Revista Escuela de Administración de Negocios N° 95- julio a diciembre de 2023
ISSN: 0120-8160 (Impreso) - ISSN: 2590-521X (En línea)

Effect of the big data ecosystem on knowledge management and organizational design: An exploratory case study in the biofuels sector

Erik Daniel Maldonado Ascanio[1]
Corporación Politécnico de la Costa Atlántica, Colombia
erik.maldonadoa@pca.edu.co

Francisco Balbastre Benavent[2]
Universitat de València
francisco.balbastre@uv.es

DOI:

Fecha de recepción: 11 de agosto de 2023
Fecha de aprobación: 09 de noviembre de 2023

Cómo citar este artículo: Maldonado Ascanio, E.D.; Balbastre Benavent, F. (2023). Effect of the big data ecosystem on knowledge management and organizational design: An exploratory case study in the biofuels sector. *Revista Escuela de Administración de Negocios*, (95), (páginas). DOI:

Abstract

This paper aims to investigate the factors that are crucial for organizations to acquire the necessary resources and capabilities to extract value from big data. The study explores the impact of implementing big data ecosystems on knowledge management processes, coordination, and control mechanisms, and organizational design variables through a selected case study. For the research, a qualitative approach was adopted, employing a case study design, which is considered the more suitable approach given the exploratory nature of the research, according to the literature. Data collection involved in-depth interviews and corporate information, with analysis conducted using an inductive approach and axial coding. The findings reveal a reciprocal relationship between the implementation of big data ecosystems, knowledge management processes, and coordination and control mechanisms. Additionally, the case study identifies mediating and moderating variables influencing this relationship. This research contributes to the existing body of knowledge by addressing a gap in the literature. While previous studies have focused on the relationship between big data ecosystems and knowledge management processes, this paper highlights the organizational changes necessary for implementing such ecosystems that have been overlooked. It emphasizes the importance of understanding how this implementation affects organizational design and sheds light on the skills and capabilities required to adopt these technologies. This exploratory case study serves as a valuable contribution to the understanding of the broader implications of big data ecosystem implementation in organizations.

Keywords: Big data ecosystems; knowledge management processes; organizational design; coordination and control; biofuels sector.

****

[1] Profesor e investigador con amplia experiencia en temas asociados con la Inteligencia de Negocios, Análisis de Datos y Gestión Organizacional. Corporación Politécnico de la Costa Atlántica, Colombia. Doctorado en Dirección de Empresas. Universidad de València. ORCID: https://orcid.org/0000-0002-3281-811X

[2] Doctor en Dirección de Empresas. Universidad de València. Destacado académico con experiencia como profesor visitante y conferencista en foros nacionales e internacionales. Sus áreas de investigación son gestión de calidad, cadenas de suministro, gestión del conocimiento, Big Data, sostenibilidad, formación estratégica y métodos cualitativos. ORCID: https://orcid.org/0000-0001-9549-2412

Efecto del ecosistema de *big data* en la gestión del conocimiento y el diseño organizativo: caso de estudio exploratorio en el sector de los biocombustibles

Resumen
Este artículo tiene como objetivo investigar los factores cruciales para que las organizaciones adquieran los recursos y capacidades necesarios para extraer valor de *big data*. El estudio explora el impacto de la implementación de ecosistemas de *big data* en los procesos de gestión del conocimiento, los mecanismos de coordinación y control, y las variables de diseño organizacional a través de un estudio de caso seleccionado. Para la investigación, se adoptó un enfoque cualitativo, utilizando un diseño de estudio de caso, el enfoque más adecuado dada la naturaleza exploratoria de la investigación acorde a la literatura. La recopilación de datos involucró entrevistas en profundidad e información corporativa, con análisis realizados mediante un enfoque inductivo y codificación axial. Los hallazgos revelan una relación recíproca entre la implementación de ecosistemas de *big data*, los procesos de gestión del conocimiento y los mecanismos de coordinación y control. Además, el estudio de caso identifica variables mediadoras y moderadoras que influyen en esta relación. Esta investigación contribuye al cuerpo de conocimiento existente al abordar una brecha en la literatura. Mientras que estudios anteriores se han centrado en la relación entre los ecosistemas de *big data* y los procesos de gestión del conocimiento, este artículo destaca los cambios organizativos necesarios para la implementación de dichos ecosistemas que han sido pasados por alto. Se enfatiza la importancia de comprender cómo esta implementación afecta el diseño organizacional y arroja luz sobre las habilidades y capacidades necesarias para adoptar estas tecnologías. Este estudio de caso exploratorio sirve como una contribución valiosa para comprender las implicaciones más amplias de la implementación de ecosistemas de *big data* en las organizaciones.

Palabras clave: ecosistemas de *big data*; procesos de gestión del conocimiento; diseño organizativo; coordinación y control; sector biocombustibles.

****

1. Introduction

The importance of data, information, and knowledge has led to an evolution of information systems and technologies (IS and IT), promoting important changes in organizations, to the extent that it is considered a major revolution (Orlikowski & Barley, 2001). In organizations, IS and IT are currently ubiquitous resources (Dewett & Jones, 2001), implemented with the aim of improving the efficiency of the organization (Hevner *et al*., 2004). However, the value of IS and IT within an organization will depend on the usefulness of the information they offer (Hilton, 1981), which is determined by the organization's characteristics, its work systems, culture, employees, and their capabilities in developing and implementing methodologies (Hevner *et al*., 2004).

Big data reached its exponential growth in 2012, becoming a central topic at the World Economic Forum, during which the United States announced an investment of 200 million US dollars in big data research (Lake & Drake, 2014). Due to the introduction of new IS and IT to address big data issues, big data became one of the main contributors for decision making and knowledge creation, as high-velocity data allows real-time analysis of data and information for decision making and simultaneously limiting the excess of information that has no value—process known as big data Analytics (Intezari & Gressel, 2017).

Therefore, it is important to approach the big data phenomenon by considering the set of systems, technologies, methods, techniques, tools, human factors, and organizational changes involved in the use of big data within organizations, forming a set of factors that is called in this research as the "big data ecosystem".

Despite its growing importance within organizations, there is a lack of research in the area of business management that addresses the organizational changes implied by the implementation of big data ecosystems, and it has been primarily addressed from The area of knowledge management, as one of the main objectives of big data is problem solving and making better decisions through a systematic process that allows obtaining valuable knowledge for the organization (Carayannis *et al*., 2017; Rothberg & Erickson, 2017; Sumbal *et al*., 2017).

However, it is considered that the change involved in the implementation of a big data ecosystem within an organization involves more organizational factors that must be considered. Therefore, the primary objective of this research is to analyze how organizations carry out the process of knowledge management that arises from the collection, processing, and analysis of big data. The secondary objective is to address this phenomenon from the perspective of organizational design, specifically on how the coordination and control mechanisms of activities, people, and systems that arise within the new environment created by the big data ecosystem.

To achieve this, the phenomenon is studied, and the article is structured as follows. First, the concepts corresponding to big data ecosystems, knowledge management processes, and coordination and control mechanisms are described. Second, the relevant theoretical concepts corresponding to the relationships between big data ecosystems, knowledge management processes, and coordination and control mechanisms are described. Third, the methodology used in this research is outlined, justifying the choice of the case study as a suitable methodology for the study. Fourth, the results obtained from the case study explain the relationships between the implementation of big data ecosystems, knowledge management processes, and coordination and control mechanisms found in the case study, establishing a preliminary model of relationships. Finally, the conclusions from this research and the implications it will have on the literature and on organizations are discussed.

