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Aldona Małgorzata Dereń (ORCID: 0000-0002-2377-4573)
Faculty of Management, Wrocław University of Science and Technology, Wrocław, Poland, e-mail: aldona.deren@pwr.edu.pl
Jan Skonieczny (ORCID: 0000-0002-1027-991X)
Faculty of Management, Wrocław University of Science and Technology, Wrocław, Poland, e-mail: jan.skonieczny@pwr.edu

Big data in strategic management in an organization

Big data w zarządzaniu strategicznym w organizacji

ABSTRACT

This article aims to present the management of big data sets as a strategic issue in an organization. Data strategy is today a key tool for developing the organization and gaining its competitive advantage in a dynamically changing environment. A qualitative methodology has been chosen, including literature research and a description of practical examples that allowed for the examination of the impact of managing large amounts of data on the formulation of a functional data strategy as the main component of the organization's strategy. Based on literature and practical examples authors showed that data, information, and knowledge in a contemporary organization are strategic resources. Effective use of data in an organization consists of developing a data strategy (as part of the business strategy) and coherently linking it with other functional strategies such as production, marketing, and finance. The instrument supporting these activities is big data technology. The article recommends the approach of developing a functional data strategy based on big data technology, which is consistent with the organizational and other functional strategies. The prerequisite for this process is the recognition of data as a strategic resource and overcoming the barriers associated with the implementation of big data technology.

Keywords: big data, knowledge, information, data, strategy.

STRESZCZENIE

Artykuł ma na celu przedstawienie zarządzania dużymi zbiorami danych jako strategicznej kwestii w organizacji. Strategia danych jest dziś kluczowym narzędziem rozwoju organizacji oraz zdobywania przewagi konkurencyjnej w dynamicznie zmieniającym się środowisku. Wybrano metodologię jakościową, zawierającą badania literatury oraz opis praktycznych przykładów, które umożliwiły zbadanie wpływu zarządzania dużymi ilościami danych na formułowanie funkcjonalnej strategii danych jako głównego składnika strategii organizacji. Na podstawie literatury i praktycznych przykładów autorzy pokazali, że dane, informacje i wiedza w współczesnej organizacji są strategicznymi zasobami. Efektywne wykorzystanie danych w organizacji polega na opracowaniu strategii danych (jako części strategii biznesowej) i spójnym łączeniu jej z innymi strategiami funkcjonalnymi, takimi jak produkcja, marketing i finanse. Instrumentem wspierającym te działania jest technologia big data. Artykuł rekomenduje podejście do rozwijania funkcjonalnej strategii danych opartej na technologii big data, które jest spójne z organizacyjną i innymi strategiami funkcjonalnymi. Przesłanką tego procesu jest uznawanie danych za strategiczny zasób i pokonywanie barier związanych z wdrożeniem technologii big data.

Słowa kluczowe: big data, wiedza, informacja, dane, strategia.

INTRODUCTION

Digitalization of enterprises, especially in the SME sector, is essential for their economic competitiveness. Therefore, using big data technologies should be treated as a way of measuring their readiness to meet this challenge. According to the authors of the report "Big Data in Poland," only 8% of enterprises use big data technologies. However, a more detailed analysis shows that this result is influenced by the low use of this technology in the SME sector: 6% for small enterprises (10-49 employees) and 12% for medium enterprises (50-249 employees). On the other hand, among large Polish enterprises (with 250 or more employees), 26% use Big Data (Big Data w Polsce, 2020). Other studies on using Big Data technologies in

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Polish enterprises show that only 11% of small and medium-sized enterprises use advanced data processing in their operations. If the analysis is narrowed down to large enterprises (with at least 250 employees), the percentage rises to 16%.

In the opinion of surveyed enterprises, the main reason for the low interest in analytics of large data sets is "no need for it" (77.5% of responses). Whereas other reasons, such as: "lack of competence" (10% of responses) or "high costs of implementing such a solution" (2% of responses), are relatively less critical (Badanie, 2020). Conclusions from both reports indicate that the main reasons for the implementation of big data are not technological and financial barriers but the belief of managers that there is no need or benefit to implement this technology. On the other hand, companies that use big data analytics perceive big data mainly as a tool for computerizing processes rather than as an instrument supporting strategic data management. This problem applies to Polish companies and any organization that bases its future development on technologies that process big data sets. A logical approach to these issues within an enterprise is to formulate a data strategy that should be both a component of the business strategy and consistent with other functional strategies within the company (production, marketing, and finance). The development of a data strategy based on big data technology will enable the effective management of data, which, after appropriate processing, may constitute strategic information resources and be a source of competitive advantage for the organization in a dynamically changing environment. In this context, the article presents data strategy as a functional strategy and its relationship with business strategy, functional strategies, and big data technology. There is a lack of in-depth studies on this issue in the strategic management literature. This article is part of a broad discussion on business analytics based on big data that has enabled managers to make effective management decisions in a dynamic environment.

