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Application of big data information technologies at modern manufacturing enterprises

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Abstract. The article is about the applications of big data in production companies. In the first part of the article it refers in a general way to the general concepts of big data, its need for creation and application in companies. Big data as a layer of business intelligence, as emerging technology, among others. Also, the article shows the top leader big data companies around the world, and the top of analytics big data tools among the other information related to some tools to use in big data companies. In the last part of article it shows Big data analytics market revenue worldwide in 2019 and 2025.

Key words: big data, emergent technology, business intelligence, digitalization, digital economy.

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Научная статья
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Применение информационных технологий больших данных на современных производственных предприятиях

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Аннотация. Статья посвящена применению больших данных в производственных компаниях. В первой части статьи в общих чертах говорится об общих понятиях больших данных, необходимости их создания и применения в компаниях. Большие данные как слой бизнес-аналитики, как новая технология, среди прочего. Кроме того, в статье показаны ведущие мировые компании, занимающиеся большими данными, а также лучшие инструменты аналитики больших данных среди другой информации, связанной с некоторыми инструментами для использования в компаниях, работающих с большими данными. В последней части статьи показаны доходы рынка аналитики больших данных во всем мире в 2019 и 2025 годах.

Ключевые слова: большие данные, новые технологии, бизнес-аналитика, цифровизация, цифровая экономика.

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Introduction

Digital Big data is the term that describes a large volume of data, which grows exponentially over time. Simply put, it's such a large and complex data set that none of the traditional data tools are capable of storing or processing it efficiently.

However, this volume of data can be used to address business issues that you might not have faced before.

Among the types of big data we can find the following classifications:

1. Structured

Any data that can be stored, accessed and processed in fixed format is called "structured" data. During this period of time, talent in computing has achieved better results in the development of techniques for working with this type of data (where the format is already known) and value has been derived.

However, today, we are foreseeing issues when the size of such data grows greatly, typical dimensions are in the range of multiple zettabytes.

2. Unstructured

They are any data of unknown form or whose

structure is classified as an unstructured data. In addition, from being huge in size, unstructured data poses multiple challenges regarding its processing to derive value from it.

A typical example of unstructured data is heterogeneous data sources that contain a combination of simple text files, images, videos, among others.

Organizations now have a wealth of data available. But, unfortunately, they don't know how to derive value from them because this data is in its raw form or unstructured format.

3. Semi-Structured

Semi-structured data can contain both types of data. They usually have a format that can be defined, but the user cannot easily understand it and requires the use of complex rules that help determine how to read each piece of information. An example of a semi-structured data is a data represented in an XML file.

The characteristics of big data are the following:

1. Volume

The amount of data matters. With big data, you'll have to process large volumes of low-density unstructured data. It can be data of unknown value,

such as Twitter data channels, click traces on a web page or mobile app, or devices with sensors enabled.

For some organizations, this can mean tens of terabytes of data. For others, it can involve hundreds of petabytes.

2. Speed

Speed is the accelerated pace at which data is received and processed. Typically, the highest data rate flows directly to memory instead of being written to disk. Some smart products with internet access operate in real time and will require real-time evaluation and action.

3. Variety

Variety refers to the different types of data that are available. Traditional data types were perfectly structured and adapted into a relational database.

With the increase of big data, it comes in new types of unstructured data. Semi and unstructured data types, such as text, audio, and video, require additional preprocessing to deduce their meaning and be compatible with metadata¹.

1 Big data: definición, tipos, características y beneficios. Posgrado UCSP: [website]. URL: <https://postgrado.ucsp.edu.pe/articulos/que-es-big-data/> (accessed 11/25/2021).



Fig. 1. The four's V of Big Data
Source: [Patidar 2018]

Big Data Applications

Social networks, geolocation, browser cookies an enormous amount of data in digital format is accumulated through the internet. What happens to this information? These are generally unstructured data whose volume, variability and speed of growth make it difficult to process them using conventional methods. Therefore, big data in companies is the solution that allows you to extract the necessary intelligence and give it value.

Big data is one more of those emerging technologies that have the potential to transform companies. We are facing a new revolution that introduces great opportunities and, at the same time, important challenges for our companies.