2. Theoretical framework

2.1. Big data Ecosystems

There is currently no real consensus on the definition of the term big data (Frizzo-Barker *et al*., 2016; Gandomi & Haider, 2015; Lake & Drake, 2014; Ward & Barker, 2013). However, the specialized literature (Diebold, 2012; Frizzo-Barker *et al*., 2016; Gandomi & Haider, 2015; Günther *et al*., 2017) agree that the basis of the concept of big data lies in the work of Laney (2001) and, although is not a paper on big data, the three principal dimensions are defined to address the challenges presented by data management, known today as the three main attributes (the 3 V's: volume, velocity and variety) of big data:

Volume: refers to the increasing magnitude of data generated or collected by transactions within an organization, by individuals or globally (Gandomi & Haider, 2015; Laney, 2001), having an exponential increase since 2000 following the global deployment of the internet (Bumblauskas *et al*., 2017; Russom, 2011).

Velocity: refers to the increase in the frequency with which data is generated or collected (Katal *et al*., 2013; Laney, 2001; Lee, 2017; Russom, 2011). The increasing popularity of

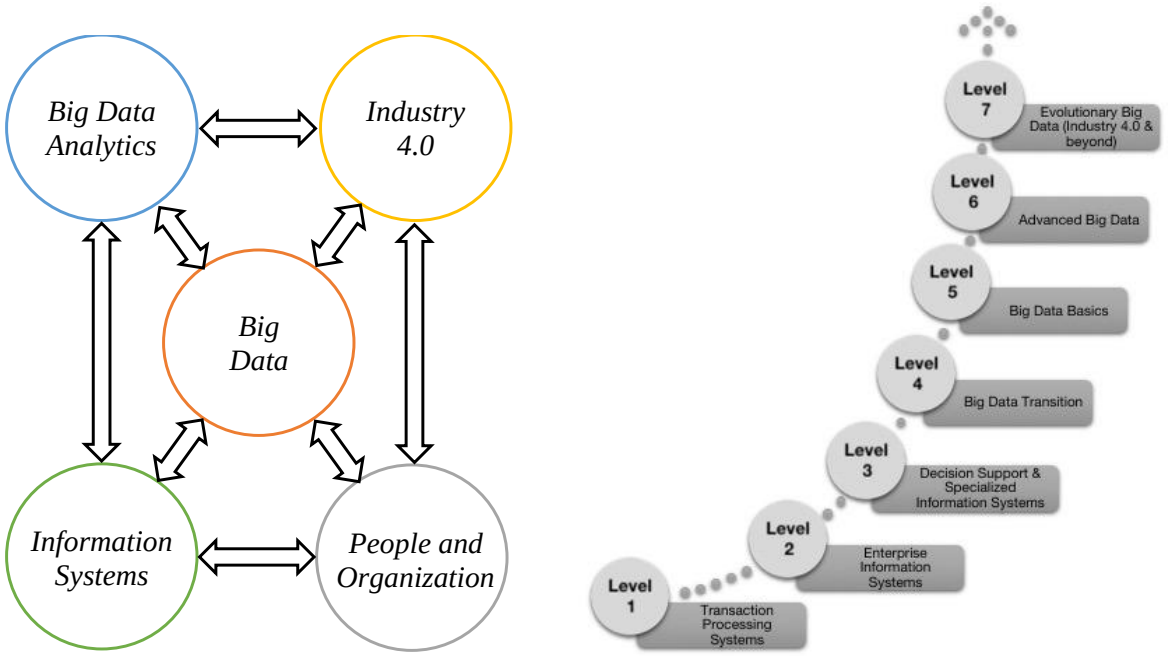
smartphones, devices, and sensors connected to the internet, are the main reason for this phenomenon, and has required new systems capable of collecting and analyzing this increase in the speed of data generation in real time (Gandomi & Haider, 2015; Lee, 2017; Russom, 2011).

Variety: REfers to the heterogeneity (or lack thereof) of a dataset and the increasing diversity of sources from which it can be obtained (Gandomi & Haider, 2015; Russom, 2011). Variety is one of the main problems in data management due to incompatibility of formats, non-aligned data structures, and inconsistency in data semantics found in large volumes of information (Laney, 2001).

Therefore, big data is a term associated with the growth in the amount and complexity of data obtained from a wide variety of sources, whose attributes lead to rethink the way in which data is collected, stored, processed, and managed within an organization, to acquire greater knowledge, improve performance, and achieve competitive advantages.

Hence, as the accessibility of systems and technologies associated with big data increases, organizations will experience a progressive adoption of them. The implementation of systems, technologies, methods, techniques, tools, and human factors related to big data in organizations is referred to as the "big data Ecosystem." In line with this statement, the authors Maldonado Ascanio & Balbastre-Benavent (2018) have identified seven levels of implementation of systems, technologies, methods, techniques, tools, and human factors that are related to big data in organizations. These levels of implementation are based on the classification of traditional IS, defining three initial levels: transaction processing systems, business information systems, and decision-making and specialized business information systems. Then, four levels are established in which the organization can be found according to the level of adoption of the different systems and technologies associated with big data: transition to big data systems, Basic big data systems, advanced big data systems, and a higher level than what was called big data evolutionary systems (see figure 1).

Figure 1. Big data ecosystems and its levels of implementation



Source. Own elaboration based on Maldonado Ascanio & Balbastre-Benavent (2018).

For each of these levels, Maldonado Ascanio & Balbastre-Benavent (2018) defined five categories or dimensions, which describe the characteristics that an organization must have to correspond to a particular level. These categories are organizational implication of big data, human factors and their machine-systems relationship, BDA method used, type of BDA tool, and integration of information technologies. These levels and dimensions have been used as a tool for selecting the case study in this research.

2.2. Knowledge management processes

Knowledge management is seen as a discipline that promotes the creation, storage, transformation, transfer, and application of organizational knowledge to increase innovation and performance within the organization (Becerra-Fernández & Sabherwal, 2014; Nonaka & Peltokorpi, 2006; Shujahat *et al*., 2019). This type of definition is categorized as a perspective in which knowledge management is considered as a human resource process (Jashapara, 2004).

In contrast to the above, authors such as Gurteen (1998), Jashapara (2004), argue that knowledge management cannot be seen from a single perspective, so a more integrative and holistic view must be adopted to define knowledge management. Along these lines, Gurteen (1998, p. 6) proposes that "knowledge management is an emerging set of organizational and operational design principles, processes, organizational structures, applications, and technologies that help knowledge workers leverage their creativity and ability to deliver value to the organization". As observed, Gurteen (1998) vision implies that knowledge management involves many functional areas of the organization, since it does not focus solely on a single process or only on the technologies involved, but also focuses on human and organizational aspects that are not considered by traditional definitions.

In the literature it is common to find many proposals about the processes that compose knowledge management. However, these processes are commonly classified into four main groups corresponding to the processes of knowledge creation, knowledge storage/retrieval, knowledge transfer, and knowledge application (Alavi & Leidner, 2001; Jashapara, 2004). The knowledge management processes will be described below.