1. BIG DATA – ESSENCE AND FUNCTIONS

In today's organizations, data and its analysis contribute to reducing the time required to perform optimization tasks. Defining the scope of big data, called big data, poses some difficulties. The concept has evolved over the years and needs to be clearly understood. Big data represents a range of information that is so large and complex that it is impossible to process according to traditional models. Although NASA scientists were the first to use the term "big data" in 1997, there is still no standard definition (Gubbi et al., 2013). Mayer-Schönberger and Cukier (2014) believe that big data is a revolution in business analytics that is changing not only the face of business but also how many people worldwide think, live, and work. Big data is the space of a race of technology and civilization where new forms, methodologies, and knowledge pragmatics are at stake, moving away from their analog prototypes at an accelerating pace. Along with database rules and based on data resources, a new info system shaped by modern analytical tools is emerging. In this context, one should talk about the multidimensionality of big data.

There are two research approaches to big data: technological and organizational. The technological approach treats big data as data sets with high volume, variability, and diversity that require new ways of processing to support optimal decision-making, the discovery of new phenomena, and the automation of processes (Laney, 2011, p. 4). Big data are high-volume, high-velocity, and diverse information assets that require cost-effective, innovative forms of information processing that enable better understanding, decision-making, and process automation (Beyer, 2011). De Mauro et al. (2016, pp.122-134) expressed a similar opinion; for them, big data is an information resource characterized by such a large volume, speed, and variety that specific technologies and analytical methods are required to transform it into value. Provost and Facett (2013) indicate that the role of big data technology is to improve the decision-making process, reducing the time required to make decisions. For Hazen et al. (2014), the domain of big data, as a comprehensive information technology component, is to generate and analyze information for the needs of managers as decision-makers. Big data is a process that involves quantitative and qualitative techniques, technologies, systems, and practices to operate on existing large data sets (Russom, 2011; Wang et al., 2016; Gravili et al., 2018).

From this point of view, big data can be considered as a set of tools to support a company's decision-making process through the use of technology aimed at rapidly analyzing large amounts of diverse data (e.g., structured data from relational databases and unstructured data such as images, videos, emails, transactional data, and social media interactions) from different sources to create a stream of practical knowledge (Caputo et al., 2017). Taking into account the technological progress with much information and the multitude of definitions of big data, J.S. Ward and A. Barker (2013) developed their definition of big data as a term describing the storage and analysis of large and complex data sets using several techniques such as NoSQL, MapReduce, and machine learning.

Considering the technological aspect of big data, the increase in processed data can be considered an evolutionary effect of technological progress and the ever-larger data sets available. Therefore, when defining big data, one should indicate the specific size of the collections used and their diversity, reliability, usability, and processing speed. The term big data in the technological aspect should be treated as a description of new trends in IT and analytical methods, with particular emphasis on analyses carried out directly on source data in real time.

In the organizational approach, big data is captured as a broad and abstract concept, gaining significant recognition among researchers and practitioners. Traditional data management methods cannot be applied to quantitatively large, highly unstructured, and rapidly changing data. Traditional data management methods cannot be used for large, highly

unstructured, and rapidly changing data. For this purpose, big data analysis is used (Davenport, 2013). Big data analysis makes it possible to classify them as business-useful information that affects the effectiveness of decision-making processes (Ferraris et al., 2019, p. 1923). According to Chen et al. (2012), big data should be treated as a decision-making environment that combines technology and human capabilities to make decisions in line with the company's plans. Big data tools allow organizations to reduce the time needed to implement routine processes and can support them in paying more attention to defining their vision and mission (Caputo et al., 2019). In this sense, it is essential to have a strategic approach to collecting, cleansing, combining, matching, and transforming data into information that can be effectively managed. The concept of big data in enterprise management refers to a modern approach to data analytics, which includes the ability to collect, process, and visualize data for the needs of a wide range of needs in various areas of business (Gandomi & Haider, 2015, pp. 137-144). Khan and Vorley (2017, pp. 18-34) recognize that combining big data with knowledge management manifests the usefulness of big data in this area:

- capturing and visualizing the most common words from vast amounts of structured and unstructured data

- big data text analytics plays a vital role in the timely transmission, sharing, and managing of vast data. Generating keywords through text mining across large datasets helps internalize, share, and manage data, information, and knowledge as non-material strategic resources.

One of the factors limiting the development of organizations is a strong focus on tangible resources and marginalization of intangible resources such as data, information, and knowledge. These concepts belong to complex terms and are challenging to define due to their original nature. They are used interchangeably in everyday language, often according to the current fashion. Two fields deal with them: knowledge management and information theory. Therefore, depending on the mentioned field, the hierarchy of cognitive concepts is called a pyramid or hierarchy of knowledge or information. It is also possible to meet the term DIKW abbreviated from the first words of the individual components: data, information, knowledge, and wisdom (Zeleny, 1987; Cooley, 1987).

There needs to be more consensus in the literature on distinguishing between these concepts, mainly due to the adoption of different interpretations and simplifications. According to Avison and Fitzgerald (1995, p. 12), data represents unstructured facts. On the other hand, Laudon and Laudon (1991, p. 14) define data as raw facts that can be shaped and formed to obtain information. Raw data such as customer retention rates, sales data, and delivery cost data are of limited value until it is integrated with other data and transformed into information that can aid decision-making. Historical or market sales data suddenly become meaningful-they may increase or decrease relative to metrics or in response to a particular strategy (Martin, Powell, 1992, p. 10).

