UNLEASHING THE POTENTIAL OF **BIG DATA**

A white paper based on the 2013
World Summit on Big Data and Organization Design

IBM

Organizational Design Community

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FOREWORD

"While knowledge is the engine of the economy, Big Data is its fuel." This characterization of Big Data was made by Ms. Neelie Kroes, European Commission Vice President in charge of the digital agenda for Europe. Kroes calls Big Data the "new oil." For traditional industries and the service sector, Big Data will create a huge number of commercial opportunities. For the public sector, Big Data offers a promising route to service improvement and transparency as well as a tool for making infrastructure and other investments.

Politicians and policymakers are aware of both the potential and the dangers of Big Data. In 2012, the Obama Administration launched the Big Data Research and Development Initiative in the United States, and the European Commission (EC) is taking steps to remove obstacles to the use of Big Data through legislation, standards setting, and its R&D programmes. Hand-in-hand with new data-protection legislation, the EC wants to formulate an overall cybersecurity strategy to ensure that individual and organizational data are properly used and protected. Alongside harmonized rules for how data is handled, the EC is pushing for standards to allow the interoperability and integration of data. Other government initiatives focus on technological development and infrastructure projects.

This White Paper offers ideas and recommendations to further increase the value of Big Data initiatives while protecting against their risks. Governments, universities, and business all have a role to play in this endeavor, and we hope that decision makers will find the paper helpful as they pursue their respective tasks.

We acknowledge and thank the speakers and participants in the 2013 World Summit on Big Data and Organization Design for their time, hard work, and contributions. A unique network of people and organizations has been created. We hope their efforts will continue to influence and open up the world of Big Data for the good of society.

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EXECUTIVE SUMMARY

Big Data is the term for data sets that are so large and complex that they are difficult to capture, curate, manage, and process with current data-management tools. If the Big Data process can be effectively developed and controlled, its potential benefits to business, government, and society are huge. The Big Data phenomenon also contains real concerns and potential dangers, which need to be identified, debated, and resolved. Global society will certainly benefit if we can fully understand Big Data and use it for the common good.

The World Summit on Big Data and Organization Design was initiated by the Organizational Design Community (ODC) and co-sponsored by IBM, the Interdisciplinary Center for Organizational Architecture (ICOA) at Aarhus University (Denmark), and Université Panthéon-Sorbonne (Paris). The conference was held at the Université Panthéon-Sorbonne on May 16–17, 2013, and included 11 keynote and distinguished speakers as well as 130 participants from 26 countries. The speakers and participants represented academia, business, and government.

A call was issued for papers on any of five themes: **(1)** university/business-driven applications, **(2)** university/public-driven applications, **(3)** data challenges, **(4)** organization design, and **(5)** partnerships/networks/communities. Seventy-four papers were received and assigned to five working groups. The working groups held several virtual meetings before the conference to develop their working papers, which were then presented at the conference. After the conference, the working groups revised their papers and submitted their final reports to the Organizing Committee. Members of the Organizing Committee prepared this White Paper, **Unleashing the Potential of Big Data**.

The final reports of the five working groups contain many specific findings and recommendations. Aggregating across the reports results in the following key recommendations:

1. Invest in interdisciplinary research to develop and improve technologies to acquire, analyze, curate, and share huge quantities of data. Harnessing the Big Data process can accelerate the pace of knowledge development, strengthen international cooperation and security, improve social welfare, enhance business productivity, and transform teaching and learning.

2. Create coherent regulatory frameworks and standards for Big Data across countries and economic sectors to support entrepreneurship and innovation.

3. Optimize the benefits of Big Data by protecting individual and organizational rights of privacy while promoting the development and use of Big Data. Various analysts and observers have pointed out negative by-products of Big Data, and these must be minimized while advancing the positive uses of Big Data. There needs to be a workable balance between individual/organizational freedom and global security.

4. Develop training and education programmes. Both certificate and degree programmes are needed. The process of incorporating Big Data into the operations of business, government, and education will require hundreds of thousands of new, specially trained knowledge workers.

5. Develop government policies that promote the beneficial uses of Big Data. Certainly, large firms and institutions can benefit directly from Big Data, but the small enterprises that are part of the value streams of large firms can benefit as well. In order to include all types of organizations that can benefit from the Big Data revolution, policy makers must use systems thinking and engage in intergovernmental cooperation.

6. The impact of Big Data on organizations will be considerable, especially in large organizations that are equipped to harness the potential of Big Data. Big Data will enable these organizations to become more entrepreneurial and empowered. Various types of studies are needed to make the incorporation of Big Data as efficient and effective as possible. Other, more predictive studies and analyses will be needed to minimize the risks and liabilities associated with the greater use of Big Data.

7. Create partnerships among universities, businesses, governments, and NGOs. Some networks and communities will form naturally as problem-finding and/or problem-solving mechanisms. Others will need to be deliberately created. Policy makers will need to open up decision-making processes to obtain and use inputs from these groups and organizations.

