

Business Value Creation Through Project Management Based on Big Data Approach

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<https://doi.org/10.18280/isi.270516>

ABSTRACT

Received: 11 June 2022

Accepted: 30 August 2022

Keywords:

big data, business value, project management, big data analytics

In the era of big data, the high level of businesses' digitalization, and new technology development in various fields, awash companies in a flood of massive amounts of data. Dealing with that fact is non more an option. Companies have to reexamine the way they do business in order to gain benefits from big data. Consequently, they have to review their approach of managing projects in order to create the added value. For the purpose of assessing this issue, we have adopted a research approach built on two phases. In the first, we have performed a systematic literature review to spot the gaps in the current research. The results have revealed that so far, no scientific work has discussed how companies can create business value through project management in a big data context. These results have also shown significant contributions of the research community on how big data contributes to value creation in organizations. In the second, we have suggested an approach to fills the identified gap by proposing a framework that support project management process in big data environment.

1. INTRODUCTION

Nowadays, big data is playing an ever-increasing role in business environment [1-3]. Due to the businesses' digitalization, the development of the web and the growth of new technology in all areas, organizations are drowned in data. Therefore, dealing with big data is a must in the current competitive landscape, and companies are being forced to review the way they do business in an effort to take advantage from big data. But, how can they do that?

The Project Management Body of Knowledge (PMBOCK) points out that projects drive change in organizations and enable business value creation [4]. Furthermore, it was demonstrated that project management is a means to add value [5] and that the final goal of project manager should be to create business value [6]. So, the initial issue can be rephrased as follows: "how companies must reconsider the way they do project to create added value from big data?" or simply "How companies can use big data in project management to create business value?"

The purpose of this article is to answer that last question. To do that, we conduct a systematic literature review, and propose a framework combining big data and project management process.

The rest of this paper is organized as follows. Section 2 contains the overview of business value, project management and big data. Section 3 is devoted to the review methodology of the systematic review process. Section 4 covers the results and discussion of research. Our framework is presented in Section 5. Finally, sections 6 draws conclusions and suggests further research.

2. BACKGROUND

2.1 Business value

Oxford dictionary defines the value as "The regard that something is held to deserve; the importance, worth, or usefulness of something" [7]. The value can be expressed in several forms, for example, financial value, economic value, personal value or business value which is part of the focus of this paper.

There is no single agreed-upon definition of "business value" and its understanding is either implicit. Racheva et al. [8] report that business value is "an informal term that includes all forms of value that determine the health and well-being of the firm in the long-run". Patton states that "Business value is something that delivers profit to the organization" [9]. Williams et al. link it to the financial worth of the organization [10].

However, for the purpose of this paper and from a project management perspective we will consider it as the net quantifiable benefit derived from a business endeavor. The benefit may be tangible (Monetary assets, Stockholder equity, Fixtures, ...), intangible (Reputation, Trademarks, Goodwill, ...), or both [4].

2.2 Project management

This section is based on the PMBOCK shaped by Project Management Institute (PMI). Within the context of this methodology, the following elements stand out [4]:

A project is a temporary endeavor undertaken to create a unique product or service. Thus, when a project is initiated, it sets about to accomplish something, to create something, and, most importantly, to achieve business value for the

organization. Project is usually regarded as a success if it achieves the objectives according to quality criteria, within time and budget.

To execute projects successfully, organizations use project management which is the application of knowledge, skills, tools, and techniques to project tasks in order to meet project requirements, in an effective and efficient manner. Project management is accomplished by using the correct project management processes at the right time, to the correct depth, and with the correct technique. These processes are series of project management activities like showed in Figure 1, and each one of them produces one or more outputs from one or more inputs by using appropriate project management tools and techniques.



Figure 1. Example process [4]

2.3 Big data

The literature contains several definitions of big data [11]. However, the most comprehensive one is “Big Data is a name given to data with high volume, high velocity, and/or high variety, that involves new technologies and techniques to collect, store, handle and analyse it; and that are used to support decision making, provide insight and discovery, and improve processes” [12].

So far, there has been no unified taxonomy agreed for big data lifecycle [13]. A various taxonomy with different classification granularity has been proposed [14-17]. Nevertheless, for a business perspective, we adopt lifecycle proposed by Hu et al. [18] and we complete it by the step of visualization, as illustrated in Figure 2.



Figure 2. Big data lifecycle

The description of each step is given as follows:

(1) Big data generation concerns the production of data from various sources such as sensors, video and websites.

(2) Data acquisition is about getting information through the collection, transmission, and pre-processing of data.