2.2.1. Knowledge creation process

The process of knowledge creation is the most described in the literature, often referred to as acquisition, search, generation, or capture of knowledge in several articles (Gold et al., 2001). This process aims to create new content or replace existing content to accumulate valuable knowledge for the organization, achieved through social interactions of individuals and individual cognitive processes. The process of knowledge creation focuses on the interactions between tacit and explicit dimensions of knowledge that form a knowledge spiral at the individual, group, and organizational levels, creating the four modes of knowledge conversion: socialization, combination, externalization, and internalization (Alavi & Leidner, 2001; Jashapara, 2004; Nonaka, 1994).

2.2.2. Knowledge storage/retrieval process

An important aspect to consider in knowledge management is to avoid the loss of knowledge that has been created. For this reason, the process of storage/retrieval of knowledge arises with the purpose of storing, organizing, and consulting the accumulated knowledge of the organization, also called organizational memory (Alavi & Leidner, 2001). According to (Huber, 1991), poor organizational memory arises for three main reasons: the loss of employees, the failure to anticipate future needs for information and knowledge, and the lack of awareness among organizational members about the existence of knowledge or who possesses it.

Therefore, it can be considered that this process oversees managing organizational memory, including the management of structured information in databases, human knowledge codified in expert systems, documented processes and procedures of the organization, and the tactical knowledge of individuals and networks of individuals (Alavi & Leidner, 2001).

2.2.3. Knowledge transfer process

Knowledge is ubiquitous and can be found at all levels of the organization, and given this distributed nature of knowledge, the knowledge transfer process plays an important role in ensuring that knowledge is transferred from individuals or groups to the places and people who need it (Shujahat et al., 2019). According to Gupta & Govindarajan (2000), the knowledge transfer process is based on eight basic elements of the communication process: a message, a sender, an encoding scheme, a channel, transmission through the channel, a decoding scheme, a recipient, and the assignment of meaning to the decoded message.

In the literature (Argote et al., 2003; Inkpen & Tsang, 2005; Jashapara, 2004; Khachlouf & Quélin, 2018; Szulanski, 2000), the transmission channels are emphasized as the most important aspect, and are commonly divided into four types of transmission (or transfer) channels. First, informal channels, such as seminars and informal conversations, are

characterized by promoting socialization but may impede knowledge dissemination and tend to be more effective in small organizations. Second, formal channels, such as training days, enhance knowledge sharing but may inhibit creativity. Third, personal channels, such as in-company internships or face-to-face transfer, are characterized by being more effective in distributing context-specific knowledge. And fourth, impersonal channels, such as knowledge repositories, are characterized by being more effective in distributing generalized knowledge.

2.2.4. Knowledge application process

The knowledge application process is considered as the process that achieves competitive advantage from knowledge (Alavi & Leidner, 2001), as it is responsible for putting into practice the knowledge that has been created, stored/consulted, and transferred within the organization (Shujahat et al., 2019). Thus, the knowledge application process focuses mainly on the use and application of knowledge and aims to convert knowledge into processes and organizational behavior for problem solving, adjust the strategic direction of the organization, and improve efficiency (Gold et al., 2001; Shujahat et al., 2019).

According to Grant (1996), there are four mechanisms to apply knowledge in the organization: rules and guidelines (standards established by the organization), sequencing (organizing knowledge into activities in a predetermined time sequence), routines (patterns to coordinate tasks), and problem solving and decision-making groups (creating groups with intensive communication, where rules, guidelines, sequences, and routines are used to integrate knowledge).

2.3. Organization design and coordination and control mechanisms

Organization design is a framework that emerged from research in the fields of organization and management between the 1960s and 1970s. However, it has gained renewed interest in recent years due to the new and complex organizational forms that have emerged due to the rise of complex ecosystems, new configurations, structures, and distributed organizational forms that sometimes span more than one organization (Good

et al., 2019). Thus, organizational design seeks the effectiveness, efficiency, and agility that the organization needs to keep pace with dynamic market environments, especially in knowledge-intensive industries (Fjeldstad & Snow, 2018; Good *et al*., 2019).

For authors such as Good *et al*. (2019), Jonker *et al*. (2012), and Miterev *et al*. (2017), among the most prominent proposals are the work of (Galbraith, 1995) and his star model, which defines organizational design as "the deliberate process of shaping structure, processes, reward systems, and people policies and practices to create an effective organization capable of achieving the organization's strategy" (Galbraith *et al*., 2001); the work of (Mintzberg, 1979), which groups organizational design into job design, superstructure design, lateral linkage design, and the design of decision making systems (Mintzberg, 1979); and the work of (Waterman *et al*., 1980) with the 7S model, which states that effective organizational change comes from the relationship between structure, strategy, systems, style of management, skills, staff, and superordinate goals.

Coordination and control mechanisms are a fundamental part of organizational design, considered by some authors (Child, 1973; Galbraith, 1995; Mintzberg, 1979; Van de Ven *et al*., 1976) as a key element in organizational design models, and are responsible for ensuring the proper functioning and alignment of tasks through the integration of different parts of the organization, and are aimed at meeting the goals and objectives that are part of the organization's strategy (Burton *et al*., 2015). These mechanisms are described below.

2.3.1. Coordination mechanisms

Coordination mechanisms are the tools, technologies, and/or interactions required to order and bring together employees and interdependent elements of an organization to achieve the objectives and a certain level of performance (Okhuysen & Bechky, 2009). According to Child (2015), the main coordination mechanisms can be summarized in three types, which are discussed below.

Coordination by a senior manager: centralized coordination mechanisms where coordination is mainly carried out by the senior management of the organization and is usually considered a cost-effective way to carry out coordination.

Coordination through formal procedures and planning: coordination mechanisms with a high level of formalization, divided into three mechanisms (Child, 2015; Mintzberg, 1992): standardization (set of rules and procedures), plans and schedules (scheduling of activities to be coordinated), and committee meetings: bringing together members of the organization to agree upon and coordinate procedures and activities. This type of coordination mechanisms is usually found in bureaucratic organizations but, in turn, can work in organizations where activities are predictable and the complexity of their activities does not warrant great efforts for coordination (Child, 2015).

Lateral coordination: is currently one of the main mechanisms for coordinating activities within an organization (Galbraith, 2014). This coordination mechanism consists of integrating the contributions of different people distributed in different units or departments within the organization to carry out a common task (Child, 2015; Galbraith, 2014; Mintzberg, 1979). With this integration, the organization achieves decentralization of decisions through the creation of groups with autonomy in decision making, providing agility to meet organizational needs or problems (Galbraith, 2014).

Lateral coordination, by promoting decentralization and maintaining a balance in formalization, remains one of the preferred mechanisms in organizations that operate in dynamic environments, because it allows them to keep pace with market innovation by being mechanisms that promote creativity and flexibility in group members (Galbraith, 2014).