WORLD SUMMIT ON BIG DATA AND ORGANIZATION DESIGN

In 2007, T.H. Davenport and J. Harris published a book, **Competing on Analytics**, which is widely recognized for building awareness about the emerging phenomenon of Big Data. In 2011, the McKinsey Global Institute published a report entitled "Big Data: The Next Frontier for Innovation, Competition, and Productivity." This report forecasted the large impact Big Data would have on business. The World Economic Forum held a session on Big Data at its 2012 Davos meeting and issued a report entitled "Big Data, Big Impact: New Possibilities for International Development." This report put Big Data on the world stage and acknowledged other important stakeholders in the phenomenon such as government and global society. Already in 2013, a novel called **The Circle** (by Dave Eggers) describes the Orwellian world we will live in when Google and other Big Data companies know everything about us. Thus, in the brief space of just a few years, Big Data has burst onto the scene, portending both countless opportunities and unforeseen dangers.

The World Summit on Big Data and Organization Design was held to try to make scientific sense of the Big Data phenomenon and to offer recommendations to business, government, and education about how to incorporate the beneficial aspects of Big Data into their policies and decision making. **Unleashing the Potential of Big Data** is based on the input from 11 keynote and distinguised speakers and the work of 130 participants who attended the World Summit on Big Data and Organization Design held in Paris on May 16–17, 2013. Representing 26 countries, the participants were from academe, industry, and government. In order to participate in the World Summit, participants had to submit a paper to the Organizing Committee. Seventy-four papers co-authored by the 130 participants were accepted by the Organizing Committee.

In order to ensure the optimal outcome of such an impressive mix of professionals, the World Summit utilized a pre-conference workshop process in which the authors of each paper were assigned to one of five Working Groups: **(1)** University/Business-Driven Applications, **(2)** University/Public-Driven Applications, **(3)** Data Challenges, **(4)** Organization Design, and **(5)** Partnerships/Networks/Communities. One person in each Working Group was asked to be the Chair who would organize the group and conduct pre-conference webinars in which the group assembled its analyses, findings, and recommendations. Four Working Groups each held four webinars, and one Working Group held five. The pre-conference workshops resulted in a draft Working Paper from each Working Group.

At the Paris conference, each Working Group presented its Working Paper. Presentations were followed by plenary discussion, and the 11 keynote and distinguished speakers were interspersed throughout the program to contribute their insights and inspirations. After the conference, each Working Group was asked to revise its Working Paper and resubmit it to the Organizing Committee. Selected members of that committee prepared the White Paper **Unleashing the Potential of Big Data**.

Appendix A lists the conference participants and their affiliations. Appendix B shows the Working Group members and their chairs. Appendix C lists the keynote and distinguished speakers. Appendix D is the conference program of the World Summit on Big Data and Organization Design. Appendix E shows the conference organizers.

FINDINGS AND RECOMMENDATIONS

The five Working Groups discussed a wide variety of issues within their respective domains, considered relevant evidence regarding the most important issues, and used their collective wisdom to arrive at reasoned conclusions. Based on their conclusions, each Working Group put forth a set of recommendations on their topic.

WORKING GROUP 1
UNIVERSITY/BUSINESS-DRIVEN APPLICATIONS

No matter how Big Data is defined, there is general agreement that the basic conundrum with Big Data is that data is easier to get in than out. Data is useless unless universities, businesses, and other types of organizations are able to transform the data into information that subsequently can be analyzed and interpreted and thus transformed into usable knowledge. Furthermore, business faces the fact that much data becomes outdated fairly quickly and loses its value. The key to developing new business applications from Big Data is to know what you are doing and to act expeditiously. Obviously, this is easier said than done.

WG1 produced 12 summary papers dealing with Big Data in relation to university/business-driven applications. These papers addressed an array of topics in the university-business domain: **(a)** Big Data and health care; **(b)** applications that support customer-centric transformation and real-time economy; **(c)** open knowledge sources and data mining; **(d)** Big Data and value creation; **(e)** open-innovation cooperation between research and business organizations; **(f)** a postgraduate degree programme called the Master in Business Intelligence and Knowledge Management; **(g)** the Big Data classification problem in a dynamic world; **(h)** Big Data business issues in medium-size European companies; **(i)** Big Data and molecular biodiversity; **(j)** customer analytics in marketing; **(k)** Big Data challenges and opportunities in financial applications; and **(l)** Big Data and business services.

The various challenges identified in university/business-driven applications can be met by the following recommendations:

- We need to deepen our understanding of how to create and use real-time data exchange platforms. Unless organizations are able to utilize Big Data concurrently in real time, the full potential of Big Data will remain unrealized.

- More research needs to be done on data representation and visualization, data filtering, and data orchestration. The objective of such research is to improve how Big Data is interpreted.

- New standards and regulations with respect to data quality and information governance need to be developed. These standards will have to be developed through international and intergovernmental cooperation.

- Traditional statistical algorithms and techniques are not completely adequate in the era of Big Data. New statistical and decision-making techniques need to be developed. Cognitive computing should be embraced and researched because most of the successful advanced techniques associated with Big Data come from computing, neural network, machine learning, and expert systems.

- Research must address the relationship between Big Data and small– to medium–size enterprises. The value streams of large multinational organizations include such enterprises, and Big Data applications must be developed with the entire value stream in mind.