(3) Data storage deals with persistently storing and managing large-scale datasets. It aims to ensure a useful utilization of large volumes of both structured and unstructured data from a variety of sources in terms of analytics [16].

(4) Data analytics refers to how to process, analyse and handle heterogeneous data with a view to discover relationships features and develop effective models that can accurately predict future instances [19]. It refers also to the use

of advanced analytic techniques on big data [20]. For many, big data analytics (BDA) improves company performance [21], drive better decision making [22] and creates competitive advantages [23].

(5) Data visualization is “the representation and presentation of data that exploits our visual perception abilities in order to amplify cognition” [24]. In other words, Data visualization provides a clear exhibition of data (table, images, diagrams, maps...) so we can easily analyse to make better decisions [25]. Data visualization has two main purposes, sense-making and communication of synthetic information using graphical displays [26].

3. RESEARCH METHODOLOGY

In this paper, we conduct a Systematic Literature Review in an attempt to summarize the existing research studies related to our issue and to identify the gaps in the current research. By adapting the guidelines presented by Kitchenham et al. [27], we carried out the review in several distinct phases.

First, we defined research questions that cover the review scope, identify relevant publications and allow us uncover the results provided in this paper. Two research’s questions guided our study:

(1) RQ1: Did companies use big data in project management to create business value?

(2) RQ2: How did "big data" contribute in the creation of the business value?

Second, we targeted digital libraries where we will search for articles. We chose Google scholar, Science Direct, IEEE Xplore, Springe and ACM as they are indexing a wide range of studies, covering at the same time technical and business areas. To conduct the research, we use search strings that we have defined from the research questions:

(1) ST_RQ1: "big data" and "business value" and "project management" and company.

(2) ST_RQ2: Company and "big data" and "business value creation" or "create business value".

Third, the initial study identified following the previous steps was assessed by several filters. First of all, only articles with relevant title were chosen. Also duplicated articles were deleted. And last but not least, we ended up by applying inclusion/exclusion criteria to exclude papers that are not relevant to answer the research questions. The inclusion/exclusion criteria are listed in Table 1.

Table 1. Inclusion/Exclusion criterias

Inclusion	Exclusion
Papers published in English	Paper not written in English
Paper published from January 2010 to 2020	Papers published out of period
	Papers that are out of research questions
	Thesis and reviews

Finally, we performed an in-depth reading the abstract’s results, followed by a synthesis of past findings. Below is an overview of the research process (Figure 3):

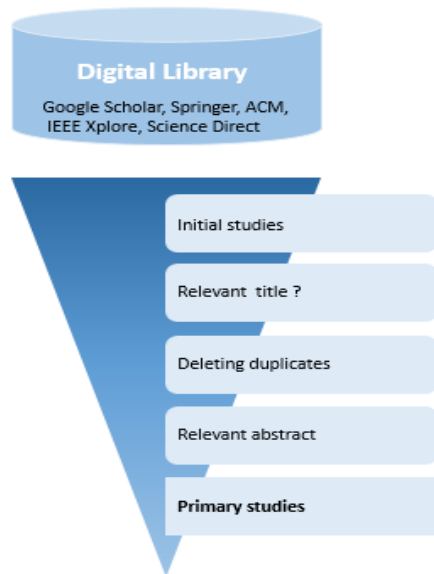


Figure 3. Selection process

address the second. The result of the selection process and the distribution of papers by years are respectively presented in Figure 4 and Figure 5.

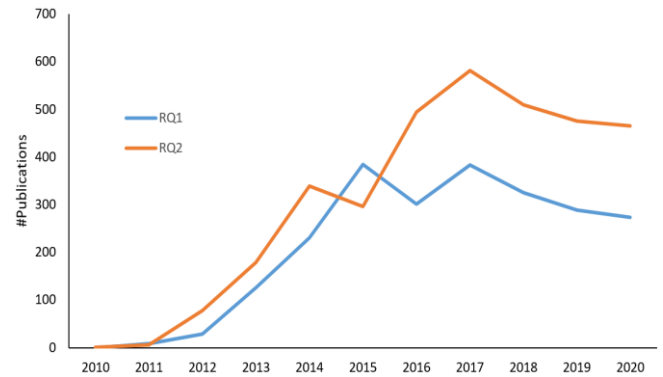


Figure 4. Papers' distribution



Figure 5. Selection process' result

4. RESULTS

4.1 Findings

At the end of the search process phase, we had identified zero articles that answer the first question and sixteen that