2.3.2. Control mechanisms

Control mechanisms are defined as the management processes through which the power and influence of some members regulate organizational activities, in such a way that the results of these activities align with the objectives, strategy, and expectations of the

organization (Child, 2015). According to the author (ibid.), there are six types of control mechanisms (see table 1):

Table 1. Control mechanisms

Control Mechanisms	Characteristics
Centralized Personal Control	✓ Direct supervision of people's activities. ✓ Centralized decision making. ✓ Rewards and punishments according to compliance with personal authority.
Bureaucratic Control	✓ Divide the task into defined elements. ✓ Formal methods, procedures, and rules. ✓ Technology designed to limit variation in task behavior. ✓ Rewards and punishments commensurate with compliance with rules and procedures.
Control of Results	✓ Responsibly designed assignments and units to complete objectives. ✓ Definition of standard results and objectives. ✓ Delegation of operational decisions: semi-autonomous. ✓ Rewards and punishments according to results.
Control by Electronic Surveillance	✓ Allows recording of tasks, to be evaluated remotely. ✓ Employee performance evaluated against other workers. ✓ Use of monitoring to reward and discipline employees.
Control through Human Resources Management	✓ Use of selection methods to ensure that profiles match the skills required by the company. ✓ Training and coaching to reinforce desired profiles. ✓ Evaluation procedures and reward systems.
Cultural control	✓ Development of the employee's personal identity with the organization's objectives. ✓ Strong emphasis on the collective character and mutual support in the organization. ✓ Employment characterized by security of tenure and progression in the organization.

Source. Child (2015).

As seen in the table above, the first three mechanisms correspond to mechanisms with a high degree of formalization and centralization of control. As noted earlier, given these characteristics, they are mechanisms better suited to old forms of organization or small organizations. On the other hand, the electronic surveillance coordination mechanism uses monitoring techniques that reduce the need for formalization and centralization of control, which makes it more aligned with modern structures.

3. Methodology

As established by much of the specialized literature (Bluhm *et al*., 2011; Boeije, 2009; Bryman, 1988; Leech & Onwuegbuzie, 2009; Saunders *et al*., 2015; Yin, 2014), social science research mainly follows two methodological strands for solving research questions, namely quantitative and qualitative. Quantitative research is primarily used to establish propositions and hypotheses that can be tested by analyzing numerical data, while qualitative research can uncover meanings and interpretations of a phenomenon through the analysis of non-numerical data (Balbastre Benavent, 2001; Saunders *et al*., 2015).

Given the nature of this research topic, the methodology that best fits is the qualitative methodology. Our research objective is to analyze how the implementation of big data affects knowledge management processes and the forms of coordination and control in organizations and is the preferred methodology to document and conceptualize a new phenomenon (Bluhm *et al*., 2011; Yin, 2014).

In terms of research strategy, the exploratory case study has been selected because it is a strategy that involves an empirical investigation of a contemporary phenomenon in a real-life context using multiple sources of evidence. Typically, case studies are conducted when the researcher does not control the context in which the phenomenon under study is located and seeks to gain a deeper understanding of that phenomenon (Saunders *et al*., 2015).

According to Yin (2014), Dul & Hak (2007) and Swanborn (2010), the unit of analysis in a case study is directly related to the way in which the researcher has posed the research questions, and this unit of analysis can be an individual, a group or represent events, entities, or entire organizations.

Thus, and considering the above, the unit of analysis in this research is the organization, since the interest of our research is to study how big data ecosystems affect knowledge management processes and coordination and control mechanisms in the organization

and, consequently, these organizational aspects need to be analyzed taking into consideration the entire context in which they are developed.

The basic selection criterion in a case study is, according to Stake (1995), that the cases chosen should allow the researcher to learn as much as possible about the object of investigation. This general criterion is concretized in this research through the following criteria:

- Organizations that have a certain level of maturity in the application of big data ecosystems.
- Because the phenomenon under study implies that the organization must possess some kind of method, techniques, or advanced data analysis tools to explore its effect on knowledge management processes and coordination and control mechanisms, organizations that are at least at level three in the implementation of the big data ecosystem will be considered.
- Another important criterion for selecting the research case is that the organizations to be studied must have a strategy and a culture for knowledge management, being desirable that the organization has a visible knowledge management process with clearly defined objectives and practices.
- From the point of view of their demographic scope, the organizations to be studied should be in Colombia, given the geographical location of the researcher at the time of conducting the case study, thus facilitating his access to the primary data.
- The researcher needs to have access to the phenomenon under study, for which it is essential to develop a good relationship with the informants, all of which will result in better access to information and, consequently, in a better development of the fieldwork.

In practice, the application of these criteria will involve a systematic and thorough assessment process to ensure the selection of suitable organizations for the study. Firstly,

a comprehensive review of potential organizations will be conducted to identify candidates that exhibit a certain level of maturity in their big data ecosystem implementation. This evaluation will include examining publicly available information, such as organizational reports, case studies, and online presence, to gauge the extent of their big data initiatives. Organizations meeting the minimum requirement of being at least at level three in their big data implementation will then undergo further scrutiny.

This will involve in-depth interviews and discussions with key stakeholders within the organization to understand their approach to knowledge management and ascertain the presence of a robust strategy and culture for knowledge management. Throughout this process, establishing and nurturing relationships with informants will be paramount to gain insights into the organization's operations and ensure effective data collection. By adhering to these rigorous criteria and methodological approaches, the research aims to select organizations that provide rich and relevant insights into the interplay between big data implementation, knowledge management processes, and coordination and control mechanisms.

As previously mentioned, varying levels of big data implementation can impact knowledge management processes and coordination and control mechanisms through different means. Therefore, it is imperative to examine multiple cases exhibiting various degrees of maturity in big data ecosystem implementation, thus necessitating the design of a multiple case study. In this article, we present the first case study developed by researchers, which has been addressed in depth. Additionally, other companies in different economic sectors were studied, and the results obtained, along with the collective case analysis, will be elaborated upon in subsequent articles.

In this research, two basic methods were used to collect information on the cases to be studied: in-depth interviews and corporate documentation. As regards in-depth interviews, and as established by Tellis (1997) and Yin (2014), data collection in a case study involves the development of three main tasks: preparing for data collection, distributing the questionnaires (interview script, in our case), and conducting the

interviews. The second source of information utilized is corporate documentation. Employing a second source of evidence enables triangulation of the information obtained through interviews, thereby enhancing the internal validity of the conducted research. Various types of documentation have been collected and analyzed, including information available on the websites of the cases studied, corporate reports, management reports, strategic plans, quality manuals, and work procedures.

Once the interviews have been transcribed and reviewed, the corporate documentation and field notes organized, the next step is to analyze qualitative data. Qualitative data analysis, one of whose best-known techniques is "pattern matching" (Dul & Hak, 2007), is based on segmenting the collected data into manageable parts, units or elements, and then reorganizing them in a comprehensible way by looking for patterns and relationships between the parts or elements, in order to create an understanding of the phenomenon from a theoretical perspective (Boeije, 2009; Flick, 2018; Miles *et al*., 2015).

Considering the above, in this research, a mixed coding approach will be adopted. Initially, codes will be defined based on the researcher's theory and experience. Subsequently, given the exploratory nature of the research, additional codes will be generated that have not been previously considered and will emerge from the observed evidence. Therefore, a deductive coding approach was undertaken, based on the main concepts explained above. Following this, an axial coding process was conducted to establish subcategories and categories that integrated the codes generated in the first phase of the analysis process.

