

In Europe, efforts are being made to promote a data-driven economy that will contribute to the well-being of citizens as well as to new business opportunities and more innovative public services.

Big Data in the European Union



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As the accumulation and application of Big Data grow rapidly all around the world, the European Union is affected by specific aspects and concerns. The focus of our analysis is the European industrial and societal landscape, considered from a general perspective based on recent official documents of the European Commission and independent reports.

After providing some historical background, we present general impacts and then report on the response of European industry to Big Data before reviewing EU priorities, concerns, and plans of action.

Background

Fifty years ago Licklider (1960) anticipated the role of computers in supporting humans to make decisions, when he proposed an idealized vision of “precognitive” human-computer systems, which were meant to “enable man and computers to cooperate on making decisions and control complex situations . . .” In the mid-1970s Alter (1975, 1980) described *decision support systems* (DSS), based on the generic operations they performed independent of the problem type and decision maker’s goals and knowledge. He

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identified seven DSS subclasses, three of which put the emphasis on exploitation of data: (1) *file drawer systems* provide access to data for simple queries and corresponding reports; (2) *data analysis systems*, based on the use of computerized tools to manipulate data, anticipate recent data warehousing solutions; and (3) *analysis information systems* are conceptually similar to current *business intelligence and analytics* (BI&A) tools. In 2002 Power combined these three subclasses under the term *data-driven DSS*.

These and other systems are now being adapted for Big Data, a term that describes “the methods and technologies for the highly scalable loading, storage and analysis of unstructured data. Big Data technology can help companies to manage large data volumes, complex analysis and real-time integration of data from a variety of data structures and sources” (Bange et al. 2013, p. 12).

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Impacts

The world is changing under the influence of hyperconnected interaction patterns of societal and economic entities and is “increasingly driven by insights derived from big data” (WEF 2013). In the European Union these changes are apparent in a number of recent documents and activities. According to a recent document of the European Commission (EC 2013b), “Big Data is already affecting all areas of the economy” and “data-driven decision making estimations indicate the volume of stored data is increasing at an ever more rapid rate.” And the slogan of the 2013 European Big Data Conference, held October 1 in Brussels, was “Toward a data-driven economy.”

European Commission vice president Neelie Kroes (2013), responsible for Europe’s Digital Agenda (EC 2013c), recently observed that the amount of information now produced in two days equals the

volume of “information humanity produced from the dawn of civilization until 2003.” Bollier (2010, p. vii) of the Aspen Institute estimated the volume of data available on the Internet at 1 trillion gigabytes in 2011. Fortunately, advanced analytics are already available to “tame the Big Data tidal wave” (Franks 2012).

Benefits

The benefits of processing immense volumes of data by using technologies that can analyze sensor, geolocation, behavior, and social media data are obvious. The value of the relentless accumulation of huge volumes of data resides not only in the quantity but also in new insights that enable decisions and actions to transform the economy and society (WEF 2013). Managers are enabled to make more informed decisions, and companies and governments better understand their markets and population, respectively.

As Chen and colleagues (2012) point out, BI&A has evolved to enable big impacts from Big Data. Tene and Polonetsky (2012) estimate 5–6 percent economic gains due to data-driven decision making. There are also good premises to change the role of individuals through shifts from mere access to information to understanding and from passive consent to engagement, among others (WEF 2013). These and other facts explain why the Big Data sector is growing at a rate of 40 percent per year (EC 2013b).

Risks

At the same time, there are risks and concerns associated with the increasing acquisition and availability of data. For example, it is possible to profile people from digital records of their behavior without their consent or even notification. A recent study (Kosinski et al. 2013) empirically shows that easily accessible digital records of behavior can be used to infer personal attributes ranging from gender, age, and ethnicity to political views and even personality traits, the malicious use of which could not be excluded or prevented.

The same authors conclude that the ever growing digital exposure may have a negative impact on people’s attitude toward information technologies. Hall (2013) noticed that “over the last 20 years, as our data keep getting stronger, our customer relationships keep getting weaker. Eighty-six percent of consumers trust corporations less than did five years ago.”

Big Data in European Industry

Independent studies (e.g., Bange et al. 2013; Dittmar et al. 2013) have analyzed the situation of the Big Data sector in European industry. A Business Intelligence Maturity Audit analysis (biMA Survey) was recently carried out in 20 countries, with 650 participants. The resulting report (Dittmar et al. 2013, p. 14) stated that “only 7% of the participants in the survey grade Big Data as very relevant to their business.” Other technical and organizational problems are revealed by the analysis, such as the poor quality of data, a very low proportion of the companies that have a business intelligence strategy, and different mindsets of business units, IT departments, and so on.

In the recent report of the Business Application Research Center (BARC; Bange et al. 2013), a series of questions were addressed by 272 participants from a European perspective. Respondents answered questions such as “Who are the Big Data drivers?,” “How is Big Data organized and utilized?,” “What are the advantages created?,” “What are the problems encountered?,” and “Who are the most important vendors in the domain?” The main advantage cited was “better steering of operational processes.” One rather surprising finding was that small and medium enterprises were more advanced in their use of Big Data than several big companies. Results also showed that most of the vendors and service providers associated with Big Data—among them IBM, Oracle, Teradata, Microsoft—are US-based, revealing the dependence of European industry on American companies.