Pure, unprocessed data has little practical meaning. Only by processing the data and determining its meaningful context is it given the form of information. Thus, processed data are those that have been previously interpreted, are understandable to the recipient, increase the recipient's knowledge, and have value and usefulness in specific management decisions (Hicks, 1993, p. 675). According to Azma and Mostafapour (2012), data has two main characteristics: organizational learning process and intelligent data processing. Organizational learning involves the discovery of new knowledge and its dissemination.

Conversely, intelligent data processing refers to analyzing and evaluating information to ensure that practical plans are identified and appropriate control methods are adopted. Data is one of the most valuable resources of an organization, and its potential is constantly growing. Data collection and distribution is a process that uses multiple sources such as online sources, social media, various operating systems, transactions, information obtained from scanners, smart meters, sensors, and many, many more. Information is an intangible resource of an organization that co-determines its strategic potential and growth opportunities. Various business communication processes acquire relevant, timely, and helpful information. Due to the growing role of employees in management, traditional techniques of information exchange have become ineffective, which is the reason for the growing role of IT tools as media in this process and the noticeable tendency to move from direct (interpersonal) to indirect communication with the use of technical means (Dudycz, 1998, p. 9).

On the other hand, knowledge is any information obtained through learning and experience. It is a set of accurate and helpful information about reality and the ability to use it for individual and organizational purposes. Knowledge is valuable and accepted information, combining data, facts, and often hypotheses. Knowledge creation requires that someone has previously processed, combined, and interpreted the information. Knowledge creates a new model of business and economic activity (Bhatt, 2002, pp. 31-39). Properly processed data and information support creative thinking processes like innovative, design, and strategic thinking. Additionally, they facilitate effective communication between the creators and recipients of innovative solutions, including projects and models (Dereń & Skonieczny, 2017, pp. 163-170).

Knowledge is a unique combination of experience, ideas, intuition, values, judgments, and skills of individuals and teams (groups) - creating a framework for evaluating, understanding, and assimilating new experiences, information, and data. Knowledge is now becoming the genome of the organization – just as the DNA record determines a person's traits, personality, and capabilities, knowledge about the organization determines its shape in the future (Mierzejewska, 2004, pp. 27-39). Knowledge is a unique resource characterized by dominance, inexhaustibility, simultaneity, and non-linearity. It is most often defined by combining it with data and infor-

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mation in the so-called knowledge pyramid (Brdulak, 2005).

It is only the existence of a model. This pattern links the relationships mentioned above that produce an archetype characterized by repeatability and predictability, constituting dynamic knowledge that allows us to predict future events. There are several fundamental differences between information and knowledge: information is only an intellectual tool; by itself, without further processing, it will not contribute anything to practice and will not create anything new in the broadly defined culture; it is a closed package; information does not solve problems; information concerns (instead) phenomena and things, not processes; it belongs to the sphere of static. From the top of a pyramid, one can see the entire mass; similarly, this perspective also applies to knowledge. If we know, then at the same time, we must have data and information (Nonaka & Takeuchi, 2000, p. 81) because they are part of it.

Figures 1 and 2 illustrate two different organizational data management approaches. Figure 1 illustrates the traditional approach to strategy formulation. The basis of strategy is knowledge and information extracted from data processing (little data technology). In contrast, Figure 2 illustrates a new approach where the basis of strategy formulation is big data technology, which processes data, information, and knowledge. In this approach, all data are exposed, coming from different sources, which, in the process of processing, become a vast resource, allowing the preparation of different options and strategic scenarios.

In this situation, it seems reasonable to identify big data as a critical technology to support the development of a functional data strategy as a component of an organization's overall strategy. Big Data technology has unleashed the power and importance of data as intangible drivers of organizational decision-making, dependent on data center resources comprising a diverse mix of old and new technologies, applications, and employee skills. Having a clear, long-term strategy for data management in the organization is essential to meet all the challenges, ensure alignment with the company's goals and strategic plans, and enable effectiveness in the long run.

2. DATA STRATEGY

The problem of managing modern organizations is not only the ever-increasing amount of data, its diversity and variability, but the fact that data exchange has become the basis of broadly understood economic exchange. In this situation, it is essential to effectively acquire, process, store, allocate, and use data as strategic resources of the organization. Data, which does not have a holistic form, does not become of interest at the strategic level because it is not treated as a strategic resource. On the other hand, data has a holistic form, capable of being processed into information and knowledge. These are strategic and are used to build the organization's strategy.

For this reason, the goal and task of the organization is no longer just the production of products (or provision of services) but also obtaining data on what products should be, in what quantity, and under what conditions the market can absorb them. The orientation on the acquisition and use of data has become modern organizations' dominant management philosophy and development strategy. The strategic management literature needs to describe big data as a data management problem. However, various issues exist concerning understanding strategy and its relation to big data. Nowadays, strategic management is a systemic business concept embedded in the realities of the environment, involving the continuous search for information resources, the use of modern technologies that enable the effective management of these resources, and the improvement of competence in this area.

