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**EVOLUTION AND CURRENT SITUATION OF THE
DIGITAL TRANSFORMATION OF INDUSTRIAL
ORGANISATIONS IN SPAIN**

INDUSTRY 4.0

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INTRODUCTION

The main objective of this project is to study the digital transformation of organisations in the industrial field, which is known as Industry 4.0.

The concept of Industry 4.0 is based on the digitalisation of industrial processes through artificial interaction with machines and the optimisation of resources. Companies need to be able to identify the technologies that best meet their needs in order to invest in them.

Organisations have implemented these transformations due to the volatility, complexity and uncertainty of the environment, in a way that allows the industry to have great opportunities based on the use of a large amount of data.

The structure of this project has been devised to fully understand how this concept works.

Firstly, the evolution of the four revolutions that have taken place will be analysed and Industry 4.0 will be examined in greater depth in order to understand what it consists of, in addition to mentioning a series of its advantages and risks.

Once its meaning is understood, the various techniques used for digital transformation projects will be discussed. For this purpose, the concept of Digital Lean and Industry 4.0 will first be developed, and then the synergies and mismatches between both of them will be explained, as well as their interaction.

Next, the degree of maturity of digital transformation in Spain will be explained through the fourth study of the Digital Maturity Index of companies, 2020-2021. In addition, the phases into which the digital transformation of industrial companies is divided will be developed.

Subsequently, the different stakeholders and their role in supporting digitisation will be presented. We will also analyse how Covid-19 has influenced this transformation and review some of the existing European support for it.

Lastly, a conclusion with the final points of the project will be written along with the bibliography.

This document represents a theoretical review of evolution and current situation of the digital transformation of industrial organisations in Spain, starting from the need to understand what Industry 4.0 is. The document pays reference to existing literature

related to Industry 4.0 such as websites, articles, books, blogs and theses, among others.

1. HISTORICAL CONTEXT OF INDUSTRY

Industry has been evolving throughout history and has been marked by specific events that occurred at different stages. Industrial revolutions refer to the enormous social changes brought about by both economic changes and technological progress. Four major events emerged that involved important moments for industry and its development.

The First Industrial Revolution began in England in the 18th century. However, it did not spread across the northern hemisphere until the 19th and early 20th centuries. (Maximo, 2021)

Great economic and social transformations took place. These involved moving on from a rural world to an industrial one. In addition, through the mechanisation of production, productivity could be improved.

Using the energy of mineral coal and turning it into mechanical energy allowed machines to work and also meant a real breakthrough in production techniques, thanks to water and steam. (Sectorial, 2019)

The Second Industrial Revolution began in the 19th century and lasted until the outbreak of World War I in 1914. (Maximo, 2021)

The means of production were developed and new ways of organising work were established. Mass production appeared thanks to factories and assembly lines. In addition, new sources of energy, such as oil and electricity, began to be used.

In short, automation and chain work made it possible for production to increase, for expenses to be reduced and for the final prices of the products to be cheaper. (Desoutter, 2022)

The Third Industrial Revolution began in the seventies and was characterised by the automation of repetitive processes in production lines. (Maximo, 2021)

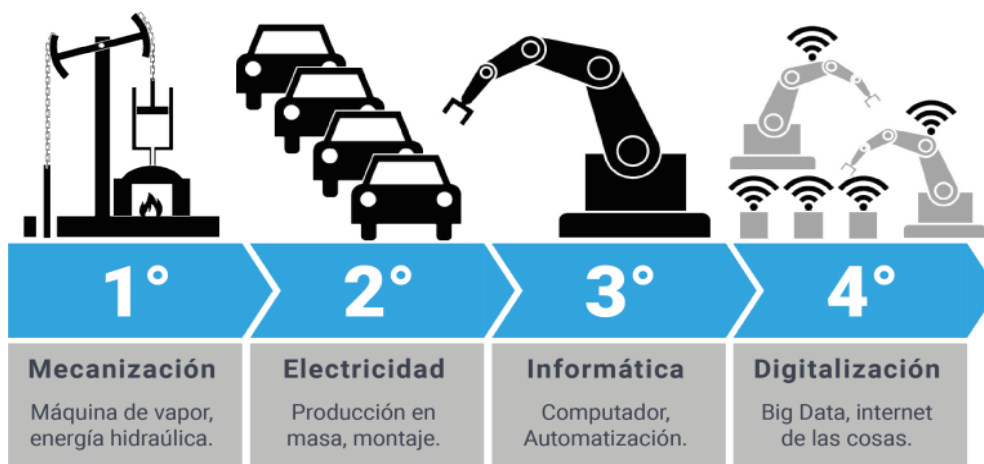
The most relevant event at this stage, which is also known as the Information Society, took place in 1969, with Neil Armstrong's landing on the moon.