However, for most organizations it is still difficult to understand what benefits big data can bring and how to incorporate this technology into their business model.

The key to big data is what organizations do with data. We can have a lot of information that if we don't know how to use it, it has no value.

In many cases it is adopted for an efficient management of resources (material or human), thanks to a detailed analysis of large volumes of company data: billing, customers, products, dates, etc.

In general, this technology generates analyses that lead to improved decision-making and strategic business movements. Below, we list a series of activities that demonstrate the use of big data in companies.

Predictive analytics

Big data is a tool that allows you to anticipate the behavior of the market. In this sense, one of the main applications of big data in companies is the detection of trends, which allows to estimate the future demand of users. How does this work?

Customers are observed on a large scale and their preferences are known and studied by detecting patterns of behavior. Thus, predictive models are generated for new products and services.

A simple example is the case of supermarket chains. Through the purchase history data of their customers, they personalize direct emails to their consumers.

Netflix, is one of the companies that collects the tastes and interests of its users in order to get an idea of how their next series will be received. Depending on the information received, they make decisions about their future projects.

Another example, this time a little more particular, is the reference to the predictive maintenance of equipment: appliances, aircraft engines, trains, cars, etc. Producers are interested in knowing what failures would be obtained and within what time.

To do this, they use sensors that allow them to collect data on the operation of their devices. In this way they can anticipate possible errors and determine when the next maintenance will be necessary.

Customer experience

The customer study has proven to be the most appropriate to build loyalty and direct business actions towards success. Now it's easier than ever! The use of new technologies offers a clear view of the customer experience. This brings multiple benefits to the company, such as the opportunity to segment customers according to their preferences.

Big data allows you to collect information from website visits, social networks, call logs and other data sources. In this way, it is possible to improve the interaction experience, as well as optimize the value offered, reduce visitor abandonment rates, manage incidents proactively, etc. The objective is to improve the customer experience, build customer loyalty and obtain a greater clientele.

By triangulating customer data, Spotify knows which songs are most popular in a summer, people's favorite moments to listen to music, and which geographic areas are the most popular.



Fig. 2. Application of Big Data in the companies
Source: [Patidar 2018]

Human resources of companies

Although everything indicates the analysis of the external of the company, big data is also used to collect information regarding the internal of the organization, for example, employees.

The information is analyzed and through a descriptive study it is possible to detect profiles of people who leave the company, know conformities and non-conformities of workers with the company, among other analyzes.

As a result, projects are carried out to reduce labor turnover and favor the motivation and commitment of the members of the company. Even big data can be applied to achieve a more strategic selection of personnel, by establishing profiles of accepted candidates and calculating their probability of success.

Supply chain

Big data is increasingly being used to optimize business processes in companies. A process that benefits greatly is the supply chain and the optimization of delivery routes.

Thanks to geographic positioning and radio frequency identification sensors, real-time traffic data is integrated. This allows you to track goods and delivery vehicles and also optimize routes.

Intelligent alert systems

Big data is also used in companies for alert systems that collect and process data, offering forecasts or temporary predictions about their action and possible effects.

For example, this type of mechanism has been applied on the Stock Exchange to warn of unexpected peaks and falls in quotes. Another case could be in the public sector, where alert systems are used in the management of risks or emergencies, natural disasters, etc.

Detect fraud

Compliance requirements and security contexts are evolving all the time. In this sense, there are big data tools in companies designed to prevent fraud from situations such as the alteration of customer purchase patterns.

By accessing data and analyzing it in real time, this technology enables immediate responses that minimize damage. It even establishes predictive models that allow anticipating risk situations.

Driving innovation

Data management opens up new business avenues for innovation. By analysing the

interdependencies between institutions, processes, entities and people, it is possible to identify novel ways of using such information.

The possibilities are limitless: improving financial decisions and planning considerations, implementing dynamic pricing, developing new services and products, etc.¹

Importance of big data in companies

The application of enterprise big data essentially brings a layer of intelligence to the business. Working hand in hand with this tool offers you more opportunities to implement any business movement, either growth or solution.