Singh & del Giudice (2019, pp. 1729-1733) treat big data as an organization's dynamic capability that helps develop its operational and strategic potential for business value creation and innovation. Big data sets are a source of information for shaping the innovative orientation of organizations based on modern information technologies, which allows them to generate new business values, products, and services. Another topic of cognitive interest is ambidextrous strategy and its relationship with big data. Ambidextrous strategy is understood as the ability of an organization to search for new solutions based on a balance of exploration and extraction activities to

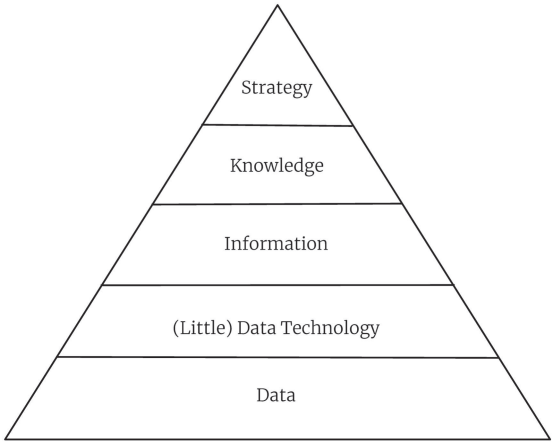

Figure 1. The traditional approach to formulating strategy
Source: own elaboration.

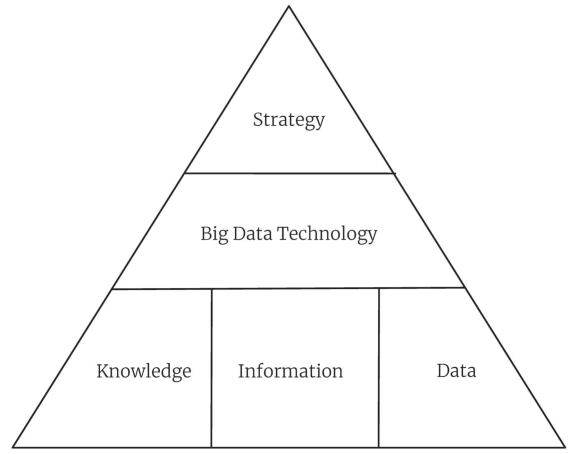

Figure. 2. Big data technology as a tool for formulating strategy
Source: own elaboration.

gain benefits from both opposing (and perhaps even contradictory) activities. Dezi et al. (2018, pp. 1163–1175) show the impact of big data in shaping business process management in the service sector. To a small extent, big data refers to data strategy.

Developing a data strategy is a complex process management task. Data management can be thought of as a journey map that systematizes all data activities. In this way, each data processing or analysis activity will either leverage existing elements or add new ones that others can easily find and use. In addition, all initiatives will respect relevant policies and procedures, ensuring an appropriate level of security and trust in the organization.

The multi-functionality of the data strategy is underlined in other proposed concepts. For example, five essential elements of a data strategy have been highlighted in the SAS management model (The 5 Essential Components of a Data Strategy, 2018, pp. 4-11):

- identification and understanding of data regardless of their structure, origin, and location;
- storing data in an appropriate structure and location to enable easy and shared access and processing;
- collecting data in a way that enables their reuse and sharing and ensuring standards (rules and guidelines) for access;
- data integration in various systems and providing them with a uniform, coherent view;
- data management with appropriate communication policy and technology to enable efficient use. A new element of this concept is data integration, which combines data from different sources stored with the use of different technologies in order to ensure their readability.

DaleMule and Davenport (2017) developed a data strategy based on key goals, main activities, data management orientation, and support architecture. They believe the data strategy has a dynamic character and includes defensive and offensive actions. Defensive actions are those that ensure and manage data security, privacy, integrity, and quality by the principles. On the other hand, defensive actions aim to improve the organization's competitive position and profitability. The appropriate architecture supporting data management guarantees the successful implementation of the distinguished activities. From this point of view, they distinguish between a single source of truth (SSOT) and multiple versions of truth (MVOT).

Dontha (2017) also proposed the seven-component data strategy concept:

- background – defines the essence of developing a data strategy, which may include the company's strategic direction, the initiative to move to digital technology, and the external development related to mergers and acquisitions, among other considerations;
- business case – explains the reason for using the data strategy in the company. It is often presented in the form of a written document but can also take the form of a short oral agreement or presentation;
- goals – defining specific goals related to the data strategy (specific, measurable, agreed, realistic, timed);
- roadmap – linking the data strategy with the tactics of the organization;
- risks and success factors – the data strategy should take into account both success factors and risks;
- budget – identifying the amount of financial resources needed to develop and implement a data strategy;
- measurement – defining and measuring key performance indicators.