A great deal of technological and scientific developments and discoveries came about. Among others, we find the use of renewable energies as well as innovations in the means of energy storage processes and the development of the smart grid. (Sectorial, 2019)

The Fourth Industrial Revolution began at the beginning of the 21st century. Industry 4.0 is mainly based on the introduction of digital technologies into all the industrial production processes. (Maximo, 2021)

Networking of all systems makes factories smart. In these, the components, the production systems and the people communicate through a network, so that production becomes practically autonomous.

Figure 1: Evolution of the Industrial Revolutions



Source: Marchena (2020)

2. DEFINITION OF INDUSTRY 4.0

The term Industry 4.0 was first used at the Hannover Fair in Germany in 2011 to describe the smart factory. This term refers to the implementation of digital enabling technologies in the industry sector. As I have mentioned before, all the processes are interconnected and this is made possible thanks to the Internet of Things. (Tapia, 2014)

Machines are increasingly relevant and connectivity becomes essential. The fusion of the factory with the Internet is produced by the use of digital technologies. In this way,

maximum performance is achieved while reducing the presence of the worker as regards the supervision of the processes.

The goal to be achieved when introducing enabling technologies is to make systems and devices collaborate with each other so that products, processes and business models can be modified quickly and respond immediately to any changes occurring in the market. (EDS Robotics, 2020)

In order to do this, integrated industrial automation systems are available, with sensors and wireless communication capabilities which allow the gathering of the maximum number of data possible between its processes. For this reason, in order to analyse all this information, the biggest challenge lies in the software industry, which will make the consolidation of this revolution possible.

Industry 4.0 is not based solely on introducing technologies in the administrative or productive system. It also initiates a change in the way organisations are guided, promoting innovation and the need to increase and share the flow of information throughout the company. (Deloitte, 2022)

Among other things, this term includes robotics, automation, analytics, the Internet Cloud Big data (Internet of Things), artificial intelligence, nanotechnology, Customer Relationship Management (CRM), etc.

2.1. Advantages of Industry 4.0

Some of the advantages that Industry 4.0 can bring to companies are the following ones: (APD, 2021)

- Improvement of productivity and quality

The processes carried out in the organisations are optimised. In this way, the time and resources used to achieve them are reduced. In addition, failures occurring in the production phase can be eliminated.

- Greater safety in work processes

Employee safety is increased by introducing robots or machines into hazardous work environments.

- Reduction of production time

Due to the improvement in productivity, better processes, without alterations or errors, are achieved. Moreover, production is available round the clock.

- Decision-making aid

The organisations have a large amount of information at their disposal and, when they treat and classify it correctly, it improves the decision-making process.

- Business competitiveness increase

Products that meet high quality standards are developed. In addition, they also better meet the needs of different consumers.

2.2. Risks of Industry 4.0

Some of the risks that Industry 4.0 can bring to companies are the following ones: (APD, 2021)

- Talent shortage

In several sectors and countries, there is no qualified workforce necessary to be able to apply new technologies efficiently.

- Technological dependency

Industry 4.0 presents a great technological dependency due to its machinery. For this reason, new specific needs, which must be identified and solved, must be developed.

- Social inequalities

Industrial advances may increase inequality and lead to social fragmentation in several parts of the world.

- Higher investment cost

The cost of implementation is, at first, high and not everyone can afford it. In any case, the ROI must be taken into account since it is easily recovered in the long term.

- Speed of changes

Both the speed of development and the updating of the solutions provided to the problems can make several companies outdated.

3. TECHNIQUES USED FOR DIGITAL TRANSFORMATION PROJECTS

Today, a large number of industrial companies continue to progress towards their digital transformation, encouraged by the impact of Industry 4.0, in order to continue to gain competitiveness and remain positioned in the markets.