- The role of universities in the Big Data revolution must be substantially expanded. Most degree programmes offered are based on a pre–Big Data logic and do not adequately embrace Big Data analytics, business intelligence, and business modeling. The need for curriculum reform in university degree programmes is not limited to undergraduate and graduate programmes. There is also a need for Big Data executive programmes. Senior executives need to be aware of the potential of Big Data and the possible consequences for corporate strategy and organization design. Lastly, there is a need for the establishment of university-business laboratories for both research and teaching purposes. Such experimental laboratories would enable universities to conduct more applied research on Big Data and also make it easier for students and managers to prepare for the challenges they will face in their business careers.

WORKING GROUP 2
UNIVERSITY/PUBLIC-DRIVEN APPLICATIONS

WG2 focused on Big Data as it relates to governmental agencies, public enterprises, and scientific organizations. Of the four dimensions that are frequently used to characterize Big Data – volume, variety, velocity, and veracity – this group focused heavily on veracity. The veracity of information, its truthfulness, suggests the need for society to make a paradigm shift in how it thinks about and leverages Big Data so as to pave the way for more effective value creation in the global economy and society. Presently, the USA, China, Germany, and Japan are the most active countries in scientific production related to Big Data, but even in those countries few local or regional governmental agencies are taking significant actions to harness the potential of Big Data. Thus, as far as university/public-driven applications of Big Data are concerned, the field is virtually wide open. There is a need for making prudent, immediate investments in a number of areas with the promise of large returns.

WG2 examined university/public issues in government, health care, social security, social sciences, information sciences, and various sustainability initiatives. Common to those different application domains are challenges associated with service quality vs. quantity, data growth vs. data expansion, speed vs. scale, structured vs. unstructured data, data ownership, compliance and security, analytics, shared semantics, and information visualization. WG2 developed recommendations in four areas:

In the public sector, the goals of the U.S. Big Data Research and Development Initiative (March 2012) should be pursued.

- Advance the state-of-the-art technologies needed to collect, store, preserve, manage, analyze, and share huge quantities of data.
- Harness those technologies to accelerate the pace of discovery in science and engineering, strengthen our national security, and transform teaching and learning.
- Expand the workforce needed to develop and use Big Data technologies.

Government agencies and public enterprises must transform their operations to fully realize the benefits of Big Data.

- The public sector should "open" the data by making it more widely available and take measures to promote its usage based on ownership of the processes and services to be developed. This will result in the services to "own," the services to "drive," and the services to "monitor."
- Benchmark organizations that have successfully embraced Big Data (e.g., banks, credit card issuers, insurance companies, and pharmaceutical companies) and adopt their approaches where appropriate. Big Data companies have made substantial investments in building required capabilities. In those organizations, Big Data is used strategically to **(a)** drive decision making, **(b)** model alternative outcomes, and **(c)** identify optimal courses of action.

In the education sector, specific recommendations include:

- Recognize and act on the dual opportunities presented by Big Data. First, education needs to expand in order to promote the use of Big Data. Student knowledge and skill sets should be developed through graduate and postgraduate programs in Data Science and Big Data Analytics. Second, Big Data technologies can be used to transform education itself by applying analytics to student learning processes and to the processes of educational administration.
- Integrate Big Data analytics with models of a pupil, a teacher, and the learning process. Business process modeling methodology, integrated with process automation methods and adaptive management techniques, can serve as the basis for educational process modeling.
- Use Big Data metrics and analytical techniques to develop sophisticated dynamic models of organizations as systems. Apply such models to the educational system in order to increase organizational agility and adaptability.

Within any given organization, roles, structures, and processes need to be reexamined using a Big Data perspective.

- In a data-driven organization, the role of Chief Data Officer (CDO) should be created whose responsibility is to (a) embed data practices into the strategies, operations, and culture of the organization; (b) build the enterprise architecture necessary to turn vast amounts of data into real business value; and (c) set up the governance structures and controls to protect privacy and prevent misuse.
- To efficiently convert raw data into the "right" data, incentives and reward systems must be redesigned to encourage leaders to (a) reengineer business processes and (b) restructure investments, programs, and projects.
- The enterprise architecture must be designed to protect the privacy principles of (a) consent (right to meaningful choice); (b) proportionality (right to limited use); (c) purpose limitation (right to limited purpose); (d) integrity (right to accuracy, completeness, and freshness); (e) transparency (right to access); and (f) opacity (right to block or remove).

WORKING GROUP 3
DATA CHALLENGES

WG3 examined current Big Data challenges, state-of-the-art projects of which they were aware, and the foreseeable data challenges and issues that can be tackled pragmatically. One subgroup focused on the intrinsic content of Big Data, trying to provide well-organized schematic descriptions. A second subgroup focused on technological concepts such as Hadoop Map-Reduce, JAQL, Hive, Pig, and PACT, including hardware and platform solutions. A third subgroup addressed the issues of data quality and value. A fourth subgroup provided an overview of possible taxonomies for Big Data applications. A fifth subgroup examined existing education and training programmes in the area of Big Data at several leading universities around the world.