When developing a data strategy, attention should be paid to its relationship to the business and functional strategies (production, marketing, finance). This problem is rarely addressed by theorists of data management in organizations. In contrast, it is discussed by practitioners who see great strategic potential in data strategy. An example is Burbank (2016), who "thinks any data strategy needs to be driven by the organization's overall business strategy." In her interview, this kind of symbiosis of both business strategy and data strategy should address the five different levels of management in an organization and use data management tools (Dennis, 2021):

- top-down management - at this level, the process of harmonization of business strategy and data strategy takes place;
- managing the people, process, polities, and culture around data – they are (as resources) involved in the process of harmonizing the business strategy and data strategy;
- leveraging and managing data for strategic advantage - includes the following instruments: master data management, data warehousing, business intelligence, big data analytics, data quality, data architecture, and modeling;
- coordinating and integrating disparate data sources - includes the following instruments: data asset planning and inventory, data integration, and metadata management;
- bottom-up management and inventory of data sources - includes the following tools: data tables, big data, unstructured data, semi-structured data, documents, and content management.

New information technologies, especially big data technology, enable data collection, processing, and analysis. They make it possible to look for ways to perform a task, analyze threats, or evaluate, for example, the information resources held. In the opinion of the authors of this article, the differences between strategic management in the past, defined by a limited amount of data and information (little data analytics), and strategic management based on big data analytics are illustrated in Figure 3.

The two distinguished alternative approaches to data strategy are based on different philosophies. In the first approach, data management is conditioned by the amount of data and the type of technology referred to as little data analytics. The data strategy is developed based on the search for

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causality between the data on phenomena in the organization and the environment. However, in the second approach, the strategy is developed based on the correlation between data in the organization and the environment. In this approach, a key role is played by aggregating significant amounts of data and information from various areas of business activity and combining and analyzing them with the use of big data analytics. The essence of the described approach is the necessity to develop a data strategy as a functional strategy that is an integral component of the organization's strategy. It is a dynamic process influenced by variable and diverse data and information. Therefore, the organization should focus on developing dynamic capabilities in searching, collecting, analyzing, and distributing these resources.

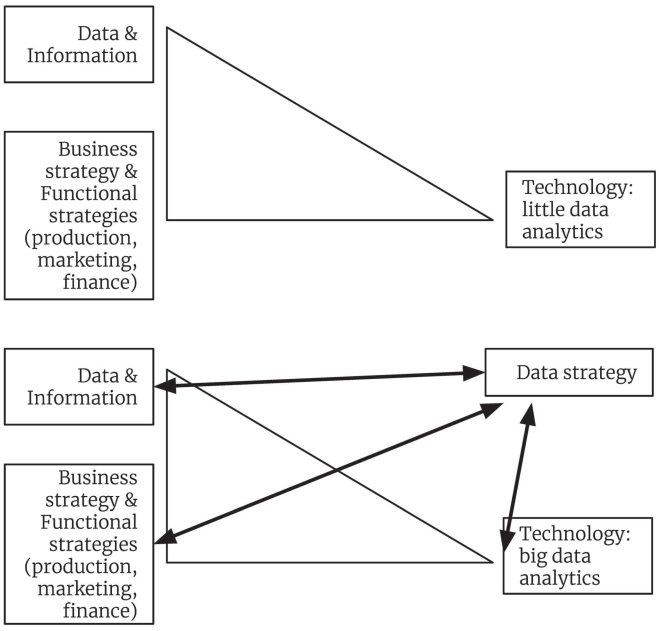

Figure 3. Strategic management based on little data analytics and big data analytics

Source: own elaboration.

Porter's value chain can be used as a strategic tool (see Figure 4). The main activities in this process include data identification, data analysis, data collection, data distribution, data implementation, and data protection. The effectiveness of the described process depends on the appropriate selection of appropriate technological and organizational solutions related to big data technology (supporting activities).

3. BARRIERS AND CHALLENGES RELATED TO THE IMPLEMENTATION OF THE DATA STRATEGY

Big data is an interesting research problem, which simultaneously is a considerable challenge for practitioners in the field of business but also for the economy and society (Lau et al., 2015). Dynamic changes in the business environment make enterprises look for new opportunities to gain a competitive advantage, and one of the possible directions is the implementation of Big Data solutions. In practice, overcoming the barriers hampering the implementation of large-scale data processing is essential. The following can be considered classic universal implementation barriers (or groups of barriers due to their general nature) presented in the literature: technical, economic, organizational, and socio-psychological (human) barriers (Wieczorkowski & Jurczyk-Bunkowska, 2018, pp. 243-255). Whether these fundamental barriers apply equally to implementing big data solutions in the organization arises.

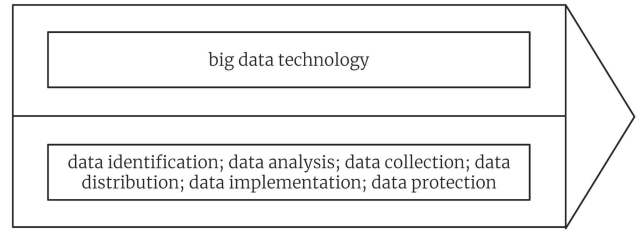

Figure 4. Data value chain

Source: own elaboration.