In order to achieve this transformation, organisations must choose the best option offered by enabling technologies. Before doing so, it is necessary to carry out an analysis of each of their processes from a Lean Manufacturing perspective in order to simplify and optimise them. In this way, it will be easier to identify the most effective technological solutions for the company. (Acero, 2019)

3.1. Lean Manufacturing

Over several decades, industry has made use of various Lean Manufacturing tools and principles in order to improve business productivity and simplify the complexity of operations. The Lean approach has been conceived as the basis for achieving operational excellence through its ability to instil a culture of continuous improvement, standardise processes and empower all members of the organisation. (Acero, 2019)

In other words, it is a people-centred management model that aims to optimise and improve production systems by identifying and eliminating any inefficiencies. Inefficiency refers to those processes or activities that use more resources than they actually need.

The working philosophy of this management model is based on the production system of Toyota, a Japanese car manufacturer. In order to operate at minimum cost and with a low error rate, this methodology focuses on production processes that do not increase the value of the final product and on aspects that do not meet customer requirements, in order to improve costs, quality, times and deadlines. (Pérez, 2019)

As mentioned above, companies using Lean techniques can build an integrated management and production system based on optimising processes, eliminating waste and analysing the value chain to achieve a stable production flow in terms of time, quantity and quality.

Furthermore, as ecosystems and the value chain change very fast, organisations need systems that can be more flexible and have the ability to integrate with suppliers, customers and other actors that make up the value chain. (Acero, 2019)

The two basic pillars on which this production system is based are the search for perfection and Just in Time production. The automation of processes that are carried out manually becomes one of the systems improving the quality of the products, as well as the introduction of quality inspections. The mission of these inspections is to find the defects or faults that the products might have in order to remove them from the chain so that they do not continue to waste resources. (Pérez, 2019)

A large number of companies that start projects in order to incorporate the various Lean concepts fail in the attempt. Therefore, it is necessary to adapt this methodology to the needs of the organisation.

After a thorough analysis, the Lean methodology is based on the following factors and techniques: (Pérez, 2019)

- Top Management Commitment

In order to implement the concepts instilled by this methodology, however simple they may be, a strong commitment from top management is needed, making them the initiators of change. Otherwise, change would not be sustained over time.

- Feedback

Both service or product performance and customer feedback need to be communicated upstream in the supply chain, i.e. from the end customer to the beginning of the manufacturing process so that the information can be put to much more effective use.

- Just-in-Time

Only the quantity desired by the customer will be produced and delivered when and where the customer wants it. In the same way, agreements with the different suppliers will be reached so that the raw materials that the company needs to produce are also supplied under the same conditions.

The main objective is to store as few goods as possible.

- Supplier Development

The strategies of suppliers and those of producers belonging to the same supply chain must be aligned in order to avoid misalignment or inconsistencies.

- Involving Customers

In this case, customers become the agents running the business. For this reason, their requirements and needs must be taken into account in the design and development of the products.

- Pull Production

Production starts with incoming orders and these ones are responsible for establishing the production flow.

- Continuous Flow

It consists of an optimised product flow within the plant for each product, thus avoiding large product transits.

- Reduction of Downtime

The time it takes for the set of machines to adapt to the different products must be reduced to a minimum. Tooling changes have to be made.

- Preventive Maintenance

Any faults in the machinery must be eliminated by effective and regular maintenance. In the event of a failure, downtime should be kept to a minimum.

- Statistical Process Control

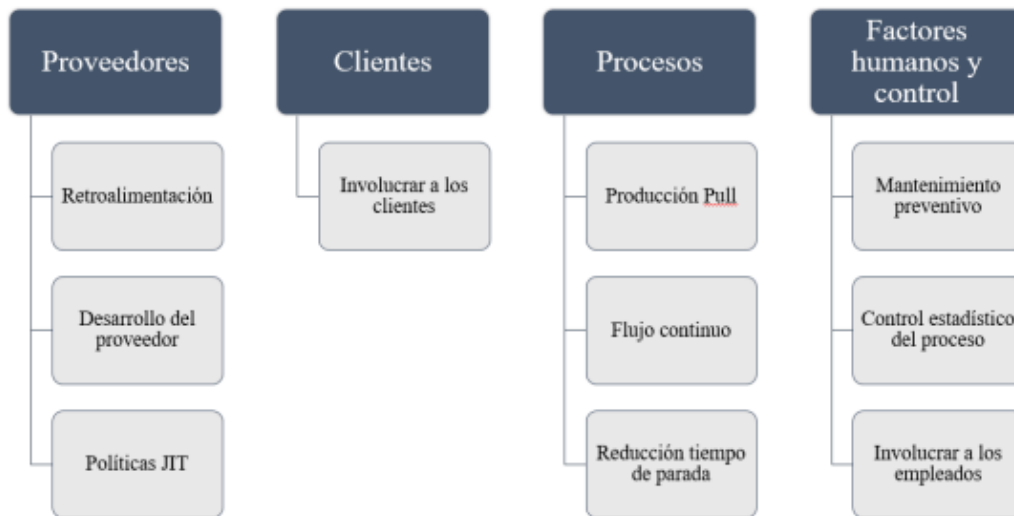
An essential factor is the quality of all products and, for this to be satisfactory, a zero-defect culture must be instilled and, in addition, care must be taken to ensure that errors do not spread down the production line.

