

Big Data in the MENA Region: The Next Path towards Socio-economic and Cultural Development

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Abstract:

As elsewhere, big data is perceived as central to the Middle East and North Africa (MENA) nations' socio-economic and cultural development. The Gulf Cooperation Council (GCC) region, by virtue of its advanced information technology infrastructure, relevant knowledge economy policies and flexible free government and market orientations, stands at the forefront of MENA's big data integration. This article discusses selected sectors in the GCC region that leverage the power of big data including the media business industries and the oil and gas industry. The authors argue that in addition to bolstering big data applications in the aforementioned sectors, MENA countries also need to ensure that those applications embrace other sectors like education, government services and cultural development. Yet, to be able to achieve those goals, the region needs to address numerous challenges pertaining to knowledge infrastructure, human capital, technology mindset and regulation.

Keywords:

big data, Middle East

Introduction

Around the world, big data is viewed as a unique technological opportunity for businesses and governments to fully harness the power of analytics in order to optimize decision-making outcomes. In the Middle East and North Africa (hereinafter MENA) region, big data holds big promises for development across multiple sectors, but it simultaneously poses threats and challenges. Academic work on big data adoption in the Arab region is scarce. This article addresses this shortage and adds to the conversation about big data opportunities and challenges. Using the case study approach, this work discusses examples of big data adoption in key sectors of the studied region.

Literature review

In its basic configuration, big data describes the exponential growth and availability of data that traditional data-processing applications are no longer able to handle (Schönberger and Cukier 2013). Big data refers to “things one can do at a large scale that cannot be done at a smaller one, to extract new insights or create new forms of value, in ways that change markets, organizations, the relationship between citizens and government, and more” (Schönberger and Cukier 2013:6). Generally speaking, the end goal of big data business is to turn a wide range of data sources such as call logs, mobile banking transactions, online user-generated content, online searches, and satellite images into actionable information. By harnessing complex computational techniques, big data users aim to pinpoint trends and patterns within and between extremely large socio-economic datasets. For example, it has been widely argued that real-time awareness of population status and of feedback on the effectiveness of policy actions “should in turn lead to a more agile and adaptive approach to international development, and ultimately, to greater resilience and better outcomes” (Global Pulse 2012:6).

In this article, the authors argue that big data technology carries huge potential that can be leveraged to significantly enhance human development and sustainability. As noted by the UN Global Pulse initiative, at the most general level, when properly analyzed, big data “can provide snapshots of the well-being of populations at high frequency, high degrees of granularity, and from a wide range of angles” (2012:6); thus, it contributes to narrowing knowledge gaps within shorter time frames. Four dimensions of big data, known as the *four Vs*, are identified: volume, velocity, variety and veracity. Charles and Gherman (2013:1071) argue that in addition to the four Vs, one should consider three other factors. The first is “the ability to understand and to successfully respond to the new challenges posed by the massification of Internet access,” the second is “connectedness,” and the third is the ability “to understand data in its wider context and within its ethical implications; and the skills to survive and thrive in the face of complex data.”

In their analysis of the semantics and metaphors of big data, Puschmann and Burges (2014) note that the genesis of big data was in the business realm; first, the data discourse evolved from faster search results and the storage of large volumes of customer data into predictive modeling of be-

havior. Then, the framing in the media of big data evolved; big data now “suggests a shift from relational database management systems to platforms that offered long-term performance advantages over traditional solutions” (Puschmann and Burges 2014:1694). The World Economic Forum’s report on big data (2012) notes the new potential of translating this data into information that leads to actions and responds to the needs of populations, especially low-income groups.

Despite this euphoria about big data, the technology has also generated substantive critical reactions around the world. Mosco (2014) suggests that big data and cloud computing are harnessed by big corporations to consolidate more control over national and global markets. He notes that the key big data players define our knowledge about the changing face of human life by giving peculiar interpretations of data analytics and controlling our access to the cloud. The UN Global Pulse report (2012) notes that big data brings with it new challenges relating to privacy and information access and sharing. Boyd and Crawford suggest that

Big Data triggers both utopian and dystopian rhetoric. On one hand, Big Data is seen as a powerful tool to address various societal ills, offering the potential of new insights into areas as diverse as cancer research, terrorism, and climate change. On the other, Big Data is seen as a troubling manifestation of Big Brother, enabling invasions of privacy, decreased civil freedoms, and increased state and corporate control. (Boyd and Crawford 2012:663-4).

In addition to bringing up a potential for false discoveries, big data also creates a data-rich and data-poor societal divide that has serious implications for social justice and equality.

Big data has been investigated in diverse contexts, including geographic representation (Kitchin 2013), occupy protests and resistance (Agarwal et al. 2014, Margetts et al. 2016), healthcare (Boyd and Crawford 2012) and corporate and consumer advertising and media industries (Couldry and Turow 2014).

