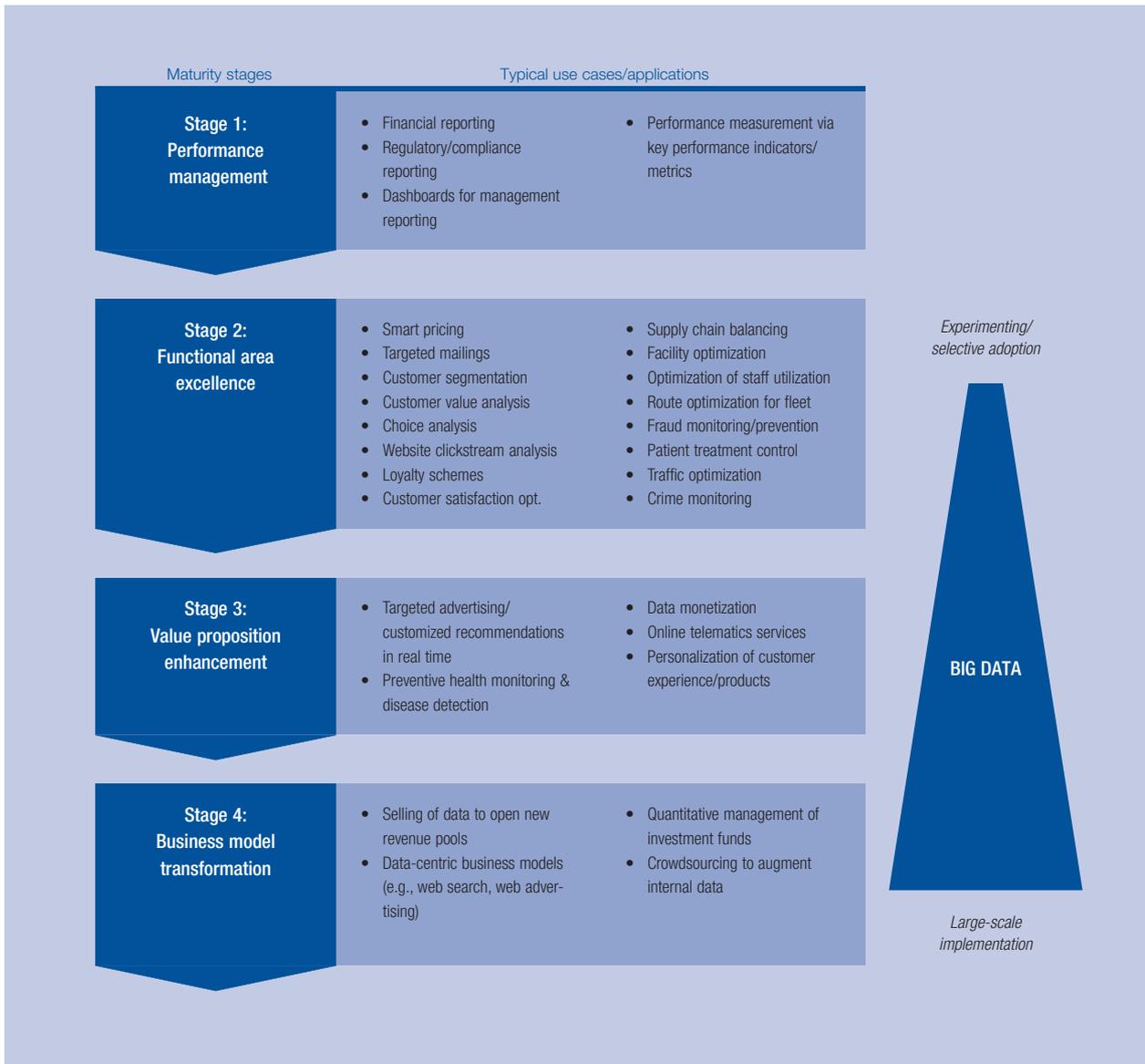
The first maturity stage, performance management, enables executives to view their own business more clearly through, for example, user-friendly management information dashboards. This stage typically relies on internal data, with an organization establishing key performance indicators (KPIs) to evaluate its success at achieving stated goals.