Based on Saunders *et al*. (2015) and Yin (2014), different tactics were defined to ensure the quality criteria in this qualitative research. Internal validity was excluded from consideration, as this test is required in explanatory or causal studies but does not apply in descriptive or exploratory studies (Yin, 2014). The criterions and tactics used are as follows:

Reliability: use a case study protocol, develop a database of case studies, use of textual quotes from interviewees.

Construct Validity: use multiple sources of evidence (interviews, corporate documents), triangulation, review of draft reports.

External Validity: use replication logic, selection of cases with different characteristics, explanation of the context of the case study.

Once all methodological aspects applied in this research have been defined, the following section will present the results obtained in the case study.

4. Results: case study

4.1. Economic activity

The economic activity of the selected company[3] is, firstly, the production of biofuel, produced from biomass, that is, organic matter originated in a biological process, usable as a source of energy; secondly, the production of biodiesel, derived from natural lipids such as vegetable oils or animal fats with or without previous use, through industrial processes of esterification and transesterification; thirdly, the production of petrochemicals, such as Diesel fuel oil D6, Diesel D2, ULSD (Diesel), Ethanol E10, Jet fuel A1/B, colonial grade 54 fuel, petroleum coke, liquefied natural gas (LNG) and liquefied petroleum gas (LPG); and finally, the production of oleochemicals, such as crude palm oil, RBD palm oil, crude palm kernel oil, RBD palm kernel oil, RBD palm stearin and RBD palm olearin.

4.2. Knowledge management process

When the company was founded, it focused on creating the knowledge required to start operations under its own business model, considering the weather conditions of the city, a process that took approximately four years. This has resulted in some 250 unique

[3] The name of the company is not shown due to confidentiality restrictions.

"recipes" that have been documented to carry out its operation, recipes that include some 20 variables such as the quality of the input, the temperature, desired final quality, etc. Thus, these recipes are kept in a database to store the fundamental explicit knowledge that the organization has, where all the tacit knowledge that may arise from its employees and from the operation itself is stored, and, in addition to this, documentation on the tests and experiments that have been carried out in the process, documentation that is constantly updated.

Knowledge has been focused on the operational part, considered to be the axis of the organization and where most of the employees are concentrated, so that the transfer of knowledge is done through externalization strategies, which convert the knowledge that arises from the operation into explicit recipes and, in addition, a socialization of this knowledge is performed within the operational part having as main actor the engineer in charge of the operation for this socialization. Consequently, the knowledge generated has allowed the organization to drive innovation by developing new procedures and processes in its market, thus differentiating itself from its competitors.

The organization includes its other functional areas into its knowledge management through an optimization model, which includes, in addition to those mentioned above, business variables that do not belong directly to the operation, where stored data and documentation are analyzed to make decisions at an operational and strategic level. Therefore, this has been the main application of the knowledge that has been created, stored, and transferred within the organization since its foundation, and has allowed making decisions supported by the model to be better than those that were previously made based on the intuition of the company manager.

4.3. Organizational structure and coordination and control mechanisms

On the other hand, the company has only 12 employees, including the president of the organization (the owner) and two members of the board of directors. Therefore, with so few employees, the organization has a hierarchical and centralized structure in which

strategic decisions are made directly by the president. However, the participation of the board of directors and other managers is important for suggesting options on issues such as strategies, innovation ideas, financing, and planning, thus supporting the president in the decision-making process.

Despite the above, the company would not be considered a bureaucratic organization because it has a low formalization and delegation of operational decisions, since there are no procedures or plans governing the work of employees. In contrast, the plant manager oversees their specific area by coordinating the activities of the workers, primarily through direct supervision.

The organization has two control mechanisms. First, centralized personal control, as decisions are largely centralized in the president, who has direct supervision of his employees and all aspects of the organization. Second, the organization employs results-based control because, despite centralization, each area has well-defined responsibilities without being governed by formal procedures and rules, with clear objectives and goals to be met in each area, and with semi-autonomous delegation of operational decisions.

4.4. Big data ecosystem implementation

Regarding the big data Ecosystem and based on Maldonado Ascanio & Balbastre-Benavent (2018), in the first dimension, it was found that the company places significant importance on collecting and analyzing data from its production process, allowing the creation of knowledge and support for decision-making through the optimization model developed by the organization. Thus, it is considered that the organization is at level three in the dimension of organizational involvement of big data.

In the second dimension, it was found that the company has trained its employees in the use of IS and IT associated with production, and the president is fully trained in making decisions based on the optimization model and the administrative and accounting IS. Therefore, it is considered that the company is at level three in the dimension of Human Factors and its Machine-Systems Relationship.

In the third dimension, the company is analyzing data with a low volume (only two data sources) and using descriptive analytics to generate reports and make decisions. It is considered that the organization is at level three in the Method Used dimension of Analytics.

In the fourth dimension, it was found that the company utilizes real-time processing with self-regulation of the production process and batch processing for reporting and decision making. Therefore, it is considered that the organization is at level five in the BDA tool class dimension, a level obtained due to the particularity of its production process.

In the fifth dimension, it was observed that the production process has integrated certain Cloud Computing solutions to store the data generated from the process and a basic artificial intelligence that allows the production process to self-regulate. All of this is integrated with the information systems managed by the company and the optimization model. However, these solutions are still specific applications and do not integrate the administrative areas of the organization. Therefore, it is considered that the organization is at level four in the BDA tool class dimension, due to the particularity of its production process.

4.5. Factors and relationships identified in the case

Thus, regarding the relationship between the big data Ecosystem and the knowledge management processes in the company, our analysis has revealed the following:

- Knowledge creation is influenced by the big data ecosystem given the self-regulation of the production process where decisions are automatically made based on the indicators needed from a specific recipe. Therefore, the process can measure indicators needed to obtain the desired quality of the final product, making changes based on existing knowledge in the recipes, resulting in data that, after analyzed by the plant manager (an expert in the process), is used to propose improvements to the recipes, thus obtaining a predictive knowledge creation that arises from the automatic analysis of the process. In turn, it is considered that the creation of predictive

knowledge promotes the implementation and/or advancement of the big data ecosystem.

- Knowledge storage is influenced by the big data ecosystem through a system that allows the storage of data and decisions made automatically by the process, for real-time consultation by the process managers and the president to adjust the recipes, being automatically stored by the same process.

- Knowledge transfer in the company happens in a reciprocal way between the process (machines) and the people responsible for it, through the communication of the recipes (explicit knowledge) to the process and the feedback provided by the process, which allows to improve the recipes in conjunction with the optimization model.

- As mentioned above, decision making in the organization is mainly made by the president. However, the knowledge embodied in the optimization model and in the recipes means that certain operational decisions are made automatically. Therefore, as these automatic decisions are based on knowledge, it implies that the big data ecosystem has led to an automatic knowledge application.

The relationship between the enterprise big data Ecosystem and the coordination and control mechanisms is not bidirectional in some components. In this regard, our analysis has revealed:

- Given the organization's small size, no significant influence of the big data ecosystem on the coordination mechanisms was noticed. Coordination remains managed by a senior manager.

- With the existence of pre-established parameters and indicators for production that are automatically measured, the management and plant manager can measure in real time the quality objectives of biofuels. Through the optimization model, the organization can establish the profitability of the business obtained from its operations, which now includes automatic performance measurement.