Research questions and methodological approach

The media discourse about big data in the MENA region echoes cele-

bratory tones of empowering and “transformative” technologies that hold promise for the Arab World. However, this euphoric mass-mediated tone appears not to be widely reflected in the region’s academic research in different fields, including communication studies. This paper addresses this shortage by discussing how the MENA region and the Gulf Cooperation Council (hereinafter GCC) countries in particular are taking advantage of the value created by big data in various sectors.

The paper explores the promise of big data in a selection of GCC countries where skills, education, culture and policies vary from those in other countries where this discussion about big data first emerged. The paper addresses the following research interrogations:

- To what extent does the ICT infrastructure in the MENA region enable the development of big data in a way that it creates value?
- How are the early adopter industries in the region, media businesses and oil and gas industries, aware of and taking advantage of the developments in the field of big data?
- What are the opportunities and challenges big data brings to the socio-economic development of the region?

To answer these questions, we use the case study approach and argue that big data presents the MENA region with ample opportunities to harness the power of knowledge to bring about sustainable socio-economic and cultural development. Information derived from reports by the International Telecommunication Union (hereinafter ITU), the International Data Corporation (hereinafter IDC), the McKinsey Group, and Booz and Co. are used in this study to describe information and telecommunications diffusion rates and big data adoption levels in the region. While the article describes the information technology landscape across the MENA region, its analysis focuses on selected initiatives in big data deployment in the six GCC nations, which enjoy a world-class IT infrastructure, progressive free-market orientations and visionary government approaches to development.

We find the case study approach most appropriate because we aim to better understand the phenomenon at hand. Leslie (2010:109) argues that researchers opt to use case studies when “the case itself is of interest.” We

chose two cases. The first is the media business industry because, based on preliminary non-systematic discussions with professionals and in line with Puschmann and Burges' (2014) findings discussed above, we found that this industry is where the discussions about big data are currently happening in this region. We also chose the oil and gas industry because of its importance in the region and its impact on development, which are both unquestionable characteristics; indeed,

[t]he data generated by oil and gas facilities can be used for more than optimizing a nation's energy output. It is also ammunition in an invisible war. Some of the most leading powers in the world are planning the battles and vital industries, such as oil and gas, are on the front line. (Salisbury 2012:27)

Thus, improvements in the business of the oil and gas industry are expected to impact the nations and the region alike.

We collected our insights from conversations with professionals in the media, advertising and banking industries, from attending regional conferences about big data (for example, 2014 GITEX Big Data conference), and from examining second-hand data and published articles in the regional specialized press. We have organized the data collected in light of the subject of our investigations: the technological readiness of the region to embrace and take advantage of big data, the current applications of big data in major regional industries and the opportunities and challenges of big data for development.

MENA IT infrastructure and readiness for big data

According to Zawya.com (2014), the big data market value in the MENA region was USD 135.7 million in 2013, and it is expected to grow in the GCC countries to USD 635.5 million by 2020, the highest in the region. This could be explained by the fact that the GCC region enjoys the strongest ICT infrastructure in the MENA region thanks to its natural and economic resources, which enabled oil-rich countries to invest in connectivity and speed well ahead of the other countries in the region. While the oil-resourceful Arabian Gulf countries have implemented a highly enabling infrastructure with high-speed Internet and 4G bandwidth, only recently

have countries in the rest of the region that are less populous, less resourceful, or conflict zones approached the global average connectivity rates and implemented a functional IT infrastructure. ITU indicators such as the penetration rate, readiness index, broadband rates, and e-government development index often rank GCC countries ahead of the rest of the countries in the region, as highlighted in the graphs and discussion below, and even ahead of the rest of the world.

In 2014, the average number of households that had access to the Internet in the Arab states was still lower than the world average (36 percent vs. 43.6 percent). Despite the high connectivity rates in the Gulf countries by 2015, this average was still pulled down by low connectivity in some countries such as those in conflict zones – for instance, Libya or Iraq, and Algeria – with 19.2 percent penetration in 2015, as the *Figure 1* below shows.

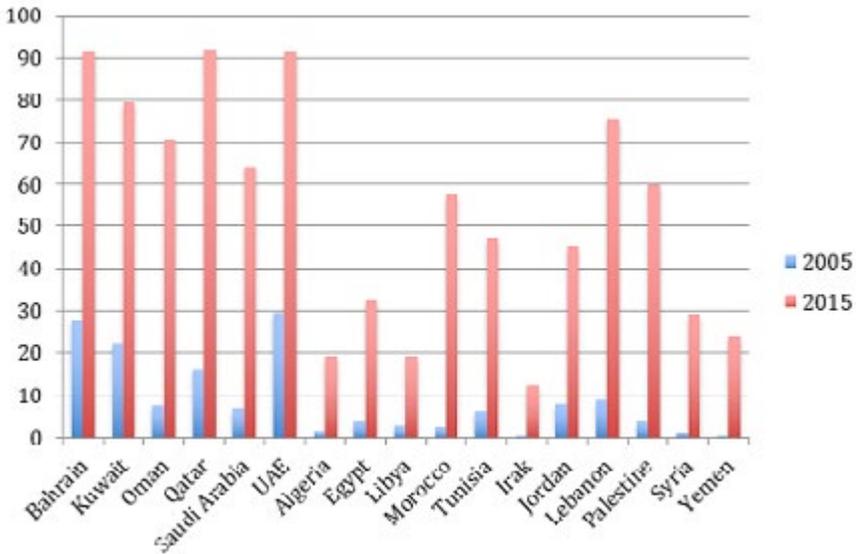


Figure 1. Internet Penetration Rates (%) 2005–2015. Source: Internet Society (2015).

