Industry 4.0

The Fourth Industrial Revolution.

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Index.

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Industry 4.0, also known as the Fourth Industrial Revolution, consists of the digitization of industrial processes to bet on greater automation, connectivity and globalization.

This revolution changes the way in which businesses operate, involving changes aimed at intelligent infrastructures and the digitization of methodologies; consequently promoting competitiveness within the market.

Industry 4.0 is made up of a series of new smart technologies that are integrated into organizations and societies. They are:

Big Data
IoT (Internet of Things)
Augmented Reality
RPA (Robotic Process Automation)
Blockchain
Simulation
Cloud Computing
Artificial Intelligence
3D Printing
Cybersecurity

In this eBook we will share the implications of this new industrial stage so that you can fully understand all the opportunities they offer.

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1 | Big Data.

With the large amount of information that companies collect today, it is necessary to have technologies that organize and manage it, in order to cope with the information efficiently, facilitating correct decision-making and the execution of strategic business actions.

Big Data is a set of data or combinations of data, whose size and complexity make difficult not only its capture but also its quality, management and processing, requiring technological applications to handle it properly.

The complexity of Big Data is due to the fact that most of the data generated by modern technologies is unstructured, that is, data that cannot be placed in standardized rows and columns, as per example: documents, videos, audios, etc.

Known as the '' 5 V's '', the characteristics that make this complexity are:

Volume: Size of the amounts of data currently being generated.
Velocity: The generation and storage of data is constant and at great speed.
Variety: Data comes from multiple supports, tools, and platforms.
Veracity: The variety of data causes many of them to be incomplete or incorrect.
Value: The data has to add value once it is converted into information.

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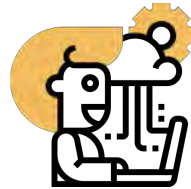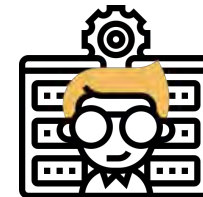
| Volume | Velocity | Variety | Veracity | Value |

Only 20% of the information is structured, which can lead to many errors. That is why in many cases to obtain effective results, unstructured data must be combined with structured data, which are basically those that are arranged in excel tables, spreadsheets, web forms and standardized files, among other formats and platform. Big Data allows organizations to identify problems faster, being able to act agile and efficiently to take advantage of new opportunities. As a result, it is possible to get smarter businesses, more efficient operations, lower costs and higher profits.

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2 | IoT- Internet of Things.

The Internet of things, or as it is better known by its acronym, IoT, refers to the interconnection of everyday objects through the internet.

This technology makes it possible to connect the physical world with the digital one to share data and even perform actions through wireless networks without human intervention.

Applicable both to residences and to industries of all kinds (retail, manufacturing, health, energy, transportation), IoT manages from the management of household appliances such as air conditioning, to the control of industrial machinery and tools, thus facilitating people's lives and work.

> What technologies make IoT possible??

Machine learning for data analysis and pattern identification, automating the process and minimizing human intervention.

Artificial intelligence (AI), transforming IoT devices into attractive, affordable and viable devices for home use.

Analytics, for the fast and easy collection and analysis of information for correct decision making.

Cloud Computing, which allows remote access to software, file storage and data processing through the Internet.

Connectivity through an Internet network that facilitates efficient data transmission.

> Most common examples of IoT:

Smart devices such as Amazon's Alexa, through which you can control household objects such as light bulbs and television.

Electronic Wallet (BIM). From your cell phone you can receive and send money without consuming the balance or megabytes of the mobile phone.

Sensors that record data on sunlight, temperatures, fertilizer level and humidity. Connected refrigerators that give notice every time a basic product is missing. In addition, it is capable of ordering at the supermarket.

IoT in logistics, where shipping containers are tagged with radio frequency identification devices (RFID) to analyze shipments in real time.

"It is estimated that there are currently close to 30 billion connected IoT devices, increasing this number exponentially every day".

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3 | Augmented Reality.

In simple words, Augmented Reality (AR), is the combination of the real world with a virtual one, mixing physical elements with tacit elements in real time.

AR allows you to visualize a real physical environment, adding layers of virtual information to that real environment through technological devices such as webcams, smartphones and tablets, to achieve an artificial and interactive three-dimensional reality. This new reality also makes it possible to carry out various modifications to the environment.

Within the physical context that functions as the interface of this resource, all types and sizes of objects can be included, as well as the presence of people with the aim of providing real knowledge that helps to understand the context with immersive experiences.

One aspect to keep in mind is that Virtual Reality (VR) and Augmented Reality are not the same. Both are solutions designed to optimize inspection and maintenance activities, facilitating manufacturing and R&D processes, but their difference is that RV does not make use of the real physical environment, but rather creates a completely new world.