- With the introduction of the big data ecosystem, the organization is performing a reciprocal control of results between people, machines, and the model (system), where sometimes human intervention is not needed to carry out the control. It is considered that a synergistic control between people, machines and systems is being carried out.

Among the factors and patterns that have emerged for the case, several have been identified:

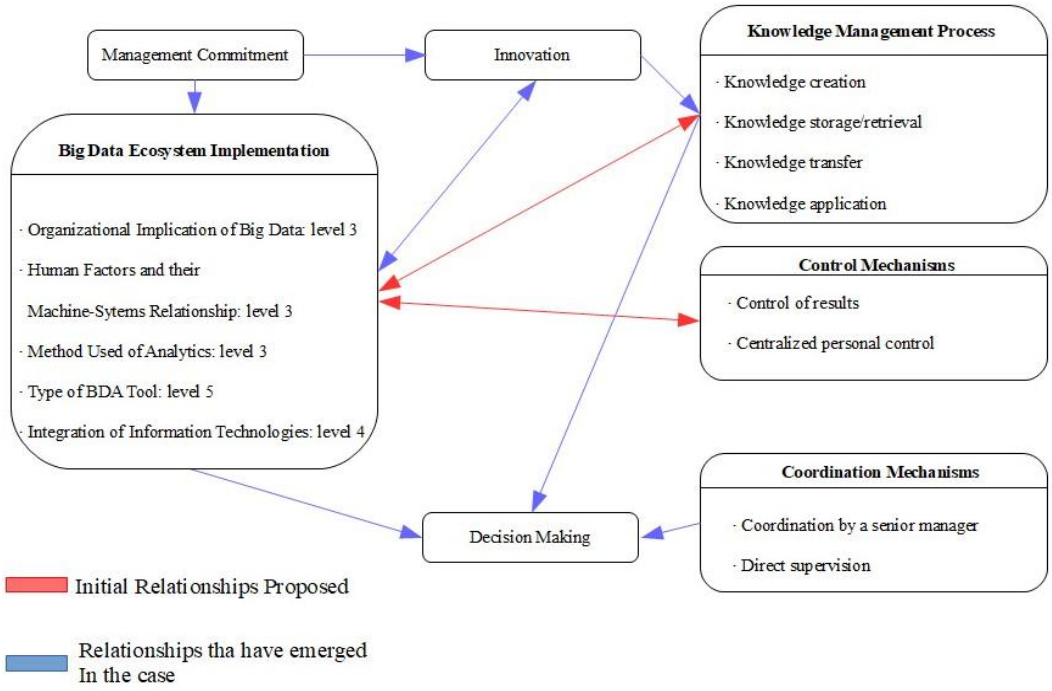
- The commitment of the management has been of great importance for the use and development of optimization models and process automation, which has led to data taking center stage in all its activities, in such a way that it influences the implementation of the big data ecosystem.

- Innovation has been one of the pillars of the organization's development since its inception, so the support and commitment of the management to drive innovation has been important, especially for the development of systems and technologies associated with the big data ecosystem, which also influences innovation by driving the constant development of new and better systems and technologies.

- It is considered that innovation promotes the advancement of knowledge management processes in big data ecosystem environments. Innovation will drive the development of agile practices for the creation, storage, transfer, and application of knowledge within the organization.

- It is considered that the implementation of big data ecosystems, the knowledge management process driven by the ecosystem, and the coordination by managers, are factors that converge to make better decisions within the organization, using the new knowledge and technologies that are integral to the ecosystem. This, in turn, is expected to lead to improvements in the performance and profitability of the organization.

Figure 2. Final relationship model for the case study



Source. Own elaboration.

5. Discussion

This case study aimed to analyze a relatively unexplored terrain in the field of organizational management. Based on the findings, it has been discovered that the implementation of a big data ecosystem can lead to changes in organizational design factors and knowledge management processes, a phenomenon that still requires further understanding of its influence.

As mentioned earlier, research on the influence of big data ecosystems has primarily focused on the relationship between knowledge management processes and the big data ecosystem (Intezari & Gressel, 2017). However, studying the relationship between various organizational factors and the big data ecosystem is crucial for understanding how these processes are modified within the organization and, consequently, how they facilitate the implementation of the ecosystem. This case study has confirmed that knowledge management processes play a significant and reciprocal role in the

implementation of the big data ecosystem, which is in line with authors such as Lugmayr *et al*. (2017), Santoro *et al*. (2018) and Tian (2017). In addition, a key contribution of this study has been the further investigation of coordination and control mechanisms to better comprehend the changes occurring in this domain.

Galbraith (2014) suggests that coordination mechanisms will be affected by the implementation of big data, leading organizations to employ electronic coordination, the use of matrix structures, and decentralized decision-making. However, contrary to this assertion, our case study did not find evidence of such changes. Instead, it was found that the organization prefers to maintain its current organizational structure with the implementation of the big data ecosystem, and that coordination by a senior manager persists post-implementation. Therefore, it is considered that this discrepancy with the literature may be due to the tendency of medium and small organizations to maintain their structures, or to cultural factors specific to the region.

Regarding control mechanisms, the authors McLeod *et al*. (2017) argue that with the implementation of the big data ecosystem, traditional control mechanisms such as centralized personal control or bureaucratic control will be used less frequently, shifting towards more analytical methods like control through human resource management and cultural control to develop in employees the necessary analytical skills to leverage big data (Murawski & Bick, 2017). However, in the case study, it was found that traditional control mechanisms continue to be maintained, contradicting the conclusions drawn from the literature. Therefore, it is believed that this may be due to the same reasons discussed earlier for coordination mechanisms.

The case study provides insights into factors and relationships not found in the literature. Firstly, management's commitment to utilizing optimization models and process automation has placed data at the forefront of all activities, influencing the implementation of the big data ecosystem. Secondly, innovation, supported by management, propels the development of systems and technologies associated with the big data ecosystem, fostering continuous improvement, and shaping innovation within

the organization. Thirdly, innovation drives the advancement of knowledge management processes within big data ecosystem environments, facilitating agile practices for knowledge creation, storage, transfer, and application. Lastly, the confluence of big data ecosystem implementation, knowledge management processes, and managerial coordination synergistically enables better decision-making within the organization, harnessing new knowledge and technologies to bolster performance and profitability.

The study's practical findings go beyond academic discussion, offering useful insights for decision-makers in organizations and stakeholders in the biofuels sector. By showing how a big data system affects how organizations are structured and how knowledge is managed, this study helps with making strategic decisions. Biofuels sector organizations can use these findings to improve how they operate, manage knowledge, and make decisions. Understanding the impact of big data adoption helps stakeholders adjust their strategies to take advantage of new opportunities and avoid risks. Recognizing the importance of managerial coordination and control mechanisms in integrating big data initiatives can foster a culture of innovation and flexibility, making organizations more competitive in the biofuels industry. Overall, the study's insights support informed decision-making for sustainable growth and innovation in both organizations and the biofuels sector.

6. Conclusions

The final model of relationships explains how the reciprocal link between the implementation of big data ecosystems, knowledge management processes, coordination and control mechanisms and, in addition, how other factors and connections influence the reciprocal relationships mentioned above, thus demonstrating that the implementation of big data ecosystems involves many organizational processes and that these processes must evolve with the arrival of this type of systems and technologies in the organization.

