

Value creation in the era of Big Data

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Value creation in the era of Big Data.

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Work Group (please mark your position paper's objective(s) with a X):

University/Business driven Applications	**X**
University/Public driven Applications	
Data Challenges	
Impacts on Organization Design	
Partnership/Fellowship	

State of the art

The concept of big data stems from the evidence that organizations have now the opportunity to collect, process, and store ever-growing and complex datasets to support their decision making process and strategies. These large and complex data bases require specific storage, management, analysis, and visualization technologies to be effectively used, such as: business intelligence and analytics tools to dive and make sense of big data (Chen, Chiang, & Storey, 2012; Pospiech & Felden, 2012). The first wave of scientific research on big data was mainly technically driven and centered around aspects of data provisioning (Pospiech & Felden, 2012) and data management (Briody, 2011). More recently, a new set of studies provided a first assessment of big data impacts and analytics' developments (Chen et al., 2012)(Abbasi, Albrecht, Vance, & Hansen, 2012; Chau & Xu, 2012; Daning Hu, Zhao, Zhimin Hua, & Wong, 2012; Lau, Liao, Wong, & Chiu, 2012; Sahoo, Param Vir Singh, & Mukhopadhyay, 2012; Sung-Hyuk Park, Soon-Young Huh, Wonseok Oh, & Sang Pil Han, 2012). These studies support the observed relationship between company performance and a data driven organizational orientation (McAfee & Brynjolfsson, 2012).

Very few studies focus on the strategic opportunities for extracting value from the real-time streams of digital data that are being created in massive quantities (Gabriele Piccoli & Federico Pigni, 2013)(Piccoli & Watson, 2008). We think that new form of value creation emerge from the interplay of the three key characteristics of big data – volume, velocity and variety (McAfee & Brynjolfsson, 2012) and firm's complementary resources (Gabriele Piccoli & Federico Pigni, 2013). This is the core of our research.

Our current work on big data

We decided to focus our work on the opportunities of value creation emerging from the exploitation of massive quantities of real time data that can be used both for real-time tactics and long-term strategy. We explained how organizations can leverage these *digital data streams* (DDSs) to increase consumer value and to improve operational efficiency (Gabriele Piccoli & Federico Pigni, 2013).

Advancing the management field: new opportunities for value creation

With the support of the Advanced Practice Council of the Society for Information Managemnet (http://www.simnet.org/?page=About_APC) we developed new conceptual tools to help managers identify

and comprehend the opportunities for innovative value creation. We have shown that there are significant opportunities once organizations have identified digital data streams and treat them as a central and coherent unit of analysis.

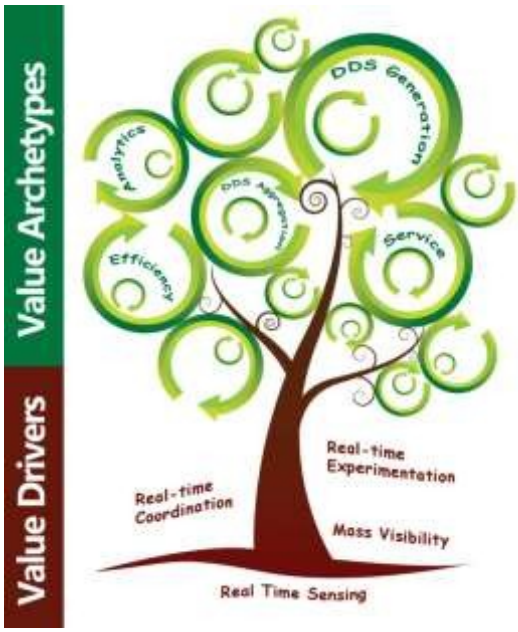


Figure 1: The value tree

Extracting value from DDS

We have identified five value-creation mechanisms or *value archetypes*, which are essentially "templates" that allow organizations to create value using DDSs (Gabriele Piccoli & Federico Pigni, 2013). Each of the five archetypes represents a class of value-creating initiatives that may employ one or more DDSs. What enables these data streams to contribute to value creation is a value driver, which is the unique quality of an activity that is the source of the activity's value contribution. We have identified four value drivers. Value drivers represent the tangible elements of a DDS that enable a firm to achieve the goals of either increasing a customer's willingness to pay or reducing the opportunity cost of existing resources, thus generating strategic value. A value driver is the mediator between the potential for action and an actual business implementation (i.e., a value archetype). Value can then be created through a mechanism rooted in one or more value drivers.
The five archetypes and four drivers are depicted as a value tree, with the drivers providing the roots for the archetypes (see Figure 1).