"With enormous potential being increasingly exploited in various industries, the possibilities of Augmented Reality are endless".

Video games turn out to be one of the best known Augmented Reality applications, but the truth is, it is a technology that is currently developing solutions for a large number of areas such as medicine, engineering and education, among others.

Some Augmented Reality examples:

Fox Sports includes complete sets on the playing fields with augmented reality during its live broadcasts, providing information and a higher level of quality to the experience.

The Ikea Place app inserts products from its catalog virtually in any space of a house in real scale to see how they look, without having to buy them, facilitating the purchase decision.

Google translate detects languages and translates words and phrases written on posters automatically, using a photo taken with a mobile phone.

L'Oréal and its augmented reality start-up, ModiFace, allows users to realistically test different make-up on their faces, before making the purchase.

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RPA - Robotic Process Automation.

Robotic Process Automation, or RPA, as its acronym indicates, is the technology that allows one to configure a software or "robot" to control and interpret existing applications. Thus, it can process a transaction, manipulate data, trigger responses and communicate with other digital systems, as defined by the Institute for Robotic Process Automation and Artificial Intelligence (IRPAAI).

In other words, RPA allows bots to be configured through cognitive technologies, so that with the help of artificial intelligence, they can execute business processes automatically. In addition, this technology is capable of interacting with any application or system, operating continuously 24 hours a day, without stopping.

In which cases is RPA applied?

- **Repetitive tasks.**
- **Periodic reports for decision making.**
- **Mass sending of emails.**
- **Transformation of data into graphic models.**
- **Comprehensive systems maintenance.**

One of the most common ways in which a company begins its path towards digital transformation is through Robotic Process Automation, since it grants the modernization of processes in a fluid way, optimizing results to ensure a competitive advantage.
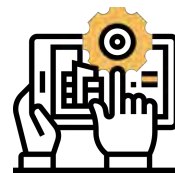
Among its benefits:

Elimination of errors in processes.

Time saving, freeing operators from repetitive tasks.

Increased productivity and accuracy of up to 100%.

Cost savings and fast return on investment.

Scalability in business processes.

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5 | Blockchain.

The chain of blocks, better known in English as Blockchain, has its origins in 1991, but it was only in 2008 that it became popular with the arrival of bitcoins.

Blockchain is a database distributed among several participants called nodes connected in a decentralized network to validate the information that travels through it, without the need for intermediaries.

This data travels in an encrypted structure within the chain, preventing its content from being revealed and enabling the protection and privacy of transactions. The chain also contains the complete history of all transactions executed on the network.

A finite number of valid transactions are clustered into each of the blocks in the chain. When a transaction does not enter into a block, it is incorporated into a new block that is linked to the previous one. That is why it is called the "chain" of blocks.

How does Blockchain work?

1. **Each transaction to be carried out is represented on the network as a "block".**
2. **That block is broadcast to all parts of the network.**
3. **Network users certify the validity of the transaction.**
4. **The block is added to the chain.**
5. **The transaction is finalized.**

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Although its best known application is cryptocurrencies or bitcoins, this technology can be applied to all types of transactions.

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Benefits of Blockchain :

Storage of information that can never be lost, modified or deleted.

Low costs by not needing intermediaries.

Secure transactions between people around the world.

Confidentiality and traceability of data.

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6 | Simulation.

As part of the technologies belonging to Industries 4.0, simulation consists of imitating the operation of a real system to build a computational model that allows experiments and tests to be carried out. All this is possible thanks to mathematical techniques used by computers.

This process makes it possible to understand the operation of a system under certain conditions and circumstances, evaluating different responses and ways of acting, and anticipating potential problems.

In addition, during the experimentation process, the system studies the operations it is carrying out in order to later include the effects of the results obtained in the subsequent tests

As a consequence of all this, simulation improves efficiency in the use of a company's existing resources without the need to put people or machines at risk.

Objectives of using the Simulation

Focused primarily on problem solving, simulation allows:

- **Understanding the behavior of a system.**
- **Anticipating future behaviors.**
- **Analyzing critical elements and estimating performance measures.**
- **Evaluating problems and proposing solutions.**
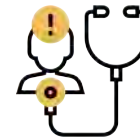- **Training projecting a variety of situations.**

Examples:

Pre-qualification tests for aviation pilots.

Rehearsals for astronauts before embarking on a space mission.

Simulation of medical interventions before their execution.

Missile trajectory traces in the military sector.

Calculation of orbit and position of artificial satellites.

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7 | Cloud Computing.

On one hand, cloud is an IT environment where scalable applications and resources run on the Internet through connectivity. On the other hand, Cloud Computing is the function of executing said resources within that cloud, to provide infrastructure, services, platforms and applications as required.