Companies that opt for this technology use their data to have a more realistic perspective on what is happening with their business and not make decisions based only on intuitions. Thus, they will be able to offer the market products and services aligned with the needs and desires of customers and improve or at least maintain their market share.

What are the benefits of big data in companies?

The techniques and tools to analyze big data are suffering a clear increase in demand due to the value they have for organizations. Let's see some advantages of big data in companies:

Improvement service

The circumstances created with big data offer availability to acquire, store and process a large volume of data. Therefore, they perfect the ability of analysis, discovery, prediction, and planning by the company.

Real-time feedback

The fact of having the data in real time, allows a quick reaction. For example, know the status of a launch or the outcome of a strategy instantly. In addition, it is possible to reduce latency in the critical processes of the organization.

Machine learning

Data is one of the causes of this process. Machines can learn instead of being programmed thanks to the availability of big data to generate machine learning models.

Cost reduction

Large data technologies, such as Hadoop and cloud-based analytics, bring significant cost advantages when it comes to storing large amounts of data, as well as identifying more efficient ways to do business.

¹ Big data en las empresas ¿Para qué sirve y cómo aplicarlo? URL: <https://negociosyempresa.com/uso-big-data-en-las-empresas> (accessed 11/26/2021).

Market knowledge

Through multiple channels you get a 360° view of current and potential customers. This allows you to locate windows of opportunity, which implies anticipating the needs of consumers, detecting consumption trends or mismatches in terms of customer service. In short, this amounts to having a competitive advantage.

Efficiency in decision making

For starters, predictive analytics enable the organization to be more effective and work proactively. In general, having and understanding more information enables better and faster business decisions.

Present and future technology

Big data offers a great opportunity for constant innovation. In addition, it is evolving and most likely in the not too distant future will be essential for companies. This is why more and more companies are betting on digital transformation [Deagon 2022].

How to apply big data in a company?

Today, more and more companies are becoming aware of the importance of data as a strategic resource. But how to make projects successful with this initiative? These 4 steps below explain what needs to be considered for the adoption of big data in enterprises.

1. Define where and why to use big data

Many of the first companies to adopt this technology spent time and resources implementing it. However, once they were done they realized that they were not entirely clear what to do with it [11].

The first thing that business managers should question before implementing a new technology is what objectives are pursued and for what. The same happens with big data. This can be a complex step because reinventing yourself is not usually easy, it involves having creativity, being competitive and having business vision².

The most advanced companies at the moment are telecommunications and financial services, with a growing presence in other sectors such as health services, technology and education. These are just some examples of companies that have already opted for Big Data:

Amazon: the e-commerce par excellence began with the suggestion of books for each customer profile and is now a benchmark in the use of data.

Carrefour: the French supermarket chain works on Big Data to know the frequency of visits of its customers and the characteristics of their purchases in order to offer a more personalized service.

BBVA: banking also plays an important role through credit card payment information. BBVA is already working with this data in projects such as Navidata, a map made in 2017 on spending during the Christmas season.

Netflix: Thanks to its individualized recommendations and trend prediction, the Netflix entertainment platform has experienced tremendous growth in recent years, driven in large part by its successful use of data.

In addition to large companies that use Big Data to improve decision making, companies that offer standard or customized solutions to other companies have been gaining strength. As it is a complex and very specialized system, many medium and large companies turn to an outsourced company to manage their data. Among the companies that provide other companies with solutions through Big Data services stand out:

Cloudera. With more than 1,600 employees distributed in 28 countries, it is one of the leading companies in the distribution of products based on Big Data.

Hortonworks. This data management platform offers solutions for enterprise data, data warehouse optimization, cybersecurity and threat management or the Internet of Things.

MAPR. It focuses on Artificial Intelligence and analytics to improve results.

Amazon EMR. Service that offers a broad set of Big Data use cases³.

Now the Big Data Leaders are: Snowflake, Intellias, Visual BI Solutions, Salesforce, Teradata, Microsoft, XPlenty, SiSense, Cloudera, Datafactz, IBM, HPE, SAP, Oracle, Apache, HPCC, Zoho, Alteryx, Thoughtworks, Talend, Amazon Web Services, Splunk, Google, TIBCO, Pentaho, Datameer, Alation, BigPanda, Splice Machine, Striim, Mu Sigma, Alpine Data Labs, Cogito, New Relic, VMware [Patrizio 2020].