Although the findings of the BARC report are, in general, fairly optimistic (which can be at least partly explained by some of the countries surveyed—Austria, France, Germany, Switzerland, and the United Kingdom—as well as the attitudes and actions of “best-in-class” companies), the report acknowledges problems associated with inadequate technical and analytical know-how. Indeed, another analysis (Madariaga 2013) pointedly noted that “The unchallenged American primacy in data control is increasingly accompanied by the appearance of new players in emerging economies whilst Europe lags behind.” A recent document of the European Commission (EC 2013c) made the same observation: “Even though the European Union is the largest economy in the world and makes around 20% of the global GDP, only two of the top twenty companies changing lives and making money out of Big Data are European.”

European Priorities, Barriers and Concerns, Objectives and Plans

Priorities

The conclusions of the European Council of October 2013 (EC 2013a, pp. 1–2) state that

A strong digital economy is vital for growth and European competitiveness in a globalized world. To this end, all the efforts must be made for Europe’s industry to regain momentum in digital production and services. There is an urgent need for an integrated single digital and telecom market benefiting consumers and companies.

As part of its growth history, Europe must boost digital-driven innovation across all sectors of the economy. Special consideration should be given to supporting the reduction of digital gaps among Member States.

Several strategic technologies, such as Big Data and cloud computing, are important enablers for productivity and better services. Cloud computing should improve access to data and simplify their sharing. Big Data aims to process, collect, store and analyze large amounts of data. EU action should provide the right framework conditions for a single market for Big Data and cloud computing, in particular by promoting high standards for secure high quality reliable cloud services.

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From the above statements a straightforward conclusion can be drawn. European leaders recognize that (1) Big Data can lead to economic gains and (2) an integrated and broad approach must be envisioned. In particular, the use of two powerful technological resources, cloud computing and Big Data (Bughin et al. 2013), is a powerful driving factor.

The recently adopted Digital Agenda for Europe (EC 2013c) defined seven “pillars” as policy areas for action on issues associated with Big Data: (1) a Digital Single Market, (2) interoperability and standards, (3) trust and security, (4) fast and ultrafast Internet access, (5) research and innovation, (6) enhanced

digital literacy, skills, and inclusion, and (7) ICT-enabled benefits for EU society.

In a recent communication (EC 2014), the European Commission sketches the characteristic features of the *data-driven economy* (DDE) of the future, analyzes the current status of Big Data use in Europe, and sets out some operational measures with a view to supporting and stimulating Europe's transition to DDE.

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Barriers and Concerns

There is general awareness of the barriers to Europe's ability to exploit the potential of Big Data (Kroes 2013; Madariaga 2013):

- fragmentation of the data ecosystem due to different national policies, languages, and sectors involved;
- fragmentation of data research efforts and lack of an effective exchange of results;
- a shortage of highly skilled persons for data-related jobs; and
- the complicated process of updating legislation.

In addition to these, privacy concerns require attention. In her talk at the November 2013 European ICT conference in Vilnius, commissioner Kroes (2013) firmly stated that "Nothing we do should be at the expense of fundamental rights. Mastering Big Data means mastering privacy too. Privacy is essential." At present, however, there is a discrepancy between, on the one hand, European views and priorities concerning the protection of personal data and rights and, on the other, Europe's limited potential to develop technologies and digital services to enforce those priorities (Madariaga 2013).

Objectives and Plans

To attain the objectives set out by the European Commission an incremental approach is envisaged (Madariaga 2013):

- Create an integrated market through the "Connected Continent: Building a Telecoms Single Market" package (EC 2013c), so that the necessary infrastructure for Big Data is implemented.
- Change the attitude of public administration toward data and enlist citizens' engagement and cooperation in data gathering and research.
- Carry out research and development programs with strong Big Data components.

The draft Work Program 2014/2015 of the *Horizon 2020* Program for Research and Innovation (EC 2013d) is meant to facilitate attainment of Europe's goal of "leadership in enabling and industrial technologies" (LEIT). In section 5i, "Information and Communication Technologies," the subject of Big Data is included in the chapter "Content Technologies and Information Management" (p. 37) as one of the four *key aspects* of digital content and information management. Two main areas of Big Data have to be addressed: (1) "improving the ability of European companies to build innovative multilingual data products and services" and (2) "solving fundamental and applied market-driven research problems related to the scalability and responsiveness of analytics capabilities."

Conclusion

A new term, *datability*, was coined as the theme of the 2014 CeBIT conference (www.cebit.de) "to denote Big Data in conjunction with the required sustainability and responsibility with regard to its use." It is hoped that datability will be realized in Europe with well-planned efforts to stimulate cooperation in attaining synergistic effects.

Having analyzed the available documents, we believe the integrated approach adopted in Europe will have a favorable impact on Europe's economy and society. As commissioner Kroes (2013) concluded in her talk, "Big Data can be more than a fashionable slogan. It can become a recipe for a competitive Europe."

Acknowledgments

We thank the editor for competent suggestions that contributed to improving the paper and Yong Shi for his initiative in creating this opportunity.

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