In short, it is a technology that allows computing services to be offered over a network.
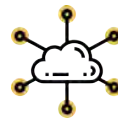
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Most popular cloud providers:

- Amazon Web Services
- Microsoft Azure
- Google Cloud
- Alibaba Cloud
- OpenStack

"Thanks to the existence of the cloud, we can have all our information on the Internet, without having to worry about the storage capacity of a computer".

Types of Clouds. Depending mostly on the location and ownership of each cloud, we can find different types:

Public cloud: Infrastructure delivered by a provider of this type of services, available to a general public.

Private cloud: A cloud environment designed on demand and with isolation level for a particular user or organization.

Hybrid cloud: Combines the infrastructure of a private cloud with a public cloud, allowing workloads to move between both environments.

Multi-Cloud: Storage systems that combine more than one cloud environment, whether public or private, in a single heterogeneous architecture.

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8 | Artificial Intelligence.

AI, from its acronym for Artificial Intelligence, refers to the intelligent behavior of computers, monitoring and interpreting physical environments, and being able to imitate human cognitive functions such as learning and problem solving.

But for this to be possible, it is necessary to first provide real-world information (data). Once this is done, the information is processed by the device, allowing decisions to be made about a particular problem or situation (knowledge transfer).

The objective then, is to transfer the human experience so that the device can reach the same (or even better) conclusions than a person and act accordingly.

> Everyday applications:

Voice assistants such as Siri from Apple and Alexa from Amazon.

Face detection for mobile devices.

Image processing for surveillance, logistics, identification of people, etc.

Virtual assistants (chatbots) that issue medical 'diagnoses'.

> Types of Artificial Intelligence:

Computer science experts Stuart Russell and Peter Norvig differentiate several types of artificial intelligence:

- **Systems that think like humans** (automate human activities)

- **Systems that act like humans** (such as bots)

- **Systems that think rationally** (emulate the rational logical thinking of humans)

- **Systems that act rationally** (rationally imitate human behavior)

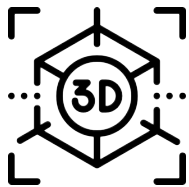"It is clear that AI, the greatest evolution since computing emerged, has come to make our lives easier".

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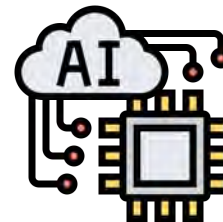
9 | 3D Printing.

3D printing is the generation of customized three-dimensional pieces for final use, prototypes or as a tool for the generation of other final products, such as molds and templates. These parts are generated thanks to computer aided design (software) and the flexibility and benefits provided by most materials.

The process is carried out through the addition of printing material in layers that gradually form the successive cross sections that make up a three-dimensional model. Plastics and metals are the most widely used materials for 3D printing, but a wide variety of materials can be used, from concrete to living tissue. This technology can either replace or complement other manufacturing methods.
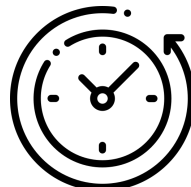
Applications:

- **Manufacture of product prototypes.**

- **Patterns, templates and molds for the generation of metal parts.**

- **Unique prostheses adapted to the anatomy of a particular patient.**

- **Final products such as electronic equipment housings.**

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Although medicine and manufacturing are the sectors where 3D printing has the greatest applications, it can also be applied in any other type of industry
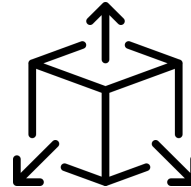<<

Advantage:

CRapid prototyping that reduces time-to-market.

Playback of any volume without restrictions.

Shortening of product development times.

Differentiation and customization of products.

Reduction of errors and production costs.

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10 | Cybersecurity.

Also called ''Information technology security'', it is the branch of computing that defends computers, servers, mobile devices and networks from malicious attacks, detecting vulnerabilities created to access, modify or destroy information.

The main objective of computer security is to protect the infrastructure and users information, which is achieved through 3 main actions: prevention, detection and recovery.

Types of attacks:

- **Malware:** Malicious software that damages computers, usually transmitted through an attachment or download.

- **SQL code injection:** cyberattack that exploits application vulnerabilities to insert malicious code into a database and steal it.

- **Phishing:** Attack through legitimate-looking emails that request confidential information such as credit card details.

- **"Man-in-the-middle":** cyber threat in which a hacker intercepts the communication between two individuals to steal data.

- **Denial of service attack:** It is based on preventing legitimate requests from a computer system by overloading networks and servers with traffic.

Preventive measures:

In order to prevent an attack, the most common measures are:

- Antivirus programs that avoid threats from the use of the Internet.

- Firewalls that restrict data traffic according to certain security standards or criteria.

- Encryption of coded information with access only through a code.

- Passwords for personal accounts.

"Cybersecurity not only serves to prevent but also to give customers confidence. That is why it is essential that companies invest in security. Also, the larger the company, the more likely it is to be attacked".

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