- Employee Involvement

Through good training and motivation, the organisation's employees have to be able to take on the various challenges that may arise. As they are the most important actors in the production chain, their correct alignment with the company's strategy is essential.

The principles explained above can be classified into four groups depending on the actors involved.

Figure 2: Lean Manufacturing Dimensions



Source: Pérez (2019)

In short, Lean Manufacturing can be described as a management and organisational model of the manufacturing system that seeks to improve service, quality and efficiency, constantly eliminating all waste.

Lean Manufacturing detects eight inefficiencies in the production line or in the way they are managed, and the main objective of this methodology is to eliminate or reduce them. (Pérez, 2019)

- Overproduction: This is a greater production than the subsequent processes need or the end customer demands.
- Excess inventory: It consists of all the inventory exceeding what is actually needed to supply customer demand, whether they are raw materials, products in progress or finished products.
- Unnecessary movements of materials: When planned incorrectly, unnecessary movements of products are carried out through the plant.
- Worker's waiting time: This refers to the waiting time of workers when they are not carrying out any productive activity.
- Non-value-adding worker's movements: Set of movements made by workers that do not alter the properties of the product or its shape.
- Defects: These involve the wastage of human efforts and raw materials.

- Over-processing or incorrect processes: It takes place when new properties are added to the product and the customer neither takes them into account nor values them. A bad process or product design can lead to this problem.
- Knowledge waste: This is one of the most frequent and most relevant shortcomings. It occurs when employees are given the opportunity to contribute their experience and skills in order to solve problems or improve processes.

3.2. Industry 4.0

Due to increasing ecosystem and market complexity, companies realise that using Lean techniques alone is not enough to solve the operational challenges they face. This is when a set of enabling technologies, known as Industry 4.0, which present new approaches to deal with this complexity, start to gain prominence. The demonstration of these technologies is used to increase efficiency, speed and coordination. (Acero, 2019)

Enabling technologies are responsible for boosting productivity improvement, having a strong impact on certain aspects such as, among others, reducing time or increasing productivity. Even so, they should not be considered magical elements that solve all the problems that an organisation has when they are implemented, as they are only tools.

With these technological capabilities, many of the industrial production processes can be automated or even a new machine capable of producing many more products than the previous one can be installed. However, if the product has a lower sales trend or the task carried out by this equipment has no value for the customer, the supposed improvement will not influence the organisation's profits. If this happens, the investment that has been made will be for nothing and the expected improvement could end up becoming a detriment, increasing, for example, storage costs, leading to a number of other problems such as the risk of obsolescence.

After having carried out a thorough analysis, it has been considered that there are ten Industry 4.0 technological tools, as nine appear in all the bibliographical references, but there is always one that is not taken into consideration. (Pérez, 2019)

What is most relevant is not the technological tools themselves, but the use to which they are put.

- Simulation

Simulation is the creation of virtual environments to be able to adjust and represent the joint operation of people, processes and machines in real time before they are put into operation in order to save time, avoid breakdowns and evaluate what the final result is in an environment in which everything is controlled. This reduces the costs associated with learning processes by performing a virtual representation. (Solid, 2018)

- Internet of Things

The Internet of Things makes it possible for multi-directional communication to form between people, machines and products, providing opportunities for optimisation and making it easier to make individualised decisions in real time throughout the production process based on the information the technology stores from its environment. (Solid, 2018). New sensors combined with cloud computing and Big Data analytics provide intelligent systems and autonomous machines.