With respect to making sense of Big Data, recommendations include:
- Use semantics (i.e., metadata, ontologies and reasoning) and create ontologies using solid principles (e.g., Gestalt)
- Differences in data structure and semantics must be expressed in forms that are computer understandable and robotically resolvable
- Introduce intelligent reduction techniques to facilitate Big Data manipulation and understanding
- Recognize crowd-data significance: how to determine "wrong" information from "disagreeing" information and how to find metrics to determine certainty
- Facilitate and automate the management and inspection of data, building environments which mimic the progressive exploring, observing, and surveying activity with which users make decisions
- Use multidimensional models that allow non-ICT users to understand, manipulate, and analyze data in terms of facts (the subjects of analysis) and dimensions.

With respect to architecture, warehousing, and abstraction, recommendations include:
- New Cloud storage and compute components will be needed to allow global data availability and access over different types of networks for various cooperative user communities
- Develop international guidelines for the storage of critical information such as scientific, medical, and personal identification data
- Develop criteria for determining the geographic locations of data repositories
- Harmonize data warehousing needs across firm/agency, national, and international levels
- Identify and develop standard/easy/free tools that will enable unsophisticated users to utilize Big Data technologies.

With respect to data quality and value, recommendations include:
- Dimensions and metrics for both quality and value of Big Data have to focus on relevance, credibility, and heterogeneity among data sources and on their provenance and usage
- Methods for quality assessment and improvement should move from exact to probabilistic, facing uncertainty as a major challenge
- Subjectivity analysis must be further explored for managing the variety of data in a turbulent world and dealing with the corresponding information overload
- Similarity mining techniques are necessary for analyzing massive and quickly evolving text streams.

With respect to applications, end-users, security, and privacy, recommendations include:
- Develop user-friendly Big Data tools. Most current tools are not accessible by the non-expert analyst.
- At the policy level, strike the proper balance between security and privacy. Big Data will create many opportunities, but if it threatens privacy and freedom the societal costs will outweigh the benefits.
- Recognize that the content of most Big Data systems is provided by users (perhaps as much as 60%). Better tools that reflect social environments and their effect on Big Data content flow need to be developed.
- A long-term goal must be the development of granular automated modeling tools that apply to entities such as a single customer or user or a product on the shelf. In order for predictive models to be applicable to the huge number of entities in the Big Data realm, they need to be generated automatically by using novel machine learning techniques.
- From a commercial perspective, document summarization methods must continue to be developed. There is a need for advanced analytics tools that enable access to huge data sets generated from searches around the world, enabling firms to offer their goods according to dynamic demand.

With respect to education and training, recommendations include:
- A variety of initiatives need to be made in the area of education and training in order to facilitate the growth of Big Data. Graduate and postgraduate programmes in Data Science and Big Data Analytics need to be developed. More teachers need to be trained. Technologies to deliver education and training must be upgraded. Collaborative learning and commercial partnerships need to be formed between schools and business.
- A similar set of initiatives need to be conceived and funded that explore how the Big Data phenomenon can transform the education and training enterprise. Using Big Data technologies, students' experiences can be improved through personalization and feedback. Administrative decision making and resource allocation can be improved by the use of learner profiles and other digitally stored data. Funding can be obtained from Big Data companies in the form of consulting and equipment.

WORKING GROUP 4
ORGANIZATION DESIGN

To unleash the potential of Big Data, its effects on organizational strategy, structure, business processes, reward systems, and human resource management must be understood. In a given organization, Big Data can be an asset or a liability (or both). The accumulation of more and different data has the potential of building an organization's asset base. These same data, however, can be a potential liability depending on how they are used. WG4's overall conclusion was that assets and liabilities have to be managed using an integrative framework. The advent of Big Data is turning many organizational hierarchies on their heads, with the increasing abundance of transparent data permitting organizations to be more entrepreneurial and empowered.

WG4 papers were grouped according to seven themes, introducing a variety of paradoxes containing both opportunities and risks:
- Complexity introduced by Big Data is sweeping the global economy and organizations
- Organizational redesign that upshifts ICT to leverage Big Data in business strategies
- Design of new tools for increasing the transparency of Big Data in organizations
- Polyarchies with empowered teams stimulating entrepreneurial initiatives
- Sense-making that seeks to integrate neuroscience, business analytics, and knowledge management
- Rapidly emerging talent wars creating hiring and skills gaps for data scientists
- Increasing organizational tensions between innovation (exploration) and optimization (exploitation).

Within each theme, major challenges were identified and discussed. Challenges included the need for systemic and integrative thinking; identification of new organizational roles specifically related to Big Data; development of rules for ownership and stewardship of Big Data; development of new business models fostered by Big Data; and so on. Based on discussions of these challenges, many specific recommendations were developed. Those recommendations were divided into three areas: new research topics and methodologies; formation of research consortia; and extensive development of case studies.

