The Potential of BIG Data Applications for the Healthcare Sector

Results of the User Needs & Requisites Study in BIG

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The EU Project BIG

Big Data Public Private Forum

Trigger

Europe needs a clear strategy for leveraging Big Data Economy in Europe

Objectives

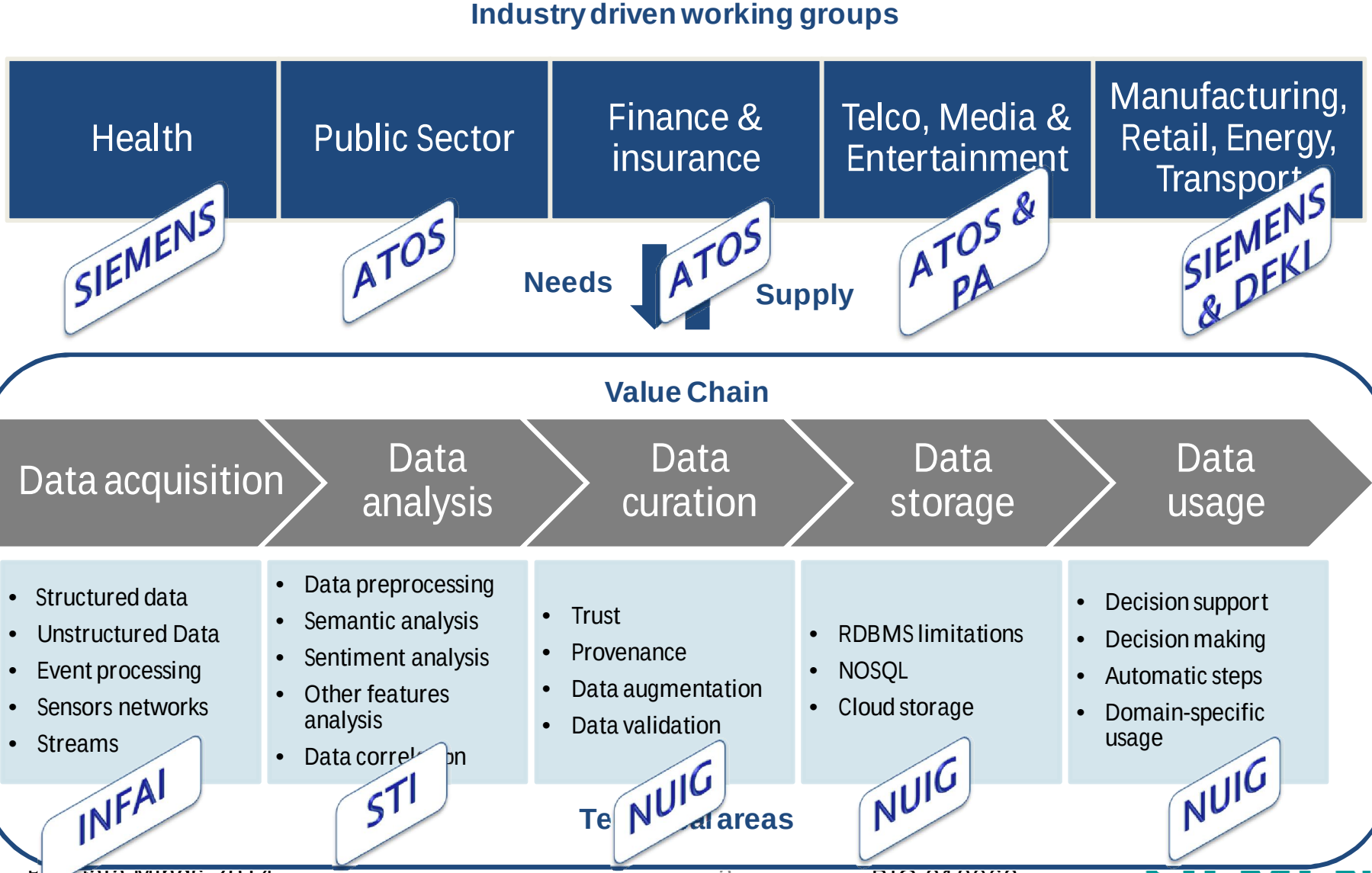
Work at technical, business and policy levels, shaping the future through the positioning of Big Data in Horizon 2020.

Bringing the necessary stakeholders into a sustainable industry-led initiative, which will greatly contribute to enhance the EU competitiveness taking full advantage of Big Data technologies.