The Internet of Things is a must-have technology for the manufacturing industry to move towards the development of smart products, create a closer link with end-consumers and collect information related to the use and performance of products, even when customers already own them. (Basco et al., 2018)

- Big Data

A set of data characterised by its speed, volume and variety, which is analysed and managed through advanced algorithms quickly, appropriately and in a short time, in order to be able to make decisions in real time, allowing better process and product quality standards to be achieved and also facilitating access to new markets.

Among other things, it also ensures that various industrial processes are perfected, new growth opportunities are created, times and costs are reduced, products are developed and services are optimised. (Solid, 2018)

These can be recorded by cameras, machines and equipment, microphones, production software, sensors, microphones and they can come from different sources such as customers, social networks or suppliers.

It is one of the most demanded technologies in the industry at a corporate level.

- Cybersecurity

The ongoing evolution towards smart industry and the integration of value chain actors through digital platforms, the Internet and the cloud, is forcing the development of cybersecurity mechanisms in the industry.

Cybersecurity becomes an essential pillar to protect every process and to shield access to anyone outside the organisation. (Solid, 2018)

- Integration

Integration increases the need, both externally and internally, to manage systems that are integrated in order to have an exclusive platform for workers to access. The systems are independent, but they are connected to automate tasks and ensure end-to-end management of the user experience. (Solid, 2018)

It consists of connecting machines with machines and, in this way, the various areas that make up the production unit are integrated, producing an impact on the internal management of the organisation. Furthermore, through digital platforms, a link is created between the organisation and the other factors that make up the value chain, such as suppliers and customers, among others.

- Robots

Robots are intelligent machines that have automated tasks that were previously limited to the human domain. The aim is to increase collaborative robotics in order to move towards smart factories in which all areas of the factory work in a connected way and with a high degree of task automation. (Basco et al., 2018)

- Augmented reality

Augmented reality has different services and uses in several branches but, applied to Industry 4.0, it consists of systems that combine modelling, simulation and virtualisation and that allow new formulas for designing products and organising processes, providing greater speed and flexibility in the production chain. These systems have a wide variety of applications such as sending instructions for repairing defects via mobile devices, capturing human resources in virtual environments or selecting parts in a warehouse. (Solid, 2018)

So far, this area has not been fully developed, but it is expected to grow as smart devices become more widely used.

- Additive Manufacturing

It makes it possible to manufacture parts by superimposing layers of different materials by taking a previous design as a reference, directly from a virtual model. It decentralises the design and development stages of products in order to introduce a larger component of services and software. 3D printing has great advantages for the reproduction of objects and parts that are difficult to manufacture due, among other causes, to the complexity and specificity of their design.

In short, additive manufacturing is used to make prototypes and produce individual and specific components in short series or small batches, without the need for tools or moulds of any kind. (Solid, 2018)

- Cyber-physical systems

Cyber-physical systems constitute a new generation of Information and Communication Technologies characterised by the link between embedded processing systems and physical processes.

These systems are similar to the basic architecture of the Internet of Things, but they have greater coordination and linkage between the processing elements and the physical elements.

They are usually connected to each other and then to the virtual world of the global digital network. The main characteristics of these systems are the ability to interact with physical objects and to use the information available in the virtual world to evolve and learn.

- Cloud

The Cloud is responsible for providing access, storage and use of online information services. It can be expressed in three different levels depending on the service, platform as a service; infrastructure as a service; and software as a service. (Landa, 2021)

This technology makes it possible for organisations to flexibly access computing resources with low administrative effort and from different devices, offering scalability, agility and interoperability. A large number of applications that previously required software to be installed on an on-premise server are now run remotely. (Basco et al., 2018)

Figure 3: Industry 4.0 new technologies



Source: Conciencia Eco (2017)

3.3. Synergies and Misalignments between Lean Manufacturing and Industry 4.0

Next, the misalignments and synergies that exist between Lean Manufacturing and Industry 4.0 will be explained, as well as the benefits generated by implementing the both concepts in order to achieve the goal of operational excellence. This is how the concept of Lean Digital is born. (Pérez, 2019)

3.3.1. Misalignments

Several investigations carried out by Piszczalski (2000) or Rüttimann et al. (2016), deal, at a theoretical level, with various incompatibilities that may occur when implementing Lean principles and enabling technologies in the industry sector.

- Decrease in information available to workers on the shop floor

The Lean Manufacturing management model allows staff to visualise information related to their tasks, thus boosting motivation and participation of workers in continuous improvement.

On the contrary, through digitisation, data is collected on the shop floor using wireless devices, centralising decision-making and management. Furthermore, this data is processed and analysed by digital means.