New research topics and methodologies
- Increase research that focuses on the future, including developing future-oriented constructs like organizational anticipation and organizational agility
- Do more thought experiments and simulation studies of what might be
- Engage in studies of organizational prototyping using computational modeling and other newer research methodologies
- Conduct experiments on individual and collective cognition as they relate to Big Data
- Predict the impact on organizations of different aspects of Big Data and identify adaptive responses

Research consortia
- Form research consortia that can conduct large-scale, cross-disciplinary, collaborative research on the phenomenon of Big Data
- Develop practical frameworks and tools for managers who must deal with the "messiness" of Big Data
- Fund university-business collaborations that will develop frameworks and solutions of both theoretical and practical value
- Study the organization of science-policy relationships so that government policymaking is based on relevant science

Case studies
- Write real-time case studies that feed back developments as they occur. Cases of both progress and setbacks are needed.
- Develop teaching cases for training and education programmes on the main topics associated with Big Data
- Develop cases that show the roles, skills, and career paths of data scientists
- Develop cases that show the dynamics of integrating Big Data into the operations of an organization
- Write cases that show how the role of ICT must be redesigned to take advantage of Big Data
- Write cases that feature privacy and security issues of Big Data.

WORKING GROUP 5
PARTNERSHIPS/NETWORKS/COMMUNITIES

The objectives of WG5 involved the identification and discussion of public and private partnerships, which often take the form of collaborative networks and communities, to engage in research, increase knowledge and skill development, and take advantage of the opportunities presented by Big Data. WG5 believes that the funding for private and public partnerships can be usefully viewed from a perspective that includes an open data philosophy, an outside-in approach to ICT and Big Data instead of an inside-out approach, and an educational philosophy that is transdisciplinary and continuing. Recommendations were developed in three areas: business intelligence, open data, and education.

Business intelligence
- Following the lead of companies such as NetApp, Cisco, Oracle, Microsoft, SAP, Cloudera, and others, create Big Data ecosystems through commercial alliances
- Major firms should explore the formation of partner networks that include viral consultants, search consultants, advertising consultants, and social media consultants to investigate opportunities and risks of Big Data
- Identify and develop the business intelligence capabilities needed in the Big Data era

Open data
- The development of open data opportunities is best pursued in networks and communities. Identify the organization design features of such networks and communities as well as their processes of self-governance.
- Explore how Big Data can be related to existing processes of open and user-driven innovation
- Determine how intellectual property rights, licensing, and other forms of value appropriation should be handled in networks and communities that have commercial goals
- Study how networks and communities can compete with other types of organizations

Education
- Education programmes need to broad as well as specific. Big Data relies on ICT infrastructure, digital and Internet devices, and analytics science for the processing of huge data volumes. Increasingly, it relies on sociology, international law, and cultural anthropology to determine how it will influence global society.
- Educational institutions must supply business and other enterprises with people who have skills in Big Data analytics, but they must also supply people who have the ability to turn Big Data into business models that will work across cultures and geographies.
- Big Data is a fast-moving phenomenon that will require continuous learning and close relationships between educational institutions and business enterprises. Both types of organizations will need to learn how to collaborate in complex learning and commercial networks.

CONCLUSION

The Big Data phenomenon is growing in both scope and impact. The potential of Big Data – in the opportunities it presents as well as the threats it poses – is vast. As is the case with any new phenomenon, however, Big Data is not clearly understood. **Unleashing the Potential of Big Data** seeks to contribute to our understanding of this powerful phenomenon so that its potential can be realized as efficiently and safely as possible. The strengths of this White Paper are its comprehensiveness and the expertise that was brought to bear on each major aspect of Big Data. We hope that decision makers in business, government, and education will find it useful as they make policies on and investments in Big Data.

APPENDIX A
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Rindos, Andrew	(IBM)
Romero, Oscar	(Universitat Politècnica de Catalunya)
Rong, Chunming	(University of Stavanger)
Rossignoli, Cecilia	(University of Verona)
Rousseau, François	(École Polytechnique)
Sacconi, Leonardo	(LENS Biophotonics Group, European Laboratory for Non Linear Spectroscopy and Department of Physics, University of Florence)
Santiago, Ivan	(Kybele Research Group, University of Alicante)
Sela, Alon	(Tel Aviv University)
Semeraro, Giovanni	(Università degli Studi di Bari 'Aldo Moro')
Senese, Francesca	(Agenzia Sanitaria e Sociale Regionale dell'Emilia-Romagna)
Silvestri, Ludovico	(LENS Biophotonics Group, European Laboratory for Non Linear Spectroscopy and Department of Physics, University of Florence)
Simonini, Giovanni	(Università di Modena e Reggio Emilia)
Sindakis, Stavros	(Bangkok University)
Sips, Robert-Jan	(IBM Nederland B.V.)
Slinger, Giles	(Concentra)
Tagliasacchi, Marco	(Politecnico di Milano)
Tanca, Letizia	(Politecnico di Milano)
Tani, Simone	(Direction for Economic, Touristic promotion and Development Strategies Municipality of Florence)
Theodoropoulos, Georgios	(Durham University)
Tirado, Juan M.	(Universidad Carlos III de Madrid)
Trujillo, Juan Carlos	(Lucentia Research Group, University of Alicante)
Tubertini, Paolo	(University of Bologna)
Turra, Roberta	(CINECA)
Uskenbaeva, Raisa	(International Information Technologies University)
Vara, Juan M.	(Kybele Research Group, University of Alicante)
Vazirgiannis, Michalis	(École Polytechnique)
Viscusi, Gianluigi	(University of Milano Bicocca)
Vitari, Claudio	(Grenoble École de Management)
Vouk, Mladen	(North Carolina State University)
Wigham, Stuart	(Aston University Business School)
Wlodarczyk, Tomasz Wiktor	(University of Stavanger)
Zemirli, Nesrine	(King Saud University - IS Dept.)