Table 2. Previous research studies on business value creation

Studies	Observations
[28]	Wetering et al. propose a configurational model for BDA capabilities to enable enterprises to create a sustainable business advantage. It is based on the adoption of three development phases, each one focuses on critical data analysis resources and capabilities.
[29]	Acharya et al. investigate the relationship between big data's influence on knowledge co-creation in the organizations. They conclude that knowledge co-creation led to make efficient decisions, as a result it constructs business value.
[30]	Müller et al. conduct a survey over 800 firms that use BDA. They reported that only in some industries, big data analytics can maximize the business value.
[31]	Wamba et al. propose a theoretical model from the perspective of managers/users that enhance business value, user satisfaction and firm performance. The study of this model showed that BDA application maximizes business value using properly information quality.
[32]	Wang & Hajli propose a conceptual model drawing on resource and capability. It illustrates how big data analytics capabilities enable business creation in health care industries by exploring the effective path
[33]	Segarra et al. develop a framework based on well-known management tools (SWOT analysis & Business Model, Matrix of change, Strategy Map & Balanced ScoreCard) also BDA to boost revenue and create business value.
[34]	Wang et al. conduct a case study from 26 published studies. They outline that healthcare organizations can profit from big data analytics to create business value. for that; they define five strategies for being successful with big data analytics in healthcare settings
[35]	Akter & Wamba perform a study on e-commerce theories. They highlight six mechanisms to improve practical business value by using Big Data. The six mechanisms are: personalization, dynamic pricing, customer service, supply chain visibility, security and fraud detection and predictive analytics.
[36]	Mikalef et al. Suggest a framework founded on the resource-based view and dynamic capability's view. It aims to add competitive performance and business value through targeted application of big data and business analytics.
[37]	Feki et al. study the use of big data analytics in supply chain management. They indicate that BDA enable understanding market demands and anticipate consumer needs. Thus, enhancing business value.
[38]	Wamba et al. focus on logistic applications and conduct a review on big data literature. As a result, they conclude that technology and information's quality are important in creating business value. They also come up with issues to be addressed in order to enhance this one.
[39]	Halaweh & El Massry propose a holistic model based on six factors which are top management support; organizational change; Data availability and quality; Infrastructure; The required skills and Privacy and security. According to the authors, the implementation of this model guaranteed the creation of business value.
[40]	Wang et al. investigate big data architecture, to highlight capabilities and strategies needed in a health care organization to improve business value.
[41]	Sun et al. examine the role of big data in the online-to-offline business model. Due to its analytical and predictive capabilities, big data technology offers new opportunities to the organizations, improve service quality, and create business value.
[42]	Watson indicates that storing and collecting data does not create value in itself. It is rather when the data is analyzed and acted on
[43]	He provides an overview of the necessary skills in big data analytics needed by organizations to achieve business value

It seems that, although the discussion on value creation, big data and companies has been presented since 2012, so far no study has examined the topic from a project management angle. Indeed, the sixteen studies relating to the second question confirms this observation by revealing several ways, other than project management, in which companies could create business value through big data (Table 2).

4.2 Discussion

All previous studies converge on the idea that business value is created through data analysis. Each of them focuses on a problematic (information quality, management tools, skills in big data, ...) and came up with an approach to make this analysis as efficient as possible. However, none of those papers explain how companies can incorporate their propositions to the way they operate and do business. The latter point will be covered using a project management approach.

The ability of project management to create value, especially business value, has been previously approved by researchers [4, 44]. However, according to our findings, to date, no study has examined the question of whether big data can help in project management. So, can big data help project management?

Projects live and exist within a context that may influence, constrain, or direct them. This context includes all characteristics of where the project operates. It is not limited to tangible characteristics (offices, equipment, information technology hardware, ...), but includes also intangible ones like the political climate, the reputation of the project manager, the amount of data being collected and more.

Those data are sourced from the project itself (team members, project documents, ...), from inside the company (company's departments, other projects, ...), or/and outside the company (government, social media, ...). When the data flow both incoming and outgoing from the project are effectively analyzed, we will have a quantifiable project. Which means, the project manager will have a clear picture of the project's health status and will dispose more accurate information to plan, execute, monitor, control and close the project. Consequently, the project will have a better chance to success.

Moreover, through big data analytics and associated technologies, organizations could find valuable knowledge through dealing with data collected from all organization's projects such as issue logs, lessons learned, best practices or any other project's document. That knowledge will provide support to adapt processes, upgrade used procedures and help determine which practices are appropriate to integrate into projects. That has huge potential value for organizations in managing all of their projects, not just one single one.