- Distancing of managers from the production plant

Relating to what was mentioned in the previous point, the centralisation of decision-making and the processing and analysis of information by digital means makes management easier, but it can cause managers to distance themselves.

In Lean Manufacturing, it is essential to observe problems first hand, since visualising how the plant operates can make it easier to spot and resolve faults.

- Lack of commitment to change

The main objective is to implement a work methodology that can be optimised and sustained over time. In order to achieve this, the commitment of the managers is essential, as they are the points of reference for all the company's employees.

The best way to incentivise them is for them to see the commitment their managers have to change, but, conversely, visualising results through digital analytics or graphs can incite the opposite.

- Implementation of unnecessary functionalities

Adding new functionalities to existing ones is a common mistake when trying to implement a process towards Industry 4.0. These are not necessary because they cause delays in the project, in addition to increasing costs.

The basis of the Lean philosophy, on the other hand, relies upon eliminating all aspects that do not add value.

In short, Lean Manufacturing encourages collaboration and workers to feel that they are involved in decision making and process improvement and, in contrast, enabling technologies to guide plant management towards centralisation.

3.3.2. Synergies

Several studies have analysed the synergies between Lean Manufacturing and Industry 4.0.

Küpper et al. (2017) analyse the benefits that industrial companies gain when they incorporate projects based on Lean Industry 4.0.

The main benefits focus on five aspects of the production lines: speed, safety, flexibility, quality and productivity.

Ruiz et al. (2018) focus their study on the digitisation of Lean industrial environments, obtaining this conclusion: "Enabling technologies act as mitigators of barriers to the implementation of Lean Manufacturing methodology".

Buer et al. (2018) provide an analysis of the different views collected in the literature on both concepts and the way in which their interrelationship has been studied.

Finally, Prinz et al. (2018), after thoroughly reviewing the literature regarding both concepts, conclude by stating that a digitisation process can only be successfully implemented if the organisation's production processes have been optimised according to Lean thinking.

These four studies affirm and explain that there is a connection between Lean Manufacturing and Industry 4.0. Furthermore, they state the need for a methodology which implements solutions in an integrated way.

3.4. Interaction between Lean Manufacturing and Industry 4.0

This interaction will be explained in terms of how Industry 4.0 enabling technologies drive and support the initiatives developed in the Lean Manufacturing philosophy. These principles are organised according to the study Shah et al. (2007).

- **Suppliers**

In order to be able to form a Lean and continuous improvement ecosystem, it is essential that the actors involved in the supply chain of a product follow the same path.

There are three relevant points in the relationship between the manufacturer and the supplier:

- **Information feedback**

An important factor in reducing the amount of waste is the transmission of information. If the data related to the supply of the product is known, production can be adapted or, on the contrary, the necessary contingency actions can be taken.

Some enabling technologies make this communication possible, cloud systems that observe and share a large volume of information in real time.

- **Supplier development**

Lean philosophy asserts that any benefit gained from any improvement made at the operational level of any organisation involved in the business will accrue to the entire supply chain. For this reason, it encourages companies to collaborate with each other and to share their experience and knowledge.

- **Just-in-Time Policies**

The main objective is to achieve zero inventory and for this, it is necessary to collaborate with the supplying companies by reaching supply agreements in which the time of arrival and the exact units are established in order to store as little as possible.

Today, there is stock and order management software that coordinates these operations autonomously and can also be linked to the supplier's operations planning software.

Another way to manage deliveries is to outsource warehousing to the supply organisation or logistics operator. Information needs to be transmitted in real time and on a constant basis in order to guarantee deliveries.

- Customers

In addition to changing relationships with suppliers, Lean Digital also modifies communication with customers.

- **Involving customers**

After introducing devices that can parametrize the way the equipment works and transfer that information, new avenues of business are created in which selling the product is as important as the subsequent collection of information on how the product works.

After-sales information enables the creation of a new service, which allows to offer the customer machine maintenance through the collection of operating parameters and advanced analytics algorithms. This implies two major benefits, a competitive advantage for the organisation providing it and increased customer satisfaction and loyalty. Among other things, collecting all this information helps to redesign the product based on the problems detected.

Moreover, with the use of collaborative platforms it is possible to know the degree of customer satisfaction and the product can be designed taking into account market demands, avoiding features that do not have an added value.