Facts

Type of project: Coordination & Support Action
Project start date: September 2012
Duration: 26 months
Call: FP7-ICT-2011-8
Budget: 3,038 M€
Consortium: 11 partners

Project Structure
(Sectorial forums and Technical working groups)

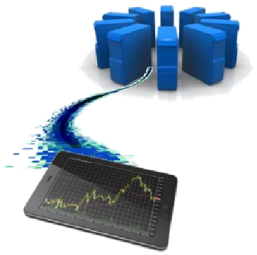


Big Data in Healthcare

What are we taking about?

Definition of Big Data in Healthcare Industry

- Big Health Data technologies help to take existing healthcare business intelligence, health data analytics and health data management application
- to the next level by providing means for the efficient handling and analysis of complex and large healthcare data by relying on
  - data integration,
  - real-time analysis as well as
  - predictive analysis



often discussed under the label „Advanced Health Data Analytics“

Characteristics of Health data

- Health data is not big in terms of large size
  - Exceptions are medical images and NGS, however the analysis of analytics approaches for medical images and NGS is immature and in development
- Health data is complex
  - Heterogeneous data (images, structured, unstructured data, etc.)
  - Various data domains (administrative, financial, patient, population, etc.)

Key Findings

Impact of Big Data Applications in Health Domain

Technology-wise = Evolution

- Big Data Technology (e.g. scalable data analytics, semantic technologies, machine learning, scalable data storage, etc.) is ready to be used
- Now these techniques are combined and extended to address big data paradigm
- Domain-specific requirements needs to be addressed (e.g. health data anonymization, understand analytic needs)

Business-wise = Revolution

- The lack of business cases is hindering block
- Integrating of heterogeneous data sources beyond organization boundaries relies on effective cooperation of multiple stakeholder with diverging interests

=> existing industrial business processes will change fundamentally, new players & business models will emerge

User Needs

Potential Benefits and Advantages

Improved Efficiency of Care [1]

- Combine clinical, financial, and administrative data to monitor outcomes relative to resource utilization
- Measure physician performance against peers and other institutions
- Mine population level data for clinical research
- Helps organizations manage regulatory compliance through detailed information reporting

Improved Quality of Care [1]

- Empowers users with key knowledge needed for effective decision making
- Identify high-risk patients and patient populations
- Develop predictive models leading to proactive patient care
- Enables uniform and multi-dimensional view of patient and population data

Real Impact

- of Big Data Analytics is expected on integrated data sets

Multiple Data Pools in Healthcare

Main impact by integrating various and heterogeneous data sources

Patient Behaviour & Sentiment Data

- Owned by consumers or monitoring device producer
- Encompass any information related to the patient behaviours and preferences

Pharmaceutical & R&D Data

- Owned by the pharmaceutical companies, research labs/academia, government
- Encompass clinical trials, clinical studies, population and disease data, etc.

Health data on the web

- Mainly open source
- Examples are websites such as PatientLikeMe, Linked Open Data, etc.

Highest Impact on integrated data sets

Clinical Data

- Owned by providers (such as hospitals, care centers, physicians, etc.)
- Encompass any information stored within the classical hospital information systems or EHR, such as medical records, medical images, lab results, genetic data, etc.

Claims, Cost & Administrative Data

- Owned by providers and payors
- Encompass any data sets relevant for reimbursement issues, such as utilization of care, cost estimates, claims, etc.

Market Impact and Competition

Hype and Hope

Market Impact

- The market for big data technology in the healthcare domains is in an **early stage**
- Concrete financial numbers are not available
- Adoption health data analytics **relies on the availability of EHR solutions**
- **US governance provides seed funding** for the implementation EHR technology as well as health analytics technology

Competition

- The market for big health data technology and solutions is **emerging and highly competitive**.
- **Different types of vendors** can be categorized:
  - IT vendors primary focusing on Big Data technology (e.g. IBM, Teradata, SAP, etc.),
  - HIS vendors that offering a range of information solutions for health care providers (e.g. Cerner, Epic, Siemens, etc.)
  - Vendors focusing primary on big data/data analytics solutions in markets with targeting only one customer segment or functionality (e.g. MedeAnalytics, QlikView, Castlight, etc.)
- McKinsey evaluation: since 2010 more than 200 businesses that offer innovative approaches for health data analytics and usage have emerged.
- Frost & Sullivan study: more than 100 competitors offering hospital health data analytics.