APPENDIX B
WORLD SUMMIT WORKING GROUPS

WORKING GROUP 1
UNIVERSITY/BUSINESS DRIVEN APPLICATIONS

Eskildsen, Jacob	(Aarhus University, Denmark) (CHAIR)
Sanz Saiz, Beatriz	(Ernst & Young, Sydney)
Pigni, Federico	(Grenoble École de Management, France)
Ebbes, Peter	(HEC Paris, Jouy-en-Josas, France)
Bielli, Paola	(Bocconi University, Italy)
Last, Mark	(Ben-Gurion University, Israel)
Leo, Pietro	(IBM, Italy)
Falcão e Cunha, João	(Universidade do Porto, Portugal)
Fathallah, Mourad	(ENPC MB, France)
Musto, Cataldo	(Università degli Studi di Bari 'Aldo Moro', Italy)
Semeraro, Giovanni	(Università degli Studi di Bari 'Aldo Moro', Italy)
Mola, Lapo	(University of Verona, Italy)
Rossignoli, Cecilia	(University of Verona, Italy)
Léonard, Michel	(ISS-University of Geneva, Switzerland)
Burtman, Pini	(IBM, Israel)
Porat, Sara	(IBM, Israel)
Washam Winson, Jo Ann	(IBM, USA)

WORKING GROUP 2
UNIVERSITY/PUBLIC-DRIVEN APPLICATIONS

Pettenati, Maria Chiara	(ICON Foundation, Italy) (CHAIR)
Carley, Kathleen	(Carnegie Mellon University, USA)
Gaultier, Renaud	(EM Lyon, Ecully, France)
Juhás, Gabriel	(Slovak University of Technology, Slovakia)
Carayannis, Elias	(George Washington University, USA)
Lejeune, Albert	(ESG-UQAM, Canada)
Kanjo, Eiman	(King Saud University, Saudi Arabia)
Hitzelberger, Patrik	(Centre de Recherche Public - Gabriel Lippmann, Luxembourg)
Denneulin, Yves	(Grenoble INP, France)
Cornu-Emieux, Renaud	(Grenoble EM, France)
Piccolo, Fabrizio	(IBM, Italy)
Tani, Simone	(Municipality of Florence, Italy)
Lodi, Andrea	(University of Bologna, Italy)
Senese, Francesca	(Agenzia Sanitaria e Sociale Regionale dell'Emilia-Romagna, Italy)
Maltseva, Svetlana	(National Research University Higher School of Economics, Russia)
Belov, Sergey	(IBM, Russia)
Vara, Juan M.	(University of Alicante, Spain)
Adembri, Giulia	(ICON Foundation, Italy)
Bassini, Sanzio	(CINECA, Italy)
Zemirli, Nesrine	(King Saud University - IS Dept.)

WORKING GROUP 2
(cont.)

Cavazzoni, Carlo	(CINECA, Italy)
Nguyen, David	(United Solutions, USA)
Pratlong, Florent	(Université Paris 1 Panthéon-Sorbonne, France)
Milani, Carla	(IBM, Italy)
Koskinen, Jyrki	(IBM, Finland)
Napoli, Juan Pablo	(IBM, United Arab Emirates)
Mähler, Martin	(IBM, Germany)

WORKING GROUP 3
DATA CHALLENGES

Ben-Gal, Irad	(Tel Aviv University, Israel) (CHAIR)
Markl, Volker	(Technische Universität Berlin, Germany)
Gavrilova, Tatiana	(Graduate School of Management, Russia)
Abelló, Alberto	(Universitat Politècnica de Catalunya, Spain)
Tanca, Letizia	(Politecnico di Milano, Italy)
Averkin, Alexey	(Plekhanov's University of Economics, Russia)
Rousseau, François	(École Polytechnique, France)
Laurent, Anne	(Université Montpellier 2, France)
Engbersen, Ton	(IBM, Switzerland)
Brink, Alexander	(IBM, Netherlands)
Sips, Robert-Jan	(IBM, Netherlands)
Batini, Carlo	(University of Milano Bicocca, Italy)
Viscusi, Gianluigi	(University of Milano Bicocca, Italy)
Uskenbaeva, Raisa	(International Information Technologies University, Kazakhstan)
Kozhamzharova, Dinara	(International Information Technologies University, Kazakhstan)
Zhyldyz, Kalpeyeva	(International Information Technologies University, Kazakhstan)
Cristea, Valentin	(University Politehnica of Bucharest, Romania)
Florin, Pop	(University Politehnica of Bucharest, Romania)
Fouladkar, Ali	(Grenoble University/CERAG Laboratory, France)
Zaarour, Lyad	(Lebanese University, Lebanon)
Wlodarczyk, Tomasz Wiktor	(University of Stavanger, Norway)
Ron, Chunming	(University of Stavanger, Norway)
Pokorny, Jaroslav	(Charles University, Czech Republic)
Sasson, Elan	(Ben-Gurion University of the Negev, Israel)
Alstrup, Stephen	(University of Copenhagen, Denmark)
Niemelä, Ilkka	(Aalto University, Finland)
O'Sullivan, Barry	(University College Cork, Ireland)
Borangiu, Theodor	(IBM, Romania)
Sela, Alon	(Tel Aviv University, Israel)
Bergamaschi, Sonia	(Dip. di Ingegneria "Enzo Ferrari" - Universita' di Modena e Reggio Emilia)
Simonini, Giovanni	(Università di Modena e Reggio Emilia)