Arab Internet users access the Internet either from home (with an average of 93 percent of users) or from work/school (72 percent; Broadband Com-

mission 2015). This is true regardless of the region. However, GCC residents are much more likely to have access to the Internet when on the move than the rest of the Arab countries. According to the Broadband Commission (2015), when on the move, 62 percent of GCC residents access the Internet, whereas 44 percent of those in North African countries do. Overall, wireless broadband subscriptions are relatively high in the region, while fixed broadband subscription are still under 10 percent for all countries in the region, except Bahrain and the UAE with 13 percent. In 2014, Kuwait, Bahrain and the UAE are ranked third, fifth and tenth worldwide for their mobile broadband subscriptions with 139.8, 126.2 and 114 per 100 capita, respectively (Broadband Commission 2015:88).

The mobile subscription rates are quite high throughout the region, whereas the broadband subscriptions on mobiles reach peak levels in the GCC but are still modest in the rest of the region, as *Table 1* below shows. Tablet ownership is also high in the GCC (77 percent, compared to 33 percent in North Africa); the same is true for game consoles (62 percent ownership in the GCC vs. 36 percent in North Africa).

Country	HH with computer	HH with Internet access at home	Mobile cellular subscription	Mobile broadband subscription
Algeria	26	23.8	102	0
Bahrain	93	82	165.9	109.7
Egypt	43.1	34.5	121.5	31.1
Iraq	24.6	15.6	96.1	Unavailable
Jordan	58.7	44.9	141.8	16.1
Kuwait	83.9	71.1	190.3	Unavailable
Lebanon	87.9	66.2	80.6	41.8
Libya	19.1	15.9	165	Unavailable

Country	HH with computer	HH with Internet access at home	Mobile cellular subscription	Mobile broadband subscription
Morocco	47	46	128.5	15
Oman	82.9	80.1	154.6	67.3
Palestine	51.4*	30.4*	95.7*	Unavailable
Qatar	97.2	96.4	152.6	76.8
Saudi Arabia	72.6	72.7	176.5	49.5
Syria	45.3	39.4	56	3
Tunisia	25.4	18.2	115.6	26.1
UAE	90.2	76.1	171.9	89
Yemen	5.6	4.7	69	0.2

Table 1. MENA countries’ connectivity profiles (2013).

Source: www.pcbs.gov.ps (2012-2013).

The ITU report (Nov., 2014) identifies the UAE, Oman, and Qatar as the most dynamic countries in terms of improvements in their ICT development index. The ICT divide between the GCC and the rest of the Arab states suggest the greater readiness of the former to use and exploit big data than the latter. The wireless transfer of data from devices such as cameras or sensors enables the rapidity and efficiency of operations but is contingent on good connectivity and high-speed Internet.

The estimated value of the MENA region cloud market from 2014 to 2018 is \$4.7 billion, with the business product growth rate approaching eight percent through 2018, according to both Gartner and Cisco (Chibber 2014). In 2014, the public cloud services market grew by 23 percent from 2013 with a market value of \$629 million (up from \$511 million in 2013). Cisco

estimates that MENA will possess the world’s highest cloud traffic rate by 2018 (moving up to 262 exabytes in 2018 from 31 exabytes in 2013) thanks to the high rates of mobile and smartphone ownership per user. According to Mckinsey Global Institute (2011), the Middle East is said to have stored more than 200 petabytes of data by 2010, compared to 250 in China, 400 in Japan and 2000 in Europe.

Companies see in technology investments the potential for business efficiency and performance. They find appealing both high Internet speed and high connectivity both at home and on the move as they enable a good on-line consumer experience and set good grounds to get in touch with a large pool of prospects and consumers. Social media in particular have enabled reaching out to a large number of prospects; for instance, more than 20 million users visit Facebook on a daily basis in the MENA region. Technology enthusiasts consider that thanks to big data, companies are well tooled to offer users targeted commercial offers, update them about relevant products, or offer them better services. Collecting information and analyzing users’ navigation habits, understanding online behavior, and predicting consumption patterns help marketers make informed decisions and improve their results. Big data not only provides information about these navigation habits but also ultimately helps improve private and public sectors’ targeting, decision-making and security initiatives, as GCC business leaders agree (*Table 2* below).

Big data gives rise to	Qatar (%)	Saudi Arabia (%)	UAE (%)
Better decision making	85	88	86
Competitive edge	44	57	45
Preventing, identifying cyber attacks	74	73	67

Technology investment leads to reaching goals	77	86	86
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Table 2. GCC business leaders’ perceptions of big data. Source: Schmarzo 2014.