This research aimed to explore a practically unknown terrain in the field of organizational management. But despite this, the effect that big data has brought to a variety of organizations around the world is undeniable, a phenomenon that has a long way to go to understand its influence on organizations.

Research on the influence of big data ecosystems has focused mainly on the relationship between knowledge management processes and the ecosystem itself. However, studying the correlation between different organizational factors and the big data ecosystem is fundamental to understand how these processes are modified in the organization and, in turn, how these processes favor the implementation of the ecosystem. Therefore, in addition to knowledge management processes, coordination and control mechanisms have been selected to understand the changes that occur in this area, which has been the main objective and research question to be solved and is an important contribution to the literature in this field.

This study faces certain limitations. Firstly, the small sample size of the case studied implies that the results obtained cannot be extrapolated to other populations or markets different from the Colombian one, where the cases were selected. Additionally, the selection of cases was based on specific criteria, which could influence the obtained results. This limitation is inherent to the case study strategy employed, where the relevance of the chosen cases is more important than statistical representativeness. Secondly, the relationship model was developed inductively due to the exploratory nature of the research, meaning that the relationships were not statistically tested. Therefore, future research could confirm or modify the proposed model. Thirdly, the selection of the interviewees in the organization, occupying middle management positions, could introduce subjective biases in the collected perspectives and opinions. It would have been desirable to have information from individuals at different hierarchical levels to facilitate data triangulation. Additionally, other interviewees from functional areas not considered in this research could provide additional perspectives on the implementation of the big data ecosystem. Lastly, although limiting factors in the relationship between big data implementation and knowledge management processes were identified, the research

results did not provide relevant information on these factors, constituting a limitation. Therefore, future research should address this aspect to better understand how these factors influence big data application in knowledge management.

Future lines of research should primarily focus on verifying the factors and connections raised in the final model. The exploratory nature of this research leads to conjectures regarding certain aspects. The aim of this case study is to serve as a starting point for researchers, entrepreneurs, and organizations to further develop the theories and theoretical proposals presented, to better understand the phenomenon of big data in organizations. Subsequently, statistical testing of the hypotheses that may arise from such models can be performed.

7. References

Alavi, M. & Leidner, D. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly, 25(1), 107-136. https://doi.org/10.2307/3250961

Argote, L., McEvily, B. & Reagans, R. (2003). Managing knowledge in organizations: An integrative framework and review of emerging themes. Management Science, 49(4), 571-582. http://www.jstor.org/stable/4133958

Balbastre Benavent, F. (2001). La autoevaluación según los modelos de gestión de calidad total y el aprendizaje en la organización: una investigación de carácter exploratorio. [Tesis doctoral]. Universidad de Valencia. https://www.tdx.cat/handle/10803/9660#page=1

Becerra-Fernández, I. & Sabherwal, R. (2014). Knowledge management: Systems and processes (second edition). Routledge.

Bluhm, D. J., Harman, W., Lee, T. W. & Mitchell, T. R. (2011). Qualitative research in management: A decade of progress. Journal of Management Studies, 48(8), 1866-1891. https://doi.org/10.1111/j.1467-6486.2010.00972.x

Boeije, H. (2009). Analysis in qualitative research (first edition). Sage Publications.

Bryman, A. (1988). Quantity and quality in social research. Unwin Hyman Ltd.

Bumblauskas, D., Nold, H., Bumblauskas, P. & Igou, A. (2017). Big data analytics: Transforming data to action. Business Process Management Journal, 23(3), 703-720. https://doi.org/10.1108/BPMJ-03-2016-0056

Burton, R. M., Obel, B. & Håkonsson, D. D. (2015). Organizational design: A step-by-step approach (third edition). Cambridge University Press.

Carayannis, E. G., Grigoroudis, E., Del Giudice, M., Della Peruta, M. R. & Sindakis, S. (2017). An exploration of contemporary organizational artifacts and routines in a sustainable excellence context. Journal of Knowledge Management, 21(1), 35-56. https://doi.org/10.1108/JKM-10-2015-0366

Child, J. (1973). Predicting and understanding organization structure. Administrative Science Quarterly, 18(2), 168-185. https://doi.org/10.2307/2392061

Child, J. (2015). Organization: Contemporary principles and practice (second edition). John Wiley and Sons.

Dewett, T. & Jones, G. R. (2001). The role of information technology in the organization: A review, model, and assessment. Journal of Management, 27(3), 313-346. https://doi.org/10.1016/S0149-2063(01)00094-0

Diebold, F. X. (2012). A personal perspective on the origin(s) and development of "big data": The phenomenon, the term, and the discipline, second version. Social Science Research Network. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2202843

Dul, J. & Hak, T. (2007). Case study methodology in business research (first edition). Routledge. https://doi.org/10.4324/9780080552194

Fjeldstad, Ø. D. & Snow, C. C. (2018). Business models and organization design. Long Range Planning, 51(1), 32-39. https://doi.org/10.1016/j.lrp.2017.07.008

Flick, U. (2018). An introduction to qualitative research. Sage Publications.

Frizzo-Barker, J., Chow-White, P. A., Mozafari, M. & Ha, D. (2016). An empirical study of the rise of big data in business scholarship. International Journal of Information Management, 36(3), 403-413. https://doi.org/10.1016/j.ijinfomgt.2016.01.006

Galbraith, J. R. (1995). Designing Organizations: An executive briefing on strategy, structure, and process (first edition). Jossey-Bass Inc.

Galbraith, J. R. (2014). Designing organizations: Strategy, structure, and process at the business unit and enterprise levels (third edition). Jossey-Bass Inc.

Galbraith, J. R., Downey, D. & Kates, A. (2001). Designing Dynamic Organizations: A Hands-On Guide for Leaders at All Levels (first edition). American Management Association.

Gandomi, A. & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. International Journal of Information Management, 35(2), 137-144. https://doi.org/10.1016/j.ijinfomgt.2014.10.007

Gold, A. H., Malhotra, A. & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. Journal of Management Information Systems, 18(1), 185-214. https://doi.org/10.1080/07421222.2001.11045669

Good, M., Knockaert, M., Soppe, B. & Wright, M. (2019). The technology transfer ecosystem in academia. An organizational design perspective. Technovation, 82-83, 35-50. https://doi.org/10.1016/j.technovation.2018.06.009

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. Strategic Management Journal, 17(S2), 109-122. https://doi.org/10.1002/smj.4250171110

Günther, W. A., Rezazade Mehrizi, M. H., Huysman, M. & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. The Journal of Strategic Information Systems, 26(3), 191-209. https://doi.org/10.1016/j.jsis.2017.07.003

Gupta, A. K. & Govindarajan, V. (2000). Knowledge flows within multinational corporations. Strategic Management Journal, 21(4), 473-496. https://doi.org/10.1002/(SICI)1097-0266(200004)21:4<473::AID-SMJ84>3.0.CO;2-I

Gurteen, D. (1998). Knowledge, creativity and innovation. Journal of Knowledge Management, 2(1), 5-13. https://doi.org/10.1108/13673279810800744

Hevner, A. R., March, S. T., Park, J. & Ram, S. (2004). Design science in information systems research. MIS Quarterly, 28(1), 75-105. https://dl.acm.org/doi/10.5555/2017212.2017217

Hilton, R. W. (1981). The determinants of information value: Synthesizing some general results. Management Science, 27(1), 1-114. https://doi.org/10.1287/mnsc.27.1.57

Huber, G. P. (1991). Organizational learning: the contributing processes and the literatures. Organization Science, 2(1), 1-147. https://doi.org/10.1287/orsc.2.1.88

Inkpen, A. C. & Tsang, E. W. (2005). Social capital, networks, and knowledge transfer. The Academy of Management Review, 30(1), 146-165. https://www.jstor.org/stable/20159100

Intezari, A. & Gressel, S. (2017). Information and reformation in KM systems: big data and strategic decision-making. Journal of Knowledge Management, 21(1), 71-91. https://doi.org/10.1108/JKM-07-2015-0293

Jashapara, A. (2004). Knowledge management: An integrated approach. Pearson Education.