WORKING GROUP 4
ORGANIZATION DESIGN

Mastrangelo, Dolly	(Independent IT Consultant (CHAIR))
Burton, Richard	(Duke University, USA)
Gabel, Tim	(RTI International, Research Triangle Park, USA)
Moellekaer, Anders	(Aarhus University, Denmark)
Despres, Charles	(SKEMA Business School, France)
Graupner, Enrico	(Institute for Enterprise Systems, Germany)
Wigham, Stuart	(Aston University Business School, UK)
Gallo, Peter	(Creighton University, USA)
Miller, Steven	(IBM, USA)
George, Martine	(BNP Paribas Fortis, Belgium)
Glady, Nicolas	(ESSEC Business School, France)
Grah, Barbara	(University of Ljubljana, Slovenia)
Dimovski, Vlado	(University of Ljubljana, Slovenia)
Ordowich, Carolyn	(STS Associates Inc., Princeton, USA)
Ordowich, Richard	(STS Associates Inc., Princeton, USA)
Morrison, Rupert	(Concentra, UK)
Slinger, Giles	(Concentra, UK)
Lewin, Arie	(Duke University, USA)
Korhonen, Janne	(Bioss, Finland)
Shepard, Ken	(Global Organization Design Society, Canada)

WORKING GROUP 5
PARTNERSHIPS/NETWORKS/COMMUNITIES

Mieyeville, Fabien	(École Centrale Lyon, France) (CHAIR)
Righini, Giovanni	(University of Milan, Italy)
Pazienza, Maria Teresa	(Roma Tor Vergata University, Italy)
Preetzmann, Thomas	(Aarhus University, Denmark)
Palpanas, Themis	(University of Trento, Italy)
Zemirli, Nesirne	(King Saud University, Saudi Arabia)
Pacheco de Almeida, Goncalo	(HEC Paris, France)
Dolev, Shlomi	(Ben-Gurion University, Israel)
Theodoropoulos, Georgios	(Durham University, UK)
Carretero, Jesus	(Universidad Carlos III de Madrid, Spain)
Aufareau, Marie-Aude	(École Centrale Paris, France)
Novotny, Ota	(University of Economics, Prague, Czech Republic)
Vrana, Lenka	(University of Economics, Prague, Czech Republic)
Flynn, James	(IBM, Ireland)
Vouk, Mladen	(North Carolina State University, USA)
Chiky, Raja	(ISEP Engineering School, France)
Zemirli, Nesrine	(King Saud University - IS Dept.)

APPENDIX C
WORLD SUMMIT KEYNOTE AND DISTINGUISHED SPEAKERS

André Richier
Principal Administrator, DG Enterprise and Industry, European Commission

Bernard Meyerson, PhD
IBM Fellow & Vice President, Innovation, IBM Global University Relations

Harry van Dorenmalen
Chairman, IBM Europe

Herve Rolland
General Manager, IBM France
Standing in for Alain Benichou, President, IBM France

Jay Galbraith
President, Galbraith Management Consultants

Philippe Raimbourg
Professor, Université Panthéon-Sorbonne 1
Standing in for President Université Panthéon-Sorbonne 1