During stage 2, functional area excellence, organizations start to experiment with internal and external data to improve selected facets of their business. This may involve sales and marketing techniques such as customer segmentation and targeting, or entry-stage analytical methods for product recommendations. For example, one retailer analyzed data recounting the past purchasing behavior of individual customers in conjunction with the company's most recent sales to predict and recommend each customer's most likely next purchase. This resulted in a revenue increase of up to 5 percent, depending on the customer segment.

Advances in operational efficiency through big data, such as the efficient deployment of staff resources and the optimization of the supply chain, also reside within this maturity stage. Recent examples include a German car manufacturer that used real-time performance monitoring of production machinery to trigger a 20 percent increase in productivity. Each machine was tightly monitored to highlight downtime and plan around those production disruptions to optimize the utilization of the overall plant. In the public sector, a Canadian hospital observed previously unseen patterns in streaming data from monitoring of newborns, enabling detection of dangerous infections 24 hours before symptoms appeared.<sup>9</sup>

At the value proposition enhancement stage (stage 3), organizations start to monetize big data, positioning it as a value driver of the business that offers a new source of competitive advantage beyond the mere improvement of operations or services. In many instances this involves obtaining data from external sources and

Figure 2: Big data maturity stages and related use cases



Source: Booz & Company.

deriving insights from it. This may include innovations such as customized, real-time recommendations or the personalization of services to augment the customer experience.

For example, one leading European bank tailored its website content to trigger an increase of 12 percent in sales. After customers logged in, the bank presented one of several alternative websites based on the relevant individual’s transaction history and segment and the company’s overall product portfolio. The content was specific to the predicted needs of the customer to maximize sales potential.

Data-rich organizations, such as retailers or telecommunications companies, are better equipped than others to utilize their internally generated data in this way. For instance, a global mass merchant was

able to increase its profit per customer by 37 percent by applying advanced customer analytics, such as behavioral segmentation, to identify its best customers and provide them with personalized offers. The frequency of those target customers’ purchases rose by approximately 25 percent, and the average basket size increased by around 10 percent.

Another instructive case involved the US city of Los Angeles, which introduced demand-responsive pricing for parking. The city sets specific prices for hourly parking in each street, varying according to the time and day. These prices are based on in-depth choice modeling, fed with data from parking sensors, surveys, weather forecasts, information about holidays, local business activities, and other information. The goal is to reach a steadily high, but not excessive, utilization

of parking space at all times. The initial results are impressive. Although city parking revenues increased by 2.4 percent due to higher utilization, 60 percent of parking rates actually fell and congestion during peak hours decreased by 5 percent.<sup>10</sup>

In the final maturity stage, business model transformation, big data permeates the whole organization. It becomes deeply embedded within the operation, determining the nature of the business and the mode of executive decision-making.

This stage can be reached by both product and services organizations alike. One example of the latter involves the recent merger of the two large advertising companies Omnicom and Publicis. Their industry is moving away from the creative “Mad Men” approach, where a catchy phrase was the pinnacle of aspiration, toward a more science-based, data-driven business that aims to personalize ads. The ultimate goal is to deliver the right message to the right person at the right time. The Internet and mobile devices play a major role in this development. This new “ad tech” world will be dominated by those major players that possess the most comprehensive data about consumers and are thus able to understand them better—who they are, where they are, what they like, who their friends are, and so on. Omnicom and Publicis believe that their combined size will produce the desired volume of data.

General Electric (GE) provides a prominent example of a product organization placing great faith in big data. GE expects that machinery and equipment will soon be loaded with sensors, making in-depth status data available both in real time and across longer time spans. To be at the forefront of this development, GE is investing more than US\$1 billion in building up its data science capabilities to provide data and analytics services across business functions and geographies.<sup>11</sup>

Another showcase for the transformative potential of big data comes from the public sector. Regional and national-level policymakers around the world are launching “open data” initiatives, making data available to the public via integrated web portals and automated interfaces. Recent examples involve the United Kingdom and New York City.<sup>12</sup> Although originally conceived as a way of increasing the transparency of government decisions, the release of public data is an important environmental factor enabling organizations to use big data, creating novel applications and services.

However, some organizations do not have to progress through all the big data maturity stages. A data-driven business model has been integral to companies such as Google, Facebook, and Twitter, which have burst on to the scene in recent years and are introducing new technologies to capture the digital advertising market. Such companies actually started operations at the final stage. By doing so, they have prompted others to proceed through the earlier stages to keep up.