There is, however, a struggle among CEOs and company leaders, some of whom recognize that they do not know how to collect big data (54 percent) or analyze and make sense of big data (85 percent; Schmarzo 2014).

A number of industries have shown interest in big data and increased their efficiency by using big data. The oil and gas industry, for instance, as will be discussed in the next section, reported accident reduction, more accurate anticipation of production levels and better rationalization when they adopted big data analytics. We also chose to discuss media and its business-related industries, such as ecommerce, because of the attention given to these sectors in recent years in the region and because of the anticipated growth in these sectors. This is also an industry where the discussions about big data are most prevalent.

Case studies

Big data in media business industries

In the context of media,

Big Data strategies can include audience analytics to enable a better understanding and targeting of customers; tools to understand public and private databases for journalistic storytelling; tools to manage and search the exploding amount of video, social media and other content; tools to target advertising, and ad campaigns; tools to automate the production of text and video stories, tools to identify waste and enable efficiencies; and much more. (Stone 2014:1)

With big data, media companies can engage the audience with better targeting of news, content and advertising. Data enables the production of targeted text, video, audio, infographics, advertising messages, promotions and all interactions pushed towards users. The World Economic Forum re-

port (2012) shows that marketing and sales are leading with regard to the usage of Web 2.0 tools; almost 80 percent of marketing functions use social networking tools. It is thus expected that big data would have an impact on the business of marketing.

There are about 4.5 million online buyers in the MENA region, mainly spread across Saudi Arabia, Egypt, Kuwait, and the UAE, which alone counts 3.6 million. Ecommerce is still considered young, as it represents only 0.4 percent of the regional retail market; its value is expected to grow to 1 percent, or \$11.3 bn, by 2019, according to Euromonitor (Dudley 2014). The largest ecommerce market is Saudi Arabia, followed by the UAE, which accounts for about 20 percent (\$387 million) of the region's spending. Whereas Saudi Arabia's population size drives its growth, the UAE growth is driven by per capita spending and mobile shopping adoption. In 2013, Saudi Arabia ecommerce valued \$504 million, a quarter of all money spent online. The increasing smartphone penetration rates are expected to propel ecommerce in the region.

The rich profusion of data is threatening and disturbing. Businesses know they can have access to a tremendous quantity of raw data, but they get value only from analyzed and processed information. Only meaningful data can inform brands and businesses about purchase behavior, credit card payments, web searches and mobile usage. For marketers and advertisers, big data enables understanding consumer behavioral patterns but most importantly predicting users' behaviors. It also helps communicate brand messages based on locations, interests, browsing habits and demographics, among other things. Telecom operator Du, for example, launched Smart Insights, a technology that tracks people's movement throughout the city of Dubai on their smartphones. The data is meant to be of use to retailers interested in mobility patterns to attract and target consumers and prospects (Communicate 2015).

Companies are also collecting information about audience responses, such as comments on brands, likes and other sentiment analyses, made possible by algorithms and brand neuroscience. Brand stories can be tweaked and adjusted to consumers' response dynamically and in real time. Thousands of variations of an ad are currently possible in digital marketing. Karine Barakat, a Dubai-based advertiser explains,

Data makes us smarter as advertisers. It allows us to reach our consumers more effectively and tells us the best context to deliver a message. This automatically increases the level of engagement with our core audiences. (...) Today we have more precise and factual insights (...). We think more of real-time/agile solutions, as we understand the evolution of behavior in specific time, occasion and circumstances. (Gulf Marketing Review 2014:34)

Omnicom Media Group has experimented with simulations in their planning system to predict consumer behavior. For instance, Annalect Group MENA says they have modeled diffusion of word of mouth into society in the UAE and predicted its impact on brand awareness. Another initiative is to predict the effectiveness of interactions across social media and paid media to understand the social multiplier effect (Gulf Marketing Review 2014).

Data brokers and “third-party” data collectors sell users’ online navigation patterns to companies. Users leave traces of their demographics and psychographics on social media and other websites or applications that require subscriptions and sign ups. Data specialist firms compile the information collected across multiple user devices and pack them in sellable formats to brands and companies that repack their offerings and tailor their messages to the most lucrative targets.

Some financial institutions have started building marketing data literacy skills and creating a data-driven culture. In Qatar, Al-Rayyan Bank, for instance, is training its end users on business reports to obtain maximum benefits. Key performance indicators (hereinafter KPIs) have been set for all the teams, department, products and branches, according to our source, Al-Rayyan Management Information System Analyst. Different kinds of KPIs for different kinds of customers help identify loyal customers and engage them for further product penetration. Big data analytics help identify loyal customers, find “influencers” among those loyal customers, and engage these influencers with exclusive events and opportunities. The same source says that big data is also used to maximize customer lifetime value and to drive growth. Internal business intelligence and analytics community and competency centers ensure a higher return on investment (ROI) from technology investment, as knowledge sharing becomes a corporate practice across the

bank.