Syoum Négassi
Professor, Université Panthéon-Sorbonne 1

Volker Markl
Professor, DIMA – Technische Universität Berlin

Juan Carlos Marcos
Managing Director, Accenture

Kathleen Carley
Professor, Carnegie Mellon University

Ton Engbersen
Sci. Dir. ASTRON-IBM Center for Exascale Technology

APPENDIX D PROGRAM

May 16. 15:00 – 16:00	**Registration and Coffee**	
16:00	**Session 1**	**Chaired by Organizational Design Community**
16:00 – 16:10	**Welcome**	Philippe Raimbourg, Professor, standing in for the President of the Université Panthéon-Sorbonne 1
16:10 – 16:25	**Why Big Data?**	Børge Obel, Center Director, ICOA
16:25 – 16:30	**Introduction to the agenda**	Børge Obel, Center Director, ICOA
16:30 – 17:00	**Keynote: Academy**	Volker Markl, Professor, DIMA - Technische Universität Berlin
17:00 – 17:30	**Keynote: Industry**	Harry van Dorenmalen, Chairman, IBM Europe
17:30 – 18:00	**Keynote: Government**	André Richier, Principal Administrator, European Commission
19:30 – 24:00	**Dinner (*)**	Herve Rolland, General Manager IBM France, standing in for Alain Benichou, President, IBM France Syoum Négassi, Professor, Université Panthéon-Sorbonne 1
May 17. 08:25 – 08:30	**Session 2**	**Chaired by IBM - Diem Ho, IBM**
08:30 – 09:00	**Big Data survey**	Bernard S. Meyerson, IBM Fellow & Vice President, Innovation, IBM
09:00 – 10:00	**Breakout sessions to finalize the work group report**	Five working groups (**): 1. University/Business–driven Applications 2. University/Public–driven Applications 3. Data Challenges 4. Organisation Impacts 5. Partnership/Fellowship
10:00 – 10:30	**Coffee break**	
10:30 – 13:00	**WG reports: report and recommendations**	Working group chairs: 1. Jacob Kjær Eskildsen, Professor, Aarhus University 2. Maria Chiara Pettenati, Doctor, ICON Foundation 3. Irad Ben-Gal, Professor, Tel Aviv University 4. Dolly Mastrangelo, Doctor, Independent IT Consultant 5. Fabien Mieyeville, Professor, École Centrale de Lyon
13:00 – 14:00	**Lunch and networking (***)**	
14:00	**Session 3**	**Chaired by ICOA - Rick Edgeman, Professor**
14:00 – 15:00	**Distinguished works in research, skills, and applications in Big Data and organization design**	1. Juan Carlos Marcos, Managing Director, Accenture 2. Kathleen Carley, Professor, Carnegie Mellon University 3. Ton Engbertsen, Doctor, IBM
15:00 – 15:55	**Participant discussion**	ODC moderator - Fabrizio Salvador, Professor, IE Business School, MIT-Zaragoza
15:55 – 16:25	**Closing keynote: Big Data as a driver for organizational design**	Jay Galbraith, President, Galbraith Management Consultants
16:25 – 16:30	**Concluding remarks**	Charles C. Snow, Professor, Penn State University
16:30	**Adjourn and have safe trip home**	

INTERDISCIPLINARY ORGANIZING COMMITTEE

Andreea Gorbatai	(UC Berkeley, Haas School of Business)
Børge Obel	(ICOA, Aarhus University)
Diem Ho	(IBM)
Fabrizio Salvador	(IE Business School, MIT-Zaragoza)
Josiane Gain	(IBM France)
Morten Bygvraa Rasmussen	(ICOA, Aarhus University)
Pernille Dissing Sørensen	(ICOA, Aarhus University)
Richard Burton	(Duke University)
Syoum Negassi	(Sorbonne University)

APPENDIX E
THE ORGANIZERS

IBM

Each day we create 2.5 quintillion bytes of data generated by a variety of sources – from climate information to posts on social media sites, and from purchase transaction records to health care medical images. At IBM we believe that Big Data represents a new era in data exploration and utilization and analytics are a catalyst to help clients become more competitive and drive growth. IBM has established the world's deepest and broadest portfolio of Big Data technologies and solutions, spanning services, software, research, and hardware. We push the boundaries of science, technology, and business to make the world work better. IBM Research is a global community of forward-thinkers working towards a common goal: progress.

For more information about IBM and Big Data and Analytics, please visit at **www.ibmbigdatahub.com**

PARIS-SORBONNE UNIVERSITY

Paris Sorbonne University is the main inheritor of the old Sorbonne, which dates back to the 13th century. It was one of the first universities in the world.

The biggest complex in France, dedicated to Literature, Languages, Civilizations, Arts, Humanities and Social Sciences, is located on the original medieval foundations, and now extends to the Latin Quarter and to other areas in Paris. The University has two characteristics : rich culture and tradition, with top-quality researchers, and therefore an excellent scientific reputation shown through publications and international exchanges and its aim to constantly adapt to present–day social and technological changes and to encourage as many students as possible to study at Paris-Sorbonne while preparing for their future careers. The Sorbonne incites its students to think freely and to construct their own judgment, so that they can become responsible and inventive citizens who can promote dignity and peace culture.

INTERDISCIPLINARY CENTER FOR ORGANIZATIONAL ARCHITECTURE

ICOA is an interdisciplinary research center at Aarhus University, Denmark.

ICOA's vision is: "Designing organizations of the future". The center strives to be world recognized within the field of organizational architecture. In close dialogue with relevant stakeholders, ICOA will renew organizational theory, design and create concrete implements for business, public organizations and society.

The research focus of the center is on developing insights on the mechanisms, dynamics, and best practices of organizational architecture activities. We draw on a wide range of theoretical perspectives, including multi-contingency theory, dynamic capabilities, and business excellence. The goal of the center is to advance the understanding of the design of intra-firm architectures and their integration into a holistic management system.

The core activity at ICOA is to do research on how to analyze, design, and redesign private and public organizations to secure their ability to excel now and in the future. Hence, we do research on how to design a robust integration and alignment of people, processes, and functional areas for optimal organizational innovation and performance.

ICOA is the host of a number of global activities like the Organization Design Community (ODC) and the Journal of Organization Design.

ICOA is headed by professor Børge Obel, bo@asb.dk.

Please see more at **www.icoa.au.dk**

ORGANIZATIONAL DESIGN COMMUNITY

The Organizational Design Community (ODC) is an international community of scholars, executives, and organizations dedicated to advancing the theory and practice of organization design. ODC seeks to be the preeminent community where research, practice, and learning intersect to produce valuable design knowledge and applications.
The ODC is hosted by ICOA.

Please see more at **http://orgdesigncomm.com**

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