Drivers and Constraints

Drivers

- Increase in volume of electronic health care data
- Need for improve operational efficiency
- **US Healthcare Reforms HITECH & PPACA**
- Trend towards value-based healthcare delivery
- Trend towards new system incentives
- Trend towards increased patient engagement

Constraints

- Only a limited portion of clinical data is yet digitized
- lack of standardized health data (e.g. EHR, common models / ontologies) affects analytics usage
- Data and Organizational silos
- Data security and privacy issues hinder data exchange
- High investments are needed
- Existing incentives hinder cooperation
- Missing business cases and unclear business models

Value-Based Healthcare Delivery

A new paradigm for effective collaboration

Value-based healthcare is becoming focus of many healthcare reforms

- The goal is to implement more effective healthcare delivery that allows to limit healthcare expenditure and at the same time help to increase the quality of care settings
- Value = Patient health outcomes per euro spent
- Example: US healthcare reform or provider starting to publishing high quality outcome data

Principles[1]

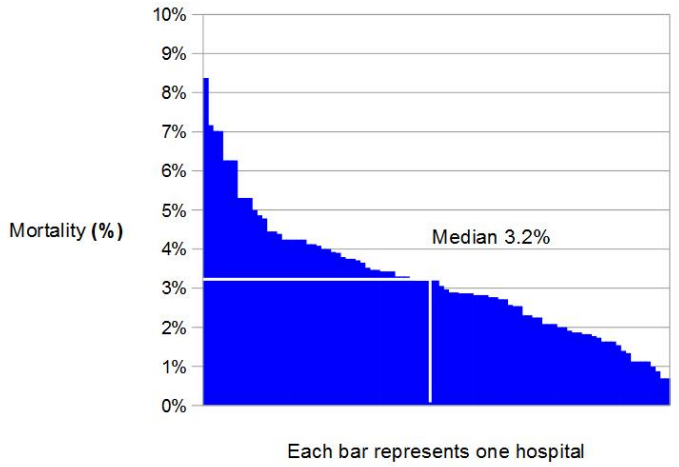
- Quality Improvements
  - Prevention of illness, early detection, right diagnosis, right treatment to right patient, rapid cycle time of treatments, fewer complications, fewer mistakes, slower disease progression, etc.
- Goal: Better health and less treatments

Big Data Technology....

- ...will play an important role to establish means to track and analyze treatment performance of patients and patient populations

Example

Variation in Quality Across German Providers:
In-hospital Cardiac Bypass Mortality for 77 hospitals (2008)



Source: BQS Outcomes 2008

1 - Porter and Olmsted Teisberg "Redefining German Health Care", 2006

Big Data applications in the health domain

Some examples

1. Comparative Effectiveness Research: compare the clinical and financial effectiveness of interventions in order to increase efficiency and quality of clinical care services.
2. Next generation of Clinical Decision Support Systems: use of comprehensive heterogeneous health data sets as well as advanced analytics
3. Clinical Operation Intelligence: identify waste in clinical processes in order to optimize them accordingly, e.g. analyzing medical procedures to find performance opportunities, such as improved clinical processes, fine-tuning and adaptation of clinical guidelines
4. Secondary usage of health data is the aggregation, analysis and concise presentation of clinical, financial, administrative as well as other related health data in order to discover new valuable knowledge, for instance to identify trends, predict outcomes or influence patient care, drug development, or therapy choices, e.g.
   - Identification of patients with rare diseases
   - Patient recruiting and profiling
   - Forecast of clinical process performance
   - Healthcare Knowledge Broker
5. Public Health Analysis aims to analyze comprehensive data sets of patient populations in order to learn about the overall /population-wide effectiveness of treatments, the quality and cost structure of care settings, etc. By using nation-wide disease registries, i.e. databases covering secondary data related to patients with a specific diagnosis, condition or procedure.
6. Patient Engagement aims to establish communication portals that foster the active engagement of patients in their healthcare process.

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Requirements

Challenges that need to be addressed

1 High Investment

Long-term investments require conjoint engagement of several partners

2 Value-based system incentives

Current incentives enforce “high number” instead of “high quality” of care services

3 Business Cases

Undiscovered und unclaimed potential business values

1 Data Security

Legal processes for data sharing & communication are needed

2 Data Quality

Reliable insights for health-related decisions require high data quality

1 Data Digitalization

only small percentage of data is documented (lack of time) with low quality

2 Semantic Annotation

transform unstructured data into structured format

3 Data Sharing

Overcome data silos and inflexible interfaces

Not-Technology-related	Regulation & Technology	Technology-related

Summary

Big data revolution in healthcare is in a early stage

1. Several developments in the healthcare domain, such as escalating healthcare cost, increased need for healthcare coverage and shifts in provider reimbursement trends trigger the demand for big data technology.
2. The availability and access of health data is continuously improving but more efforts are needed
3. The required big data technology, such as advanced data integration and analytics technologies, are theoretically in place
4. First-mover best-practice application demonstrate the potential of big data technology in healthcare
5. Current roadblocks are the established system incentives of the healthcare system which hinder collaboration and, thus, data sharing and exchange
6. The trend towards value-based healthcare delivery will foster the collaboration to enhance the treatment patient of the patient, and thus will significantly foster the need for big data applications

Thank you for your attention!

Any Questions?

http://www.big-project.eu/

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