Users interaction in blogs and social media, transactional data, foot traffic, as well as online searches and activities enable banks business intelligence units to identify the correct information, reduce profiling errors and hence make a tailored business decision to satisfy clients' needs. Using text mining and analyzing feedback to enhance the customer experience are possible thanks to information gathering and treatment, which help improve retail banking operations throughout branches and different channels. Some argue that the Internet of things will become the largest application of big data. Everyday objects will learn users' habits, send predictions, make personalized recommendations and add value in users' experiences with brands and products (Campaign Middle East 2016).

Big data in the oil and gas industry

The Middle East is known as the world's largest oil-producing region and top oil exporter. Despite problems in Syria and Iran that have impacted production levels, the Middle East has maintained this top position. The natural gas production grew by almost 5 percent, the fastest growth worldwide, driven by growth in Qatar, which has remained the largest gas exporter. The UAE, however, reached the highest record in oil production in 2013, with 3.6, right ahead of Iraq, with 3.1 Million of Barrels per Day.

In the Middle East, big data and analytics are driving business investments in the oil and gas sector, particularly in business intelligence (AMEinfo 2014). Big data today is said to have the potential not only to improve the productivity of oil and gas but also to reduce security threats on several levels, as will be discussed below.

Investing in real-data analysis in the oil and gas sector can have several benefits. An IBM oil and gas IT survey reports that more than seven out of ten executives believe that big data analysis can improve production technology, six out of ten agree that it can impact seismic/data reservoir modeling, 50 percent find improvements in integrated operations, and 35 percent observe improvements in business process management (Salisbury 2012).

The oil and gas sector is very sensitive to time, and there is a need for remote

surveillance asset and plant management, process monitoring, safety and security, and real-time monitoring. Shell, for instance, is using big data to predict the success of the drilling operations and to be informed about the how much is left in the wells. Through HP fiber cables installed in the wells, Shell collects real-time big data that is useful and accessible to technicians in the field. Big data is stored on the Amazon virtual private cloud; it is analyzed and made understandable by partners from IBM and DreamWorks Hollywood in charge of data visualization. According to a Shell source,

all data that is received from the seismic sensors are analyzed by the artificial intelligence developed by Shell and rendered in 3D and 4D maps of the oil reservoirs. Although the analyses are done in the cloud, the visualizations are immediately available to the crew working at the local factory. (Oil Review Middle East 2014)

To increase the efficiency and reliability of the data, older mechanisms that check monitors individually are replaced by Ethernet systems that offer real-time monitoring and control. However, more data does not necessarily mean higher efficiency or performance. The more data one collects, the greater the need to manage it and understand it, and the more difficult the analysis. Collecting the right data is more important than collecting big data; having the right data that is big enough to be treated and analyzed is the most useful.

Exploring and understanding the subsurface is one of the greatest need for oil and gas companies, which explains their dire interest in collecting more and more various data frequently and in real time. “[A]dvances in instrumentation, process automation and collaboration are increasing data volumes even faster. This is where data analytic firms can come in to help disseminate information and identify added value” (AMEinfo 2014).

Experts warn, however, not to focus on technology but to focus on the value proposition that can be created. This value is not exclusive to one operator; rather, it can be shared by a group of companies, which creates more synergy between oil and gas industry players with regard to information sharing, discovery and business impact models.

The ICT spending of big oil companies was estimated to be about \$35.4 billion in 2010 (about 1.4 percent of their annual revenue) and about \$50.6

billion in 2013 (Salisbury 2012). The majority of spending is for wireless technologies. The Shah Gas Project, for instance, is developed in Abu Dhabi by Al-Hosn Gas, a joint venture of Abu Dhabi National Oil company (Adnoc) and the US's Occident Petroleum. The project produces sour gas and granulated sulfur to be transported either through pipelines or through rail, which increases the risk factor and necessitates real-time monitoring enabled by wireless technology. Salisbury explains some ways big data improves safety in the working environment of oil and gas plants, reduces downtime and increases productivity,

Al-Hosn Gas understands wireless is moving beyond transmission network. We will have site-wide infrastructure (...) that includes wireless personal gas detectors, which tells the operators how much gas people are being exposed to and where people are at any given moment. Staff has wireless handheld devices that show all the relevant data in real time. Rescue teams can see people they are looking for. They are also deploying small, handheld video cameras for trouble-shooting in critical areas of the plant. (Salisbury 2012: 28)

This combination of big data and smart data in the oil and gas industry enables industry players in the MENA region to improve their management and make well-informed, data-based decisions.