To illustrate this, let's take the example of quality assurance. Quality assurance is about assessing global performance to verify that the project, meets the relevant quality standards, using appropriate policies, methods and techniques. Good quality assurance, is often the result of an effective defect tracking. Knowing where a defect was introduced in the process, when it was found and how much it cost to fix, is a lot of valuable data. This makes it possible to discover what aspects of our process are likely to create problems, to identify the most relevant quality assurance techniques to use, and find out the real cost of quality (Cost of Conformance + Cost of Nonconformance). Furthermore, the quality assurance data cited in the example, when they are collected across all company's projects could provide useful guidance in terms of

improving processes. Thus, the company would have increasingly robust management processes that fit its business.

Bellow, we present our framework that support organizations to manage project in a big data environment.

5. FRAMEWORK ARCHITECT

Project management is drowned on project management processes which are what we need to do to manage the work throughout the project life cycle (see Figure 7). As noted earlier, these processes are a series of activities, and each one of them produces one or more outputs from one or more inputs by using appropriate tools and techniques. When big data technology is implemented, processes can be upgraded to recuperate their inputs from the big data management tool and benefit from big data analytics' technique to produce outputs as shown in our proposed framework depicted in Figure 6. The standard inputs, outputs, tools and technique still unchanged.

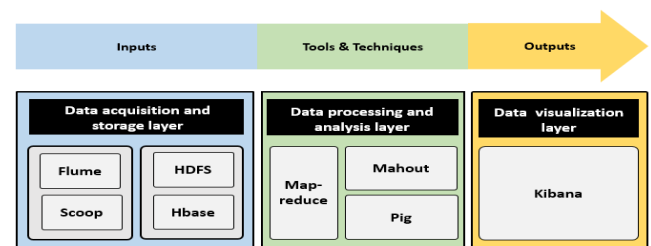


Figure 6. Overview of the proposed framework

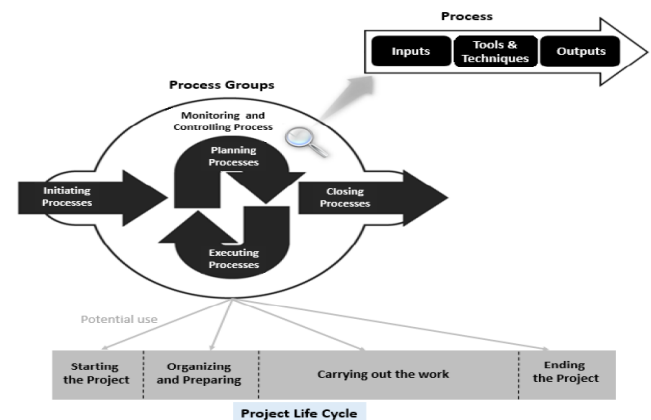


Figure 7. Project life cycle Vs. Process Groups [4]

Under this framework, the whole project lifecycle is managed. It allows projects to handle (big) data in an intelligent way by using the information (the right data source, ...) and the analysis technique (the adequate algorithm, ...) appropriate to the process being executed. It's based on Hadoop ecosystem and contains three layers, namely data acquisition and storage layer, data processing and analysis layer and data visualization layer. They are described below.

5.1 Data acquisition and storage layer

The process starts with the acquisition and storage of the sensing data from various sources (e.g. project documents, stakeholders, social media, etc.). Two components are chosen for acquiring data, Flume and Scoop.

(1) Flume: it is used for collecting and integrating the unstructured or semi structured real-time data into Hadoop Distributed File System.

(2) Scoop: used for importing/exporting between HDFS and structured datastores such as relational databases.

(3) After collecting numerous types of data from different sources, HDFS and Hbase are used for storing them.

(4) HDFS: Hadoop Distributed File System is responsible for managing the storage across Hadoop clusters.

(5) Hbase: An NOSQL database that store data in columnar format.

5.2 Data processing and analysis layer

This layer executes Mapreduce over data collected in HDFS and Hbase to remove the redundant and noise. After that, it uses components like Mahout and Pig to perform advanced analysis over cleaned data.

(1) Mahout: it is used for creating scalable machine learning algorithms based on classification and clustering.

(2) Pig: it's basically a high-level programming language for expressing data analysis programs.

5.3 Data visualization layer

Finally the data visualization layer is responsible for communicating information clearly and effectively through graphical means using Kibana.

6. CONCLUSIONS

Big data and the use of advanced analytics have a great impact on all area they affect. The purpose of our paper was to clarify its role in business value creation through project management: First, A systematic literature review was conducted to address this issue. Based on the results, the main finding was that even if several studies on the value creation of value by big data has been identified, but none of them deal with project management. Then, we discussed how big data can help project management to create business value. Finally, we proposed a framework for Big Data driven project management process to allow organization creating business value.

As future work, we intend to implement our proposed approach.

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