The value archetypes

A value archetype is a basic model for value creation that is based on digital data streaming. Value archetypes are not mutually exclusive, and each organization may create value by using more than one approach simultaneously. In our research we identified five value archetypes:

1. **DDS Generation.** A firm creates value by originating the stream of data itself, either knowingly or as a byproduct of other activities.
2. **DDS Aggregation.** A firm creates value by focusing on collecting, aggregating and repurposing DDS.
3. **DDS Service.** A firm creates value by using one or more DDSs to provide services to consumers or to improve service quality.
4. **DDS Efficiency.** A firm create value by using real-time data streams to optimize internal operations or to track business performance (e.g., waste reduction, response speed).
5. **DDS Analytics.** A firm creates value by processing DDS information to produce analyses or improved visualizations with the objective of enabling better decision making and producing superior insight or knowledge (for example, through dashboards and data mining).

Four Value Drivers

Within the framework of the five value archetypes, companies need to focus on and understand the value drivers for each archetype—the enabling factors behind the business opportunity. By identifying value drivers, companies can use DDSs for innovation as they identify new possibilities to create value. In our research, we identified four value drivers:

1. **Real-time Sensing.** This value driver requires the ability to detect the current state of a given entity. Examples are the location of a plane, the speed of a car or the mood of an individual. We consider the real-time sensing value driver to be the *first-order* value driver, because it is the basis of all of the new value-creation opportunities
2. **Real-time Mass Visibility.** This *second-order* value driver is based on real-time sensing. It represents the ability to identify the state of multiple entities in real time, contextualized by their relationships. For example, if real-time sensing makes it possible to locate one vehicle, it is possible to acquire visibility of all vehicles on a road, thus enabling traffic congestion to be detected.
3. **Real-time Experimentation.** This *second-order* value driver also relies on real-time sensing. It consists of the possibility to fast cycle reliable data generation and gathering. Comparisons of a control sample to other samples (e.g., A/B tests) on web pages for selecting a layout, or the massive experimentation ongoing in major websites, or business experiments are examples of this value driver.
4. **Real-time Coordination.** The third *second-order* value driver is also based on real-time sensing. This driver is the ability to quickly adjust behavior based on feedback about the current state of other entities.

Perhaps the most important insight regarding value drivers is that a company does not have to actually own the data generation asset (the DDS). Instead, all the firm needs is access to the DDS and a concept for how to use that DDS to add value. The criteria for success are based on an organization's ability to identify valuable DDSs, gain access to them with the appropriate tools, properly orchestrate the available resources and invest in DDS initiatives.

Ongoing research and expected results: from new value to new capabilities

We started to observe recognizable patterns in those companies that were most benefitting from big data exploitation. Moreover, dealing with real-time DDSs required a different set of organizational capabilities than dealing with traditional static Business intelligence datasets. Our early research suggests that, to implement a DDS strategy, a firm must have a sound footing in the following four capabilities:

1. **Mindset**: A critical component of innovative initiatives is the willingness to invest and face risks in data-based strategic initiatives. A hallmark of the successful DDS initiatives we studied was that the "mental readiness" of organizational members made them ready to embrace change.
2. **Skillset**: A DDS strategy consists of more than simply collecting DDS data. As the five value-creation archetypes show, the firm must develop the competencies to orchestrate the complementary resources necessary to deliver value based on the DDS. The main focus is on the managerial actions undertaken to implement DDS initiatives underpinning a specific ability of coordination within and across organizational boundaries.
3. **Dataset**: A DDS strategy hinges on being able to tap into valuable sources. The dataset refers to the ability to effectively access and use the real time data stream and match it to the organizational needs for value generation. An effective access and use implies, in turn, a good understanding of the data contained in the data streams, and of the business needs of the organization.
4. **Toolset**: Once a source is identified, the firm must be able to tap into the streaming data. This requires the ability to use appropriate tools to harvest the DDS or multiple DDSs. The toolset refers to the access to and the ability to use the technical components that allows DDS exploitation. In this sense it requires both the technical elements that are a pre-requisite of a real-time analytical system tuned for processing real-time data streams.

We are currently developing a readiness index as a composite measure of these capabilities to assess the capacity of organization to deal with real-time initiatives.

Big data and the managerial education

The four capabilities identified in our research provide useful guidelines for defining the educational objectives on big data. Clearly the domains of expertise involved are multiple both of a technical and managerial aspects, hence adequate managerial and technical skills are required. If specific programs putting an emphasis on analytics, business intelligence, big data management, post-relational databases could provide the specific competences to face the analytics challenges, a more cross-competence profile is probably necessary to develop the above-mentioned capabilities.