Big data: opportunities and challenges for the MENA region

As the previous sections suggest, variations in information and communication technology diffusions across the MENA region have varied levels of development in this sector. As benchmarked against regional and global indicators, the GCC states remain at the forefront of ICT development in terms of infrastructure advancement, Internet accessibility rates and mobile telephony usage. The launch of e-government and, later, smart services in countries such as the United Arab Emirates has induced substantive investments in the e-sector to cope with government-initiated strategies to digitize and virtualize services. The big data sector has been most positively affected by those developments, with rising investments in data storage, cloud computing and analytics. Over the past few years, Dubai has played host to a number of international big data discussions that addressed numerous aspects of this sector and its relevance for the region¹. According to

Frost and Sullivan, the GCC's big data market is set to grow nearly five-fold from USD 135.7 million in 2013 to USD 635.5 million in 2020 (Cherrayil 2014).

Big data and analytics are also drawing investment in the region. According to IDC reports (2013), most of the activity to date has been focused on businessintelligence (BI), with 35 percent of Middle Eastern Chief Investment Officers (CIOs) having invested in BI in 2013 and 41 percent scoping for 2013. Only 11 percent invested in 2012. Some analysts believe that the market has reached a turning point, as vendors and enterprises work closely on education regarding big data and its benefits (Enzer 2013). To enhance the region's big data readiness, two types of skills are needed: Hadoop technical skills and data scientists. The data scientist role is still evolving, requiring a mix of skills and business awareness. Data scientists working in analytics need a variety of skills across multiple domains, including computer science, mathematics, data mining, and business analytics, to rapidly explore and discover insights in data.

Opportunities

The deployment of big data technologies and techniques in the MENA region is likely to bring about a host of opportunities across the different socio-economic and cultural sectors. Those opportunities, of course, are highly contingent on users' access to online resources and mobile facilities. These may include the following:

Education

Data generated from institutional communications, social media conversations, search engines, website browses, and mobile phones may be analyzed for trends and patterns relating to knowledge priorities, socio-demographic group engagement and geographical participation. Such data can be efficiently harnessed to develop strategies and policies relating to Arabic language usage in learning in a context of an increasingly Westernized curriculum in GCC education, the most demanded topics of learning in the community, alphabetical and IT literacy and how to prioritize social and economic needs based on existing patterns. Picciano (2012) notes that in American education, big data and analytics for instruction are in their infancy. In the GCC countries and the MENA region, access to educa-

tional institutions is still problematic, and degree completion is a challenge for boys who prefer to leave school for work and financially support their families. This is an increasingly serious problem for the region. The UAE, for instance, has reviewed its policies about the school-leaving age, which was changed in 2012 from 14 years old to 18 years. Distance learning is also struggling to pick up due to weak government support for online education. As noted in consecutive UN Knowledge Reports about the region, there is a serious deficiency in knowledge about education in terms of inputs, outputs, use of technologies, engagement with virtual space and relationships with socio-economic development (MBRF and UNDP 2009).

Cultural development

The MENA region is rich in culture and history, and developing a sense of cultural identity in the age of globalization has always been a priority. The issue has been repeatedly debated in the past two decades, with clashing arguments centering on both religious and nationalistic issues. However, in the past decade, growing conflicts in the region have also given rise to new identities based on sectarian, tribal and ethnic affiliations. Virtual space has always buzzed with ideas and discussions relating to national and cultural identities in the MENA region. Data from social media conversations, blogs, and mobile telephones could be used to make strategic conclusions about where MENA region societies are heading with regard to defining its identity. Big data analytics could also be useful in monitoring identity-based tensions and pre-empting their explosion into full-scale conflicts. They could be helpful in setting the parameters of social and cultural policies relating to this issue and how it has to be expressed in private and public platforms. On the other hand, countries in the region – and, more particularly, those of the GCC – have to set the ground for discussions about diversity and multiculturalism. Concerns about freedom of expression, privacy and monitoring could be drawbacks to the benefit and full value of big data. Furthermore, as Crawford, Miltner, and Gray (2014) argue, big data are not repositories of data sets; they require active interpretation of researchers who may have different ways of seeing things. Andrejevic (2014) notes a major divide between users and data and argues that the value of big data is not only in access, technologies or infrastructure but also strongly linked to the capacity of analyzing it and making use of it; this remains in the hands of only a powerful few.

Aside from this, the MENA region cannot take advantage of the full advantage of cultural datasets with a mindset that may lack openness towards diversity, understanding and respect for others, regardless of ethnic origin, religions or beliefs. For people to participate openly in public forums while being aware that data is monitored, the policies of online participation have to be revised and encourage civic participation. Currently, the cyber laws in the region are quite restrictive and may lead citizens to be wary of anything they say and eventually practice self-censorship. Civic education along with democratization of big data could be an opportunity for cultural development change in the region.

Financial and Economic Development

As discussed in the media business section, audience measurement is currently the most prevalent application of big data. In addition to tracking online interactions and trying to predict consumers' journeys, there are new attempts to distribute commercial or content messages programmatically. Data captured from organizational communications, social media platforms, Internet contents, media flows and satellite exchanges could represent significant indicators of mega-trends in national and transnational economic and financial systems. Data analytics regarding national and international money transactions, sales, acquisitions, taxes, pensions, spending, travels, investments, loans, financial stock shares, etcetera are of significant value for strategic economic policy making. In sectors such as oil and gas, agriculture, manufacturing, healthcare, trade and tourism, a huge amount of data can be analyzed for patterns and correlations relating to growth, legal compliance (especially in copyright issues) and risks. In the oil sector, executives expect that big data analytics would create new business opportunities and generate additional revenue streams. They also predict that failure to use big data analytics would make them lose their market position in the next one to three years. All of these sectors would greatly benefit from analytics in handling issues such as investments, development, partnerships, recruitment, service delivery and growth.