Jonker, C. M., Popova, V., Sharpanskykh, A., Treur, J. & Yolum, P. (2012). Formal framework to support organizational design. Knowledge-Based Systems, 31, 89-105. https://doi.org/10.1016/j.knosys.2012.02.011

Katal, A., Wazid, M. & Goudar, R. H. (2013). Big data: Issues, challenges, tools and good practices. 6th International Conference on Contemporary Computing – (IC3). Noida, India,404-409. https://doi.org/10.1109/IC3.2013.6612229

Khachlouf, N. & Quélin, B. V. (2018). Interfirm ties and knowledge transfer: The moderating role of absorptive capacity of managers. Knowledge and Process Management, 25(2), 97-107. https://doi.org/10.1002/kpm.1564

Lake, P. & Drake, R. (2014). Information systems management in the big data era (first edition). Springer International Publishing.

Laney, D. (2001). 3D data management: controlling data volume, velocity and variety. Meta Group. https://studylib.net/doc/8647594/3d-data-management--controlling-data-volume--velocity--an

Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. Business Horizons, 60(3), 293-303. https://doi.org/10.1016/j.bushor.2017.01.004

Leech, N. L. & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. Quality & Quantity, 43, 265-275. https://doi.org/10.1007/s11135-007-9105-3

Lugmayr, A., Stockleben, B., Scheib, C. & Mailaparampil, M. A. (2017). Cognitive big data: Survey and review on big data research and its implications. What is really "new" in big data? Journal of Knowledge Management, 21(1), 197-212. https://doi.org/10.1108/JKM-07-2016-0307

Maldonado Ascanio, E. & Balbastre-Benavent, F. (2018, September 12-14). Big data implementation levels in organizations: a theoretical proposal. 11th Annual Conference of the Euromed Academy of Business: Research Advancements in National and Global Business Theory and Practice at: Valleta, Malta, 877-889. https://emrbi.org/wp-content/uploads/2020/09/EuroMed-11-2018.pdf

McLeod, A. J., Bliemel, M. & Jones, N. (2017). Examining the adoption of big data and analytics curriculum. Business Process Management Journal, 23(3), 506-517. https://doi.org/10.1108/BPMJ-12-2015-0174

Miles, M. B., Huberman, M. A. & Saldaña, J. (2015). Qualitative data analysis: A methods sourcebook (third edition). Sage Publications.

Mintzberg, H. (1979). The structuring of organizations (first edition). Prentice-Hall Inc.

Mintzberg, H. (1992). Structure in fives: Designing effective organizations (first edition). Prentice-Hall Inc.

Miterev, M., Turner, J. R. & Mancini, M. (2017). The organization design perspective on the project-based organization: A structured review. International Journal of Managing Projects in Business, 10(3), 527-549. https://doi.org/10.1108/IJMPB-06-2016-0048

Murawski, M. & Bick, M. (2017). Digital competences of the workforce - a research topic? Business Process Management Journal, 23(3), 721-734. https://doi.org/10.1108/BPMJ-06-2016-0126

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organization Science, 5(1), 1-118. https://doi.org/10.1287/orsc.5.1.14

Nonaka, I. & Peltokorpi, V. (2006). Objectivity and subjectivity in knowledge management: A review of 20 top articles. Knowledge and Process Management, 13(2), 73-82. https://doi.org/10.1002/kpm.251

Okhuysen, G. A. & Bechky, B. A. (2009). 10 coordination in organizations: An integrative perspective. Academy of Management Annals, 3(1), 463-502. https://doi.org/10.5465/19416520903047533

Orlikowski, W. J. & Barley, S. R. (2001). Technology and institutions: What can research on information technology and research on organizations learn from each other? MIS Quarterly, 25(2), 145-165. https://doi.org/10.2307/3250927

Rothberg, H. N. & Erickson, G. S. (2017). Big data systems: Knowledge transfer or intelligence insights? Journal of Knowledge Management, 21(1), 92-112. https://doi.org/10.1108/JKM-07-2015-0300

Russom, P. (2011). Big data analytics. TDWI Best Practices Report.

Santoro, G., Vrontis, D., Thrassou, A. & Dezi, L. (2018). The internet of things: Building a knowledge management system for open innovation and knowledge management capacity. Technological Forecasting and Social Change, 136, 347-354. https://doi.org/10.1016/j.techfore.2017.02.034

Saunders, M., Lewis, P. & Thornhill, A. (2015). Research methods for business students (seventh edition). Pearson Education.

Shujahat, M., Sousa, M. J., Hussain, S., Nawaz, F., Wang, M. & Umer, M. (2017). Translating the impact of knowledge management processes into knowledge-based innovation: The neglected and mediating role of knowledge-worker productivity. Journal of Business Research, 94, 442-450. https://doi.org/10.1016/j.jbusres.2017.11.001

Stake, R. E. (1995). The art of case study research (first edition). Sage Publications.

Sumbal, M. S., Tsui, E. & See-to, E. W. (2017). Interrelationship between big data and knowledge management: An exploratory study in the oil and gas sector. Journal of Knowledge Management, 21(1), 180-196. https://doi.org/10.1108/JKM-07-2016-0262

Swanborn, P. (2010). Case study research: what, why and how? (first edit). Sage Publications. https://doi.org/10.4135/9781526485168

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. Organizational Behavior and Human Decision Processes, 82(1), 9-27. https://doi.org/10.1006/obhd.2000.2884

Tellis, W. (1997). Application of a case study methodology. The Qualitative Report, 3(3), 1-19. https://doi.org/10.46743/2160-3715/1997.2015

Tian, X. (2017). Big data and knowledge management: A case of déjà vu or back to the future? Journal of Knowledge Management, 21(1), 113-131. https://doi.org/10.1108/JKM-07-2015-0277

Van de Ven, A. H., Delbecq, A. L. & Koenig, R. (1976). Determinants of coordination modes within organizations. American Sociological Review, 41(2), 322-338. https://doi.org/10.2307/2094477

Ward, J. S. & Barker, A. (2013). Undefined by data: A survey of big data definitions. ArXiv: 1309.5821. https://arxiv.org/abs/1309.5821

Waterman, R. H., Peters, T. J. & Phillips, J. R. (1980). Structure is not organization. Business Horizons, 23(3), 14-26. https://doi.org/10.1016/0007-6813(80)90027-0

Yin, R. K. (2014). Case study research: design and methods (fifth edit). Sage Publications.