### Obstacles to progress

Despite widespread interest in data-driven decision-making in one form or another, companies face many potential pitfalls in extracting the maximum commercial benefit from big data usage. Some of these relate to their own internal systems and culture; others are tied to the external environment.

The most prominent obstacle is the shortage of available talent specializing in data analytics—data scientists with an advanced education in mathematics or statistics who are also able to translate raw data material into exploitable commercial insights. Although many educational institutions have now started to establish courses to address this scarcity, the market demand is already considerable.

Many organizations also suffer from poor-quality data that are fragmented across various systems, geographies, and functional silos. Embracing the potential of big data as a concept will take organizations only so far. First and foremost, they must get the basics right. Internal data has to be of high quality—consistent, accurate, and complete—and available across the organization.

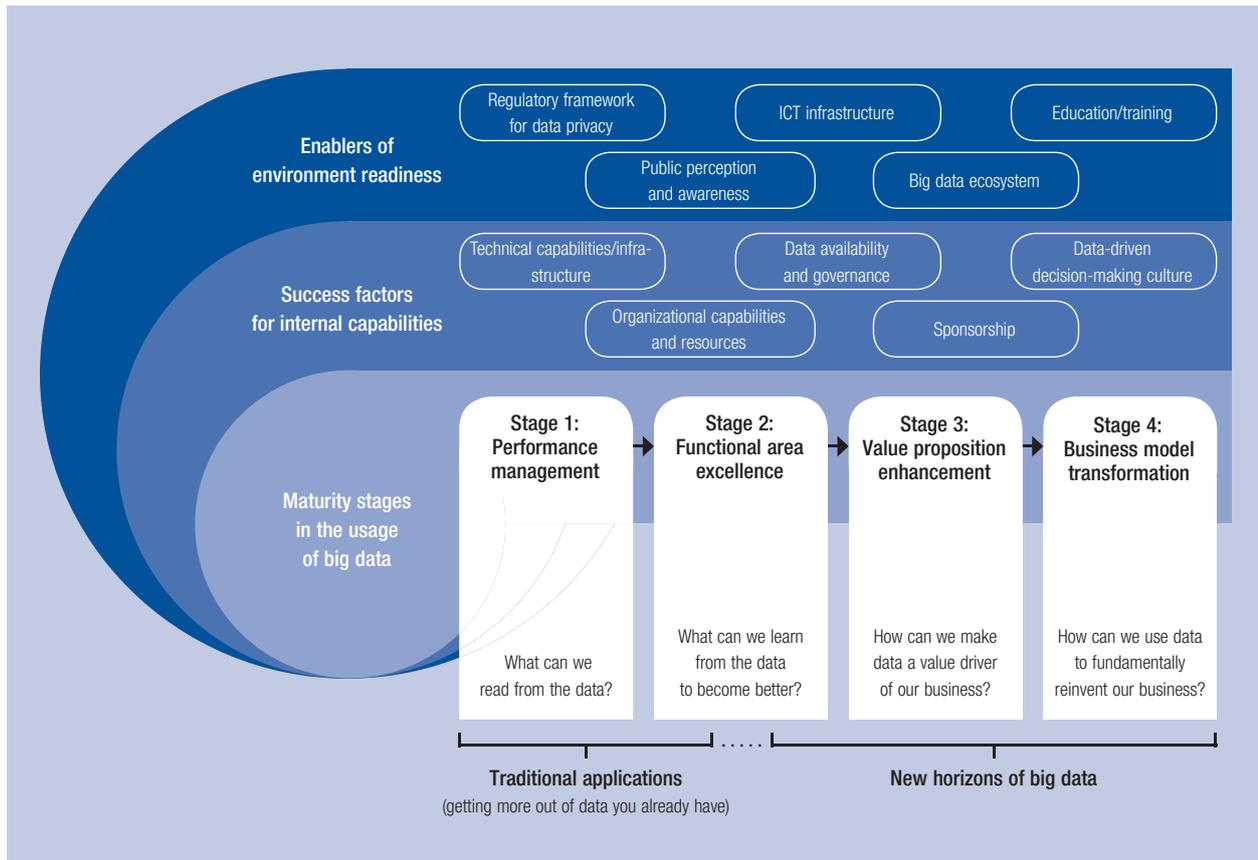
The prevailing decision-making culture presents a major internal obstacle—the one that is the least straightforward to identify and then overcome. To complicate matters, changing this culture may impinge on personal concerns relating to status. Companies and public institutions typically rely on the intuition of senior managers for important decisions. As big data extends its reach, executive instinct is challenged by the facts of hard data. However, while data can be of great assistance in solving an actual problem, it still holds true that senior management has to ask the right questions.