Government services

In the MENA region, the state remains a leading force of economic progress and social welfare. Data analytics would be helpful for governments as they seek to deliver services to the public in different realms. As noted

in the previous sections, variations in technological diffusion and policies across the region have given rise to different levels of service delivery. While the majority of Arab countries continue to deliver services and perform transactions in traditional, paper-based ways, countries such as the United Arab Emirates have taken leading strides in shifting their service delivery operations to cyberspace. Dubai has been at the forefront of this change with its e-government and smart-government transition into virtual space to handle all types of paperless transactions. In countries where online services are delivered, analytics from data streams originating in social media, websites, blogs, news portals and mobile communications could be highly useful in enhancing the quality and efficiency of those services.

Dubai Smart City (hereinafter DSC) is an outstanding example of how governments in the region could unlock the potential of big data to enhance their services. Launched in 2014, DSC facilitates the transformation of 1000 Dubai government services into smart transactions centering on the mobile telephone in 2014-16. The project features six key pillars and 100 initiatives on transportation, communications, infrastructure, electricity, economic services, and urban planning. The strategic plan draws on three basic concepts – communication, integration and collaboration – that enhance communication between the city’s residents and its institutions and facilities through convenient access to and sharing of data about the city (Emirates 24/7 2014). The plan also includes the development of smart and personal boards containing all information and data about the city of Dubai in one platform to enable individuals to communicate with various institutions and facilities in Dubai. The Dubai Electronic board has been made available to decision-makers to ensure sound decisions are made on the different service sectors falling under their jurisdiction. While this initiative is worth celebrating, it is important to examine its applicability because of the privacy, democratization and monitoring issues discussed above. Questions to examine are in line with concerns regarding corporations’ and public services’ access to and interpretation of the data collected. Ideally, the data collected and analyzed by the smart city helps improve predictive models of services at different levels and is not exclusive to the government but could reach a democratization stage (Boyd and Crawford 2014) to the point that users also have access to this data for the benefit of various sectors and groups of populations.

Challenges

It is clear that as much as big data brings about huge opportunities for socio-economic and cultural development to societies in the MENA region, it also presents the following challenges.

Cultural

Big data is still a novelty in the MENA region. And to harness its potential for socio-economic and cultural development, a new mindset conducive to the adoption of this technology in the different sectors seems indispensable. Many private and government organizations in the region continue to base their decisions on conventional information gathering and analysis methods that fail to capture the full picture of change. Since the deployment of big data systems require hefty investments, government and corporate leaders and decision-makers should possess a good sense of understanding and appreciation of what big data is about and how it could contribute to social and economic development. Accordingly, we call for big data literacy and education to be offered to users and citizens in order to raise awareness about the extent to which their quotidian communications and transactions could be used in the context of data collection and analysis. This education is meant not only to raise awareness about citizens' contribution to the new era of big data from a protective perspective but also to stress the advantages and benefits of their mundane transactions and communications. An ethical approach would also watch for a culture where users are given the choice to opt out to protect their privacy.

Human resources

Big data is not only about understanding data at the decision-maker level but also about preparing a new generation of specialists in this field who are able to handle datasets in different organizational contexts. Big data specialists should possess the intellectual and technical competencies to be able to pinpoint issues relevant to the organization and to operationalize their analysis. A sound conceptualization of issues to be addressed in analytics is central to the conceptualization of their operational components and indicators in the Big Data context. This assignment requires a combination of talent and expertise in social research, software development

and quantitative analysis. The Gulf States should invest in educating and training a workforce for this field in order not to be constrained to hire Western and other expatriate skills, as is currently the case in most services, particularly in the media business-related industries. Because an important aspect of big data is analysis, which is subject to reading and interpretation, specialists should be wary of cultural contexts and sensibilities. This is increasingly important, as the web in the region is increasingly Arabic. Social media reports show that interactions among users are increasingly trending towards Arabic (with 48 percent in English and 45 percent in Arabic), and it is predicted that Arabic will be the leading language in the next five years. The language barrier could be a predicament for big data handling if not addressed early enough.

Infrastructure development

Without an information and communications infrastructure, big data would be rendered useless for handling different assignments in analytics. A highly developed communications infrastructure would serve as launching pad for data streams to be captured, stored and analyzed by big data staff (McKinsey Global Institute 2011). In the Arab World, except the GCC countries, the ITC infrastructure, as noted previously, continues to suffer major problems related to levels of diffusion, accessibility, censorship and costs. The main implication of an underdeveloped ICT infrastructure is that data steams captured for analysis do not reflect the full range of inputs across populations as they are limited to rich segments or urban dwellers. Analytics generated would tend to be biased and thus lack credibility in the final analysis.