1. **Mindset.** Future managers should be aware of the potentials of leveraging digital data both for supporting decision making and creating new strategic value for their organization. The actions are threefold:
    a. Develop manager's awareness and conscious strategic thinking on top of data assets and resources. Increase the capacity of managers to leverage complementary resources – both internally and externally – to create new value.
    b. Develop adequate analytical skills in managers to support their decision making process, as the increasing volume of accessible information requires mastering modeling and analytical abilities rooted in business statistics.
2. **Skillset.** Future managers will be required to advance unique configurations of resources to deliver value with data in the form of new products, processes, decision-making routines, etc. They will be required to configure and deploy process to coordinate co-specialized assets, providing a vision for those assets, and nurturing innovation, underpinning a specific capability of coordination within and across organizational boundaries. Communication skills will be required both to properly interact and communicate with the different domain experts and stakeholders internally and externally.
3. **Dataset.** Future managers will be invited to understand the business context in which the data is used, and its specific characteristics. These aspects are generally reflected in a specific data and information governance configuration that has to be interpreted. The use of low quality data for critical decision making process could have disastrous consequences, as high quality ones are associated to firms success. Managers will need appropriate skills to deal with this issue.
4. **Toolset.** The future manager will need to properly make sense of the technical capabilities of the firm in facing the big data challenge. Several are the examples in which new architectures and software have emerged once the fulfillement of the business objective required to overcome currents systems' limits .

Foreseen Challenges and Recommendations

The challenge that we are called to face consists in helping organization to profit from the opportunities emerging form big data. We suggested that this challenge can only be win by developing new skills and through a different approach to data that has to become pervasive in organizations. These changes would not happen overnight, and specific actions have to be undertaken. Our research suggests focusing on the four major organizational capabilities we identified. Furthermore, organizations should start considering process and resources trespassing organizational boundaries. More and more valuable data and complementary resources lay behind the traditional firms' perimeters. Consequently, the acquisition (e.g. harvesting tweets data stream) or the creation of new data sources (e.g. example deploying a sensor network) should be proactively examined.

References

Abbasi, A., Albrecht, C., Vance, A., & Hansen, J. (2012). METAFRAUD: A META-LEARNING FRAMEWORK FOR DETECTING FINANCIAL FRAUD. *MIS Quarterly*, *36*(4), 1293–A12.

Briody, D. (2011). *Big data: Harnessing a game-changing asset* (p. 32). London: The Economist.

Chau, M., & Xu, J. (2012). BUSINESS INTELLIGENCE IN BLOGS: UNDERSTANDING CONSUMER INTERACTIONS AND COMMUNITIES. *MIS Quarterly*, *36*(4), 1189–1216.

Chen, H., Chiang, R., & Storey, V. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. *Management Information Systems Quarterly*, *36*(4), 1165–1188.

Daning Hu, Zhao, J. L., Zhimin Hua, & Wong, M. C. S. (2012). NETWORK-BASED MODELING AND ANALYSIS OF SYSTEMIC RISK IN BANKING SYSTEMS. *MIS Quarterly*, *36*(4), 1269–1291.

Gabriele Piccoli, & Federico Pigni. (2013). Harvesting External Data: The Potential of Digital Data Streams. *MIS Quarterly Executive*, *12*(1), 143–154.

Hsinchun Chen, Chiang, R. H. L., & Storey, V. C. (2012). BUSINESS INTELLIGENCE AND ANALYTICS: FROM BIG DATA TO BIG IMPACT. *MIS Quarterly*, *36*(4), 1165–1188.

Lau, R. Y. K., Liao, S. S. Y., Wong, K. F., & Chiu, D. K. W. (2012). WEB 2.0 ENVIRONMENTAL SCANNING AND ADAPTIVE DECISION SUPPORT FOR BUSINESS MERGERS AND ACQUISITIONS. *MIS Quarterly*, *36*(4), 1239–A6.

McAfee, A., & Brynjolfsson, E. (2012). Big Data: The Management Revolution. *Harvard Business Review*, *90*(10), 60–68.

Piccoli, G., & Watson, R. T. (2008). Profit from Customer Data by Identifying Strategic Opportunities and Adopting the “Born Digital” Approach. *MIS Quarterly Executive*, *7*(3), 113–122.

Pospiech, M., & Felden, C. (2012). Big Data – A State-of-the-Art. *AMCIS 2012 Proceedings*. Retrieved from http://aisel.aisnet.org/amcis2012/proceedings/DecisionSupport/22

Sahoo, N., Param Vir Singh, & Mukhopadhyay, T. (2012). A HIDDEN MARKOV MODEL FOR COLLABORATIVE FILTERING. *MIS Quarterly*, *36*(4), 1329–A4.

Sung-Hyuk Park, Soon-Young Huh, Wonseok Oh, & Sang Pil Han. (2012). A SOCIAL NETWORK-BASED INFERENCE MODEL FOR VALIDATING CUSTOMER PROFILE DATA. *MIS Quarterly*, *36*(4), 1217–1237.