- Processes

Optimising the flow of products and work and increasing production flexibility by reducing the time needed to perform non-value-added tasks are some of the advantages generated after implementing Lean. Moreover, these are intensified with the introduction of digitalisation.

- **Pull Production**

Pull production consists of producing only when there is demand and just the quantity that is being ordered, thus avoiding wastage such as storage or overproduction. The technique introduced by Lean is called Kanban, which distinguishes the products placed on a workstation through this card, which are moved from workstation to workstation.

In addition, thanks to technology, Kanban cards have become digital and bring several advantages. The flow of information is much easier and orders are created in an automated and optimal way.

- **Continuous flow and reduced downtime**

Both pull production and Just In Time policies are related to the production flow. In addition, both manufacturing models make use of level production.

The Internet of Things and RFID identification systems are two technologies that, when combined, can autonomously route products through the manufacturing line, thereby reducing waiting times, balancing production and boosting continuous flow.

- Human factors and control

The human and control factor refers to keeping track of the prevention of stoppages and failures and quality control on production lines that lead to non-compliance in the planning phase.

- **Preventive maintenance, statistical monitoring**

Once the enabling technologies have been introduced, the equipment is ready to monitor operating parameters by incorporating advanced analytics algorithms. The machines keep track of the status of their components and, in

this way, the parts that make them up can complete their life cycle and avoid unexpected breakages.

The Lean philosophy speaks of preventive maintenance whereas, with new developments, it is possible to carry out predictive maintenance which optimises the use of resources and reduces costs.

- **Involving employees**

In the Lean methodology, the role of the employees is of great importance as they are responsible for the proper maintenance of all machines, thus reducing production downtime.

In addition, they are offered all the necessary tools so that an adequate quality control of the products as a whole can be performed. This control must be carried out on each of the production processes, trying to conduct general reviews. In this way, if these are carried out in each of the work stations, there is no waste of resources or time, reducing the number of products rejected by customers and increasing customer satisfaction. With this system, apart from effecting an inspection and eliminating defective products, the cause of the fault must be detected so that the problem can be solved immediately.

Industry favours both of these actions. An example of an enabling technology that detects faults quickly and visualises operations in real time is augmented reality.

Industries that wish to achieve operational excellence characterised by automated, flexible and predictive production must initiate an interaction between the different technologies that make up Industry 4.0 and Lean Management. In this way, the joint improvement potential is greater than the sum of the improvements achieved by the approaches independently.

In addition, several studies have shown that organisations that use both options in an integrated manner can reduce conversion costs by up to 40% in five to ten years. In short, both theories have been created to complement each other in order to improve production processes. (Acero, 2019)

4. DEGREE OF MATURITY OF THE DIGITAL TRANSFORMATION IN SPAIN

Digital technologies are changing the world and the organisations need to adopt them and evolve in order to continue surviving in the future.

INCIPY, a consultancy specialised in the Digital Transformation of organisations, and Inesdi, a business school specialised in Digital Innovation, carried out the fourth study of the Digital Maturity Index of companies, 2020-2021, in Spain.

The main objective of this study was to find out the degree of digital maturity of the organisations and see how their stages evolve over time. In order to do this, they analysed twelve indicators related to the four key vectors of digital transformation: strategy and organisation, customers or customer centric, digital business and people. Among other aspects, this includes the customer experience, the digital roadmap and the training and digital knowledge. (INCIPY, 2021)

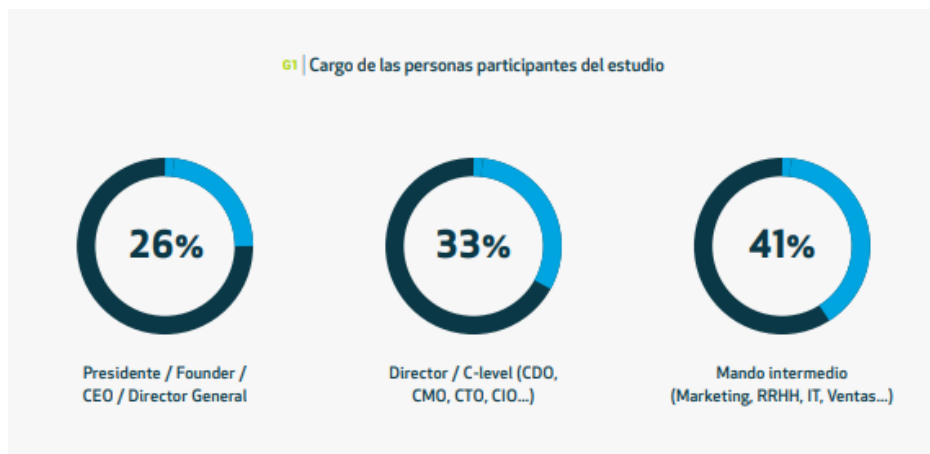
Figure 4: The 12 key indicators of digital transformation