The big data concept could come into force thanks to technological advances and a decrease in the price of equipment necessary to process big data. Consequently, the cost-free or meager unit processing cost can be treated as the primary big data paradigm. However, the infrastructure requirements for big data methods are significantly higher than typical transactional applications. Therefore, the technological barrier should be treated as the first of the barriers to implementing big data solutions. It is necessary to solve such typical problems for big data as ensuring adequate data processing efficiency, integrating the software with existing transaction systems, real-time data stream analysis, and developing tools ensuring comprehensive data visualization. Infrastructure and IT tools require appropriate service related to the human (staff) barrier. Visualization tools are designed to simplify data interpretation as much as possible and allow the software to be used directly by decision-makers. At the same time, in many cases, the methods used must be appropriately matched to the source data. Interpretation of dependencies also requires appropriate knowledge.

Only with knowledge and competence can the potential of big data in an organization be utilized. In this situation, data specialists, so-called data scientists, replace existing data analysts, traditionally dealing exclusively with statistical analysis methods. They should know IT tools and handle inconsistent and heterogeneous data well.

It is necessary to change the mental approach of managers and adapt it to the new organizational culture, which is related to another barrier, e.g., organizational or procedural. Managers should accept a situation where they must make big data-driven decisions that they cannot fully understand. At the same time, it is possible to deal with a situation in which

more accurate decisions will be made by a person without appropriate management experience, relying on the analysis of data sets, than by an experienced manager. Therefore, it is sometimes necessary to accept that it is sufficient to know the correlation between the data without knowing the causality of the phenomenon. In other situations, based on previously developed rules of operation, decisions can be made automatically without human intervention (at the decision-making stage), which means using the so-called "Golden loop" decision, where the generated proposal does not go to the manager but is carried out automatically (Surma, 2017).

Universal barriers also include financial (economic) and legal barriers. Big data methods require modern infrastructure solutions. Purchasing the appropriate technology (hardware infrastructure with appropriate programming tools) is costly. On the other hand, legal barriers are related to the necessity to respect the existing legal regulations in data collection and processing, especially when the data belongs to the private or sensitive data category. In legal terms, access to other people's or public data, which may be restricted by copyright and licenses, among other limitations, can also pose challenges. The above-mentioned universal barriers to implementing big data solutions constitute the basis for a more detailed approach to this issue in the literature. Researchers who identify these barriers refer them to the area where big data solutions are used. In the area of intelligent factories, Li et al. (2019, pp. 1147-1164) list:

1) organizational barriers: lack of understanding and strategic planning; lack of commitment from top management; lack of cooperation and adjustment between organizational departments; failure to identify significant needs in the field of data analysis;

2) human barriers: lack of qualified and experienced consultants; no internal data researcher; lack of confidence in significant data analysis results; serial resistance due to changes in positions and skills;

3) technical barriers and barriers related to data quality and standards: Immature development of CPS and IoT technologies; lack of an integrated and coherent big data set; poor management of big data; increased threat to information security.

For the challenges facing hospitals in analyzing large amounts of data, Schaeffer et al. (2017, p. 90) include:

- cost and difficulty of connecting disparate systems to a data warehouse - lack of standardization of data sets is costly; the sheer volume of data and lack of connectivity of systems make it costly; the complexity of extracting data from a large variety of sources in a different format; integration costs; cost of developing interfaces; data standardization and interoperability between interoperability; technology systems;

- lack of information systems and analytical professionals with experience - new leadership is needed, chief analytical officer; lack of information technology big data talent in health care; ability to find big data analytic talent; lack of competency of health care staff in using analytics;

- concerns over data quality and quality assurance practices - data quality will be essential to be validated before predictive analytics are applied; quality assurance will be a difficult, ongoing task; predictive modeling might have harmful effects if patients are treated differently based on a flawed data model; data must be highly current; if not, it is not going to be helpful in analytics;

- security and privacy - security and privacy concerns; data security and compliance programs

- financial motivations - current payer systems still mostly service fees and will need to continue to shift to motivate hospitals; people tend to understate negative factors and overstate positive factors; standards need to be developed to increase usefulness and unwillingness by healthcare participants to share data.

CONCLUSIONS

The distinguished barriers to organizations operating in the production or service industry are also characteristic of Polish SMEs. Many believe that data and information could be more valuable strategic resources. It is a barrier and challenge containing both awareness and economic culture. This view has its roots in the past, when, according to Kornai (1978), enterprises operated in the so-called economy of the scarcity of raw materials, information, technology, and energy. This paradigm must be updated as organizations can access various tangible and intangible resources, including data and information. In an environment of excess of these resources, a new paradigm is emerging: how to find the correct data and define the information that will be the basis of decision-making processes in the organization. It is a strategic challenge because technical, technological, organizational, structural, and personal solutions should be created around data and information to give the organization a competitive advantage. In this thinking, big data analytics is the key to the processes of effective organizational management.