An example of this is the ecommerce development in the region. As discussed earlier, although governments are pushing for investing in ecommerce businesses, the infrastructure does not enable all strata of the population to take advantage of ecommerce equally. Not only does ICT infrastructure suffer a digital divide among countries and even within the same country at times, but banking policies and regulations are handicaps to ecommerce development and are, at times, made accessible only to elite groups. This is the case, for instance, with credit card facilities, language barriers or technological barriers.

Regulation

Big data brings with it a whole set of practices with profound security, social and ethical implications that have to be accounted for in any regulatory regime. Regulations should address issues relating to data sharing, privacy, transparency, access and usage. In the GCC, Qatar has issued a data protection law to respond to concerns of security. Qatari law N13 of 2016 protects consumers in an increasingly threatening online environment and ensures that they have confidence about their personal data protection when completing transactions online or processing data electronically. Data protection in other GCC countries, including the United Arab Emirates, is regulated under the constitution, in Article 31, which provides for UAE citizens' rights to privacy. As the majority of the UAE population comprises expatriates, protection under such a regulatory frame does not extend to non-nationals. However, the cybercrime law and provisions are the closest regulation in the legislation to data protection for residents and citizens alike. In the UAE, cybercrime Law N5 of 2012 protects individuals from invasion of privacy and disclosure of confidential information obtained in the work context. Other specific regulations include the Telecommunications Law (2003) and the Privacy of Consumer Information Policy (2005), both of which have provisions for consumers' interest (individual or family privacy) but are not specific to data processing.

Big data should not be looked at exclusively from a technical perspective about data storage or compression. Ethical concerns haunt the development and adoption of big data across the world, and the Gulf region is no exception. Participation in the data project is the responsibility of all citizens, according to Crawford, Miltner, and Gray (2014), and collectively, users can monitor big data to make sure that it is not hindering human progress but enabling innovation in a trustful and ethical environment.

Concluding remarks

Big data is not a technology fad but a strategic key feature of human development for decades to come, granted that it observes ethics and human rights. Our increased ability to capture data sets of all types and generate a wide range of insights that inform strategic government and business decisions is a huge empowering force for societies around the world, including

those in the MENA region. The article has noted a rising interest within countries in the region, especially in the Gulf region, to harness big data in social and economic development through the integration of new data-capturing and data-processing technologies in their government service and business sectors. The prime adopters of big data systems in the Gulf region have been government service providers and media business sectors. The E-government and Smart Dubai initiatives in the UAE have been outstanding examples of government deployment of data analytics in the service sectors. Bahrain is another leading example for openly sharing datasets of public expenditures, demographics and data on cities for their citizens.

We found evidence that big data offers excellent opportunities for the MENA region to enhance its service and business sectors by enabling more informed decisions in education, social services, business operations and cultural development. On the other hand, we noticed that although some headway has been made in the GCC region's engagement with big data technologies, some challenges have yet to be addressed. These include building proper mindsets to understand the dynamics of big data in government and corporate contexts, the preparation of well-qualified human resources who are able to handle technical and intellectual big data requirements, the establishment of reliable infrastructures necessary for streamlined functions, and the initiation of appropriate regulatory frameworks relating to data privacy, copyright and access.

A bigger conversation about big data at the MENA-region level that should occur is about the 'Big Data divide' (Andrejevic 2014). This discussion is by no means an extension of the digital divide conversation, which remains limited around issues of ICT infrastructure and connectivity or broadband connectivity rates; all MENA countries are now mobile or smartphone connected, and the majority of them are intense social media users. The socio-democratic impact of social media usage was not negligible by the time of the Arab uprisings, and clearly, the countries in the region are inter-related socially, culturally and economically, more than one might think. A larger and more inclusive discussion on big data at a regional level is worth having for a more cohesive development in the long run.

The concerns that have been raised about big data adoption with regard to security, ethics and privacy are not reflected in the press of the region.

Threats raised by Snowden about exposure of emails, text messaging, social media, geo-locations and targeting do not seem to weigh equally with the glorious value creation from big data. The big data conversations are deterministic and emphasize the cost efficiency of big data adoption and analysis (Crawford, Miltner, and Gray 2014).

This paper admits its methodological limitations. The cases studied are only a snapshot of some current applications, and they are not meant to be representative. We interviewed professionals in the areas explored; however, we were surprised at how little the informants know about big data usage and their companies' plans in collecting and processing data. Despite this challenge, we hope this article opens up a larger Arab big data conversation among academics and professionals.

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Notes

¹ Those include the 2014 GITEX Big Data conference, IDC Big Data and Business Analytics Roundtable (2014), the Teradata Universe Conference (2014) and IDC Big Data and Business Analytics Forum (2013); and Smart Data Summit, Dubai, 2014 and 2016. Kuwait also hosts the annual Middle East Cloud and Big Data Conference and Exhibition.