Many of the external challenges that companies face revolve around data privacy considerations. For example, very specific details of an individual’s lifestyle preferences and buying habits are now captured and analyzed by companies through their own websites or by monitoring social media. These details are all collected without that person’s explicit consent, leading to significant public reservations about big data. Such concerns about privacy will strengthen demands for tighter regulatory control, potentially limiting companies’ ability to exploit big data opportunities or exposing them to threats of legal and regulatory intervention.

### HOW TO REACH BIG DATA MATURITY

Our big data maturity framework (Figure 3) comprises three elements: the enablers of environment readiness, the organization’s internal capabilities, and the different stages of maturity and sophistication in which big data can be used. The framework enables organizations to view the extent of their success in overcoming obstacles, and identifies what more can be done to promote big data maturity and reach the desired destination.

Figure 3: Big data maturity framework



Source: Booz & Company.

The environment readiness dimension considers how far the relevant governments have enabled organizations in their jurisdiction to use big data freely and productively. This is achieved through appropriate regulations and a supportive infrastructure.

The organization’s internal capabilities dimension sheds light on a company’s readiness to execute big data. By building up these capabilities and integrating them effectively, organizations move further along the path of data-driven decision-making and position themselves to extract greater benefits from big data.

While environment readiness serves as an enabler for big data usage, internal capabilities act as critical success factors for organizations seeking to progress through the maturity stages.

The following two sections explain the full range of actions that governments and organizations need to undertake and which of these take precedence.

**Environment readiness: Priorities for policymakers**

Big data will soon become ubiquitous practice in both the public and private worlds. Policymakers therefore need to act in a timely manner to promote an environment that is supportive to organizations seeking to benefit from this inevitable progression. Failure to develop comprehensive environment readiness carries

the risk of losing competitive advantage vis-à-vis other countries.

Policymakers must therefore:

- formulate a vision for the usage of data consistent with the public interest, fostering a common understanding with citizens and obtaining their buy-in;
- enable a big data ecosystem by establishing policies to facilitate valid business models for third-party data, service, and information technology system providers; and
- speed and scale up the education of talent to address the likely significant shortage of talent with the requisite skills to leverage and handle big data—from both a business and an IT perspective, potentially in public-private partnerships (PPPs). Such PPPs can avoid having students in tailored university programs graduate with outdated learning by fostering and exploiting private contributions to the educational agenda. PPPs can involve public sponsorship of private education programs, and private support for university education in terms of knowledge transfer and financial endowments.

Priorities for policymakers will vary in different parts of the world. Developing countries, for example, will concentrate on building up the required ICT infrastructure and education programs to prepare for large-scale demand from organizations intent on using big data. In more developed countries, however, the government's primary concerns should be ensuring transparent regulation and promoting a public-interest argument for big data.

### **Policymakers must make the case for big data**

In particular, policymakers should set clear rules regarding data privacy so that organizations know which personal data they can store and for how long, and which data are explicitly forbidden by privacy regulations.

If the scope of permissible data is to expand, skeptical citizens must first be persuaded that big data will work in their favor by paving the way for better products and services. Forward-thinking governments will initiate and inform this public debate about the benefits of big data. Indeed, Jules Polonetsky and Omer Tene, in their *Stanford Law Review* article (2013), argue that finding the right balance between individuals' legitimate privacy concerns and the overall rewards offered by big data practices may be the greatest contemporary public policy challenge.<sup>13</sup>

The outcome of this debate will vary depending on the country. Cultural factors will have a strong bearing on the decision about the right level of data privacy in any given country, and this decision will result in a regulatory regime appropriate for citizens and organizations. On a regional level, groups such as the European Union allow possible harmonization of data privacy regulation across borders, given that the constituent countries may share attitudes on this issue.