The behavior of modern organizations is determined by knowledge, information, and data, as well as the technologies used to collect and process them. In this situation, using large data sets supported by analysis and drawing appropriate conclusions becomes necessary. There is no doubt that big data analytics is a phenomenon necessary for enterprises, especially in strategic management. Analytics directly supports the operational and strategic business processes of enterprises. The ability to quickly use business, market, and competitive values in large data sets allows enterprises to build a development strategy based on the currently most valuable intangible resources: knowledge, information, and data. In the future, policy theorists and practitioners will recognize strategic data management as an instrument of the new management school, known as the digital school. Such a scenario seems likely due to the dynamic development of information technologies implemented in strategic planning and using various

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data sources, which, in processed form, become information of strategic importance for the organization's development. In this situation, the development and implementation of a data management strategy, harmonized with the organization's overall strategy, becomes the binding paradigm in the organization's management.

REFERENCES

Avison, D.E., & Fitzgerald, G. (1988). Information systems development: Current themes and future directions. *Information and Software Technology, 30*(8), 458-466. doi.org/10.1016/0950-5849(88)90142-5

Azma, F., & Mostafapour, M. A. (2012). Business intelligence as a key strategy for development organizations. *Procedia Technology, 1*, 102–106. https://doi.org/10.1016/j.protcy.2012.02.020

Zawiślak, M. (21.01.2019). *Badanie: Big Data nad Wisłą*. Signs.pl. https://www.signs.pl/big-data-nad-wisla,380871,artykul.html

Beyer, M. (2011). *Gartner Says Solving "Big Data" Challenge Involves More Than Just Managing Volumes of Data*. Gartner. https://www.gartner.com/newsroom/id/1731916

Big data w Polsce. Praktyczny i krótki przewodnik dla MŚP (February, 2020). Fundacja digitalpoland. https://digitalpoland.org/assets/publications/big-data-w-polsce/raport-big-data-w-polsce.pdf.

Bhatt, G.D. (2002). Management strategies for individual knowledge and organizational knowledge. *Journal of Knowledge Management, 6*(1), 31–39. https://doi.org/10.1108/13673270210417673

Brdulak, J. (2003). Zarządzanie wiedzą w procesie innowacyjnym. In A. Sosnowska (Ed.), *Czynnik ludzki w procesie zarządzania innowacjami* (p. 37–64). Szkoła Główna Handlowa.

Burbank, D. (May 1, 2016). *The business of data: focus on the data that is important to your business.* The data administration newsletter. https://tdan.com/the-business-of-data-focus-on-the-data-that-is-important-to-your-business/19757.

Caputo, F., Cillo, V., Candelo, E., & Liu, Y. (2019). Innovating through digital revolution. *Management Decision, 57*(8), 2032–2051. https://doi.org/10.1108/md-07-2018-0833

Caputo, F., Evangelista, F., Perko, I., & Ruso, G. (2017). The role of big data in value co-creation for the knowledge economy. In S. Vrontis, T. Weber, E. Tsoukatos (Eds.), *Global and national business theories and practice: bridging the past with the future* (p. 269-280). EuroMed Pres.

Chen, Chiang & Storey. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. *MIS Quarterly, 36*(4), 1165. https://doi.org/10.2307/41703503

Cooley, M. (1987). *Architecture or Bee? The human price of technology*. The Hogarth Press.

DalleMulle, L., & Davenport, T.H. (2017). What's your data strategy?. *Harvard Business Review, May-June*, 112–121. https://hbr.org/2017/05/whats-your-data-strategy.

Davenport, T.H. (2013). Analytics 3.0. *Harvard Business Review, December*. https://hbr.org/2013/12/analytics-30.

Dereń, A.M., & Skonieczny, J. (2017). Technologie informacyjne i ich wpływ na twórczość organizacyjną. In. L. Kiełtyka, A. Sokołowski (Eds.), *Techniki i technologie wspomagające funkcjonowanie przedsiębiorstw*. Publishing House of Częstochowa University of Technology.

De Mauro, A., Greco, M., & Grimaldi, M. (2016). A formal definition of Big Data based on its essential features. *Library Review, 65*(3), 122–135. https://doi.org/10.1108/lr-06-2015-0061

Dennis, A.L. (October 12, 2021). *Data Management vs. Data Strategy: A Framework for Business Success*. DATAVERSITY. https://www.dataversity.net/data-management-vs-data-strategy-a-framework-for-business-success/.

Dezi, L., Santoro, G., Gabteni, H., & Pellicelli, A. C. (2018). The role of big data in shaping ambidextrous business process management. *Business Process Management Journal, 24*(5), 1163–1175. https://doi.org/10.1108/bpmj-07-2017-0215

Dontha, R. (2017, 16 stycznia). *How to Build a Data Strategy Pt. II – The 4 Step Process*. Dataconomy. https://dataconomy.com/2017/01/16/data-strategy-part-ii/

Dudycz, H. (1998). *Visualization of data as a tool to support enterprise management.* Wroclaw University of Economics Publishing House.