2 Ibid.

3 Empresas que usan big data. IEP : [website]. URL: <https://www.iep.edu.es/empresas-que-usan-big-data/> (accessed: 11/27/2021).



Fig. 3. Big data tools
Source: [Tejedor 2021]



Fig. 4. Top 5 of big prominent Big Data Analytics Tools
Source: 5 herramientas líderes de análisis de big data para aprender en 2020. available at: <https://www.hebergementwebs.com/noticias/5-herramientas-lideres-de-analisis-de-big-data-para-aprender-en-2020> (date access: 27.11.2021)

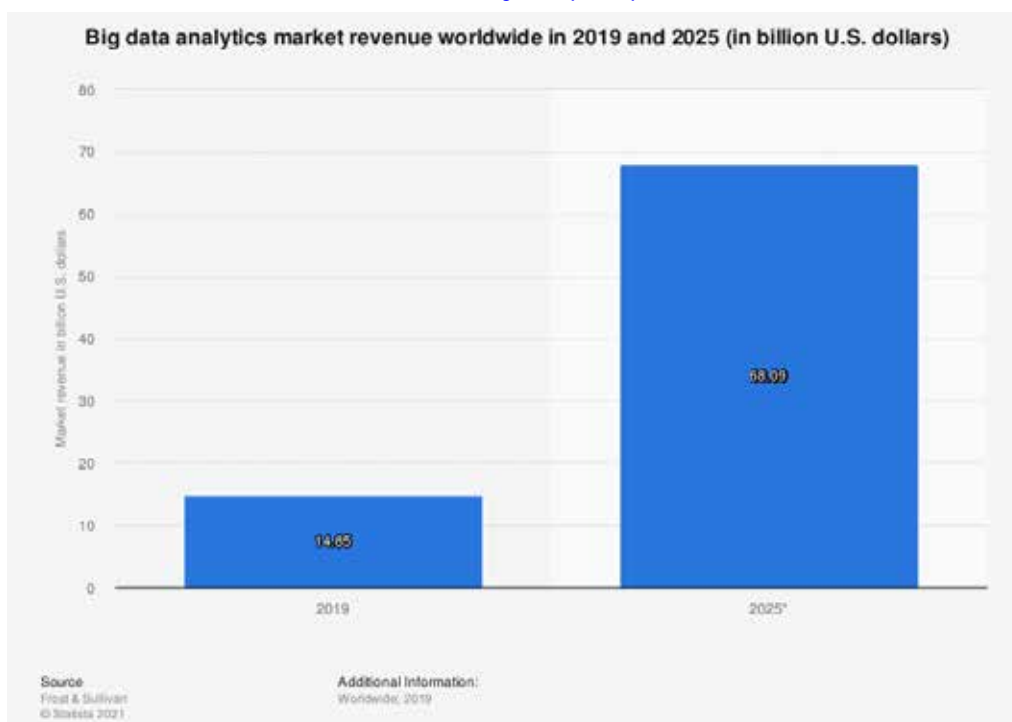


Fig. 5. Big data analytics market revenue worldwide in 2019 and 2025
Source: Statista.com, available at: <https://www.statista.com/statistics/947745/worldwide-total-data-market-revenue/> (accessed 11/29/2021)

Conclusions

The analysis of big data is a revolution within information technologies, hence the use of its term is fashionable in the business environment. Whether due to ignorance or lack of competitiveness, many still do not understand why big data is important in companies. For this reason, our site makes its contribution to enlighten its readers.

Whether the internal operations of an organization are complex or simple, they always have room for improvement that can translate into great savings in terms of time and money. Big data

helps us because it carries out a constant analysis of our business processes. These data allow generating valuable information that supports operational decision-making, detecting room for improvement and being able to react better to unforeseen events.

Any company can improve its strategies, but if you take into account the focus of the target audience, these will be more effective. In this sense, the analysis of big data is an unstoppable upward trend. In short, an efficient use of this technology will revolve around the improvement of business benefits.

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