### **Policymakers should promote harmonization**

On a global level, though, no binding agreement to harmonize regulation around data privacy currently looks likely in the short to medium term. Because countries have legitimate differences on this issue, this lack of harmonization threatens the adoption of big data on an international scale.

The prevailing patchwork situation accentuates the lack of clarity on lawful data usage—especially the question of which jurisdiction holds sway for certain cross-border cases. For example, if data are owned by a company in the European Union, but hosted on servers in the United States, which privacy law applies? Legal inconsistency between countries can even inhibit free commerce across borders. This problem arises, for example, when an organization plans to outsource data operations to a foreign provider, yet some personal data are prohibited from being transferred out of the country concerned.

The Organisation for Economic Co-operation and Development (OECD) *Guidelines on the Protection of*

*Privacy and Transborder Flows of Personal Data*, which were revised and updated in 2013, may represent a practical step in the direction of harmonization.<sup>14</sup> In the absence of binding rules, a common understanding for data privacy and data protection regulation on the basis of guidelines and recommendations from a high-profile international organization is the most sensible option currently available.

The OECD guidelines follow a best-of-breed approach. They formulate basic principles around the limitation of collection of personal data, the specification of the purpose of data collection, the protection of collected data, the prevention of data loss or unauthorized access, and the right of individuals to obtain information about collected data. The guidelines have in the past influenced national legislation, including privacy acts in Australia, Japan, Mexico, and New Zealand. We encourage both OECD members and non-members to review and adopt those basic principles and recommendations to establish common ground.

### **An organization's internal capabilities: Priorities for executives**

There is no general rule dictating how organizations should navigate the stages of big data maturity. They must each decide for themselves, based on their own situation—the competitive environment they are operating in, their business model, and their existing internal capabilities. In less-advanced sectors, with executives still grappling with existing data, making intelligent use of what they already possess may have a substantial impact on decision-making.

The main priorities for executives are to:

- develop a clear (big) data strategy;
- prove the value of data in pilot schemes;
- identify the owner for “big data” in the organization and formally establish a “Chief Data Scientist” position (where applicable);
- recruit/train talent to ask the right questions and technical personnel to provide the systems and tools to allow data scientists to answer those questions;
- position big data as an integral element of the operating model; and
- establish a data-driven decision culture and launch a communication campaign around it.

### **Quick wins**

Organizations should resist expensive upfront infrastructure investments for overly ambitious big data projects. Instead, they should select opportunities for high business impact and adopt pilot schemes that also allow for periodic refinements along the way.

Seeking out proprietary data that can be immediately exploited for commercial gain may provide

one such quick win. For example, a mobile phone operator can collect anonymized real-time travel patterns, which are of value for navigation system operators that want to provide up-to-date traffic information to their customers.

### Help from outside

External data providers can offer all types of data to organizations and can therefore complement existing data-gathering efforts. Typical datasets offered by external providers include contact, lifestyle, and demographic information on (market segments of) individuals. Social media platforms are also demonstrated to be great sources of relevant big data—for example, for sentiment analysis (to determine the voice and desires of the consumer) or for personalizing product offerings. In addition to sourcing data from outside the organization, the selective use of external analytics service providers can also prove instrumental in establishing big data maturity quickly, while potentially training employees to take on these tasks themselves.

### CONCLUSION

We currently see big data as poised to have significant impact in public and business spaces alike. Large-scale investment is flowing into establishing big data capabilities in many organizations, despite the limited number of cases in which it has been successfully used in completed projects and initiatives. Decision makers already acknowledge the future influence of data-driven decision-making.

However, organizations confront vast differences in their ability to utilize big data to good effect, as seen in their stages of big data maturity. These differences range from adopting big data practices for operational improvement in selected functional areas or building or revamping an organization's value proposition to completely transforming their business model based on big data. At the more advanced stages, organizations learn to monetize big data far beyond simply getting better at what they are currently doing; learning this lesson is an accomplishment that can mean a fundamental shift for them. Environment readiness plays a pivotal role in enabling such success, because its effect is far greater than the evolution of individual organizations' internal capabilities and usage levels of big data.