Ferraris, A., Mazzoleni, A., Devalle, A., & Couturier, J. (2019). Big data analytics capabilities and knowledge management: impact on firm performance. *Management Decision, 57*(8), 1923–1936. https://doi.org/10.1108/md-07-2018-0825

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

Hicks, J.O. (1993). *Management Information Systems: A User Perspective*. West Publishing.

Gravili, G., Manta, F., Cristofaro, C. L., Reina, R., & Toma, P. (2021). Value that matters: intellectual capital and big data to assess performance in healthcare. An empirical analysis on the European context. *Journal of Intellectual Capital, 22*(2), 260–289. https://doi.org/10.1108/jic-02-2020-0067

Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems, 29*(7), 1645–1660. https://doi.org/10.1016/j.future.2013.01.010

Hazen, B. T., Boone, C. A., Ezell, J. D., & Jones-Farmer, L. A. (2014). Data quality for data science, predictive analytics, and big data in supply chain management: An introduction to the problem and suggestions for research and applications. *International Journal of Production Economics, 154*, 72–80. https://doi.org/10.1016/j.ijpe.2014.04.018

Khan, Z., & Vorley, T. (2017). Big data text analytics: an enabler of knowledge management. *Journal of Knowledge Management, 21*(1), 18–34. https://doi.org/10.1108/jkm-06-2015-0238

Kornai, J. (1979). Resource-Constrained versus Demand-Constrained Systems. *Econometrica, 47*(4), 801. https://doi.org/10.2307/1914132

Laney, D. (2011, July). Infonomics: the economics of information and principles of information asset management. In *The Fifth MIT Information Quality Industry Symposium, 9*(5) (p. 590-603). Cambridge. http://mitiq.mit.edu/IQIS/Documents/CDOIQS_201177/Papers/05_01_7A-1_Laney.pdf

Lau, H. Y. K., Luo, H., Zhong, R. Y., Fang, J., & Huang, G. Q. (2015). Special Issue on "Intelligent Enterprise Systems". *Computers & Industrial Engineering, 84*, 1–2. https://doi.org/10.1016/j.cie.2015.01.011

Laudon, K.C., & Laudon, J.P. (1991). *Business Information Systems: a problem solving approach*. Dryden Press.

Li, S., Peng, G. C., & Xing, F. (2019). Barriers of embedding big data solutions in smart factories: insights from SAP consultants. *Industrial Management & Data Systems, 119*(5), 1147–1164. https://doi.org/10.1108/imds-11-2018-0532

Martin, C., & Powell, P. (1992). *Information systems: a management perspective*. McGraw-Hill.

Meyer-Schonberger, V., & Cukier, K. (2014). *Big data. Rewolucja, która zmieni nasze myślenie*. Wyd. MTBiznes.

Mierzejewska, B. (2004). Czym (nie) jest zarządzanie wiedzą?. *E-mentor, 1*(3), 37-39. https://www.e-mentor.edu.pl/artykul/index/numer/3/id/22

Nonaka, I., & Takeuchi, H. (2000). *Kreowanie wiedzy w organizacji: Jak spółki japońskie dynamizują procesy innowacyjne*. Warda&Kłosowski Consulting.

Provost, F., & Fawcett, T. (2013). Data Science and its Relationship to Big Data and Data-Driven Decision Making. *Big Data, 1*(1), 51–59. https://doi.org/10.1089/big.2013.1508

Schaeffer, C., Booton, L., Halleck, J., Studeny, J., & Coustasse, A. (2017). Big Data Management in US Hospitals. T*he Health Care Manager, 36*(1), 87–95. https://doi.org/10.1097/hcm.0000000000000139

Singh, S. K., & Del Giudice, M. (2019). Big data analytics, dynamic capabilities and firm performance. *Management Decision, 57*(8), 1729–1733. https://doi.org/10.1108/md-08-2019-020

Surma, J. (2017). *Cyfryzacja życia w erze big data*. PWN.

Russom, P. (2011). Big data analytics. TDWI best practices report. *Fourth quarter, 19*(4), 1-34.

The 5 Essential Components of Data Strategy. (2018). SAS. https://www.sas.com/content/dam/SAS/en_au/doc/whitepaper1/five-essential-components-data-strategy.pdf.

Wang, B., Abdalla, E., Atrio-Barandela, F., & Pavón, D. (2016). Dark matter and dark energy interactions: theoretical challenges, cosmological implications and observational signatures. *Reports on Progress in Physics, 79*(9), 096901. https://doi.org/10.1088/0034-4885/79/9/096901

Ward, J.S., & Barker, A. (2013). Undefined By Data: A Survey of Big Data Definitions. *ArXiv*, abs/1309.5821. https://doi.org/10.48550/arXiv.1309.5821

Wieczorkowski, J., & Jurczyk-Bunkowska, M. (2018). Bariery wdrożeń rozwiązań big data. In R. Knosala, *Innowacje w zarządzaniu i inżynierii produkcji*, tom 1 (p. 243-255). Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją.

Zeleny, M. (1987). Management Support Systems: Towards Integrated Knowledge Management. *Human Systems Management, 7*(1), 59–70. https://doi.org/10.3233/HSM-1987-7108