Nonetheless, policymakers and organizations in general still have much to do if they want to realize the full potential of big data. For their part, governments throughout the world need to create a supportive environment for the usage of big data to attract business to their region. Meanwhile, organizations must act in a timely manner to determine how they can most effectively deploy big data. They will have to predict what the world of data-driven insights will look like in the

medium term, anticipate which trends will lead there, and position their organization accordingly.

Within the next five years, big data will become the norm, enabling a new horizon of personalization for both products and services. Wise leaders will soon embrace the game-changing opportunities that big data affords for their societies and organizations, and will provide the necessary sponsorship to realize this potential. Skeptics and laggards, meanwhile, look set to pay a heavy price.

### NOTES

- 1 IBM, no date. "What Is Big Data?"
- 2 Constine 2012.
- 3 Aberdeen Group 2013.
- 4 McAfee and Brynjolfsson 2012, p. 6.
- 5 Gartner 2013.
- 6 The New York Times 2012.
- 7 ITP.net 2013.
- 8 The Economist Intelligence Unit 2013.
- 9 This chapter contains examples from many clients whose identities are not stated due to confidentiality reasons.
- 10 Munford 2013.
- 11 Catts 2012.
- 12 In the UK, the initiative is available at <http://data.gov.uk/>; in New York City it is available at <https://data.cityofnewyork.us/>.
- 13 Polonetsky and Tene 2013.
- 14 OECD 2013.

### REFERENCES

- Aberdeen Group. 2013. "Big Data Trends in 2013," February 1. Available at <http://www.aberdeen.com/Aberdeen-Library/8244/RA-big-data-trends.aspx>.
- Catts, T. 2012. "GE's Billion-Dollar Bet on Big Data." *Bloomberg Businessweek*, April 26. Available at <http://www.businessweek.com/articles/2012-04-26/ges-billion-dollar-bet-on-big-data>.
- Constine, J. 2012. "How Big Is Facebook's Data? 2.5 Billion Pieces of Content and 500+ Terabytes Ingested Every Day." *Tech Crunch Conference Highlights*, August 22. Available at <http://techcrunch.com/2012/08/22/how-big-is-facebooks-data-2-5-billion-pieces-of-content-and-500-terabytes-ingested-every-day/>.
- The Economist Intelligence Unit. 2013. "The Evolving Role of Data in Decision-Making." Available at <http://www.economistinsights.com/analysis/evolving-role-data-decision-making>.
- Gartner. 2013. "Survey Analysis: Big Data Adoption in 2013 Shows Substance Behind the Hype." Available at <http://www.gartner.com/id=2589121>.
- IBM. No date. "What Is Big Data?" Available at <http://www.ibm.com/big-data>.
- ITP.net. 2013. "DWTC to Highlight Big Data at GITEX: Event Organiser to Host First Ever Big Data Conference on October 22," September 29. Available at <http://www.itp.net/595102-dwtc-to-highlight-big-data-at-gitex#UkrZ9oasiSo>.
- McAfee, A. and E. Brynjolfsson. 2012. "Big Data: The Management Revolution." *Harvard Business Review*, October. Available at <http://hbr.org/2012/10/big-data-the-management-revolution>.
- Munford, M. 2013. "Don't Follow the Leaders, Watch the Parking Meters." *The Daily Telegraph*, September 15. Available at <http://www.telegraph.co.uk/technology/news/10307926/Dont-follow-leaders-watch-the-parking-meters.html>.

*The New York Times*. 2012. "IDC Sizes Up the Big Data Market," March 7. Available at [http://bits.blogs.nytimes.com/2012/03/07/idc-sizes-up-the-big-data-market/?\\_r=0](http://bits.blogs.nytimes.com/2012/03/07/idc-sizes-up-the-big-data-market/?_r=0).

OECD (Organisation for Economic Co-operation and Development). 2013. *OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data*. Available at <http://www.oecd.org/internet/ieconomy/oecdguidelinesonthe-protectionofprivacyandtransborderflowsofpersonaldata.htm>.

Polonetsky, J. and O. Tene. 2013. "Privacy and Big Data: Making Ends Meet." 66 *Stanford Law Review* 25, September 3. Available at <http://www.stanfordlawreview.org/sites/default/files/online/topics/PolonetskyTene.pdf>.