Fuente: INCIPY (2021)

Its preparation included interviews with one hundred and fifty managers from various fields, with medium-high responsibility in organisations of different sizes and sectors that operate in our country. To be more exact, 26% of those surveyed were presidents, 33% were directors, and the remaining 41% were middle managers. (INCIPY, 2021)

Figure 5: Position of study participants



Source: INCIPY (2021)

The results obtained on the basis of the four vectors were as follows.

4.1. Strategy and organisation

- Transformational Leadership

The key indicator was the leadership of Digital Transformation, as it was the most highly rated for the Spanish organisations. There was a significant reduction in companies that did not have any transformational leadership (30% in 2019 and 13% in 2021).

This meant a relevant advance for Digital Transformation, an essential support so that work teams could develop and deploy different projects related to strategy.

In addition, it should be mentioned that 8% of the organisations surveyed did not have a Digital Transformation plan within their reach. However, 69% of the companies supported it with senior leadership and with several digital leaders in key positions. (INCIPY, 2021)

Figure 6: Transformational Leadership



Source: INCIPY (2021)

- Digital roadmap

The roadmap serves to indicate the path to follow in terms of projects, resources and prioritisation. It is also essential to achieve the Digital Transformation objectives.

74% of companies confirmed that they had to speed up their roadmap due to the crisis caused by Covid-19. Even so, the organisations' awareness of the need to establish a roadmap decreased and the number of companies that do not have one increased, reaching 19%. (INCIPY, 2021)

- Agile Organisation

In order to accelerate the Digital Transformation processes and improve the level of engagement of teams and people, so that companies can quickly deliver value and improve in a competitive market, they must carry out a process of change towards a digital culture.

29% of the organisations implemented innovative and agile methodologies in some of their projects, which made it easier to adapt to new business models. (INCIPY, 2021)

- Allocated budget

In 2021, the budget aimed at both actions and technology geared towards Digital Transformation was strongly affected due to the crisis caused by Covid-19.

Although 45% of the organisations allocated less than 10% of their budgets to this transformation, 62% of them stated that they had increased it due to the impact of the pandemic. (INCIPY, 2021)

4.2. Customer Centric

In spite of its having been described as the least important vector, it is an indicator that is evolving in order to control the transformation of organisations.

- Digital solutions for products and services

A very important factor for Digital Transformation is the ability to adapt company products and services to a new form of digital consumption.

The importance of using customer knowledge to be able to develop both digital products and services increased from 14% to 21%. Even so, there are still many companies that use customer knowledge solely to improve their experience or personalise their value proposition. (INCIPY, 2021)

- Customer experience

Any Customer Experience strategy has a Voice of the Customer program as its main factor.

Incorporating technologies able to manage the customer experience brought about improvements, although only 38% of users made use of CRM to manage relationships with all customers.

In addition, they made little use of such tools as web analytics, customer intelligence and social media. (INCIPY, 2021)

- Strategy and CRM

Due to the increase in the use of new technologies, standing out from other companies in order to gain customer loyalty is getting increasingly difficult. This is when having a CRM strategy becomes more and more complicated.

87% of the means of contact used by customers were the web, chats, emails and social networks. If they integrated them, companies that did not have a CRM strategy would have a great opportunity, since they would have a 360° view of customers through the data obtained from interactions with the organisation. (INCIPY, 2021)

4.3. Digital Business

Digital Transformation has had an impact on the business model that the organisation has decided to adopt, either due to the use of new technologies that are changing the market or due to the ability of business intelligence to improve business decisions.

- Business Intelligence

Both business intelligence and data have an impact on business models, since they allow competitive advantages to be obtained through the collection and analysis of data.

The use of data was no longer focused solely on the Commercial and Marketing areas. Even so, it was necessary for Spanish organisations to gradually incorporate Big Data into the rest of their departments so that their digital business could grow up. (INCIPY, 2021)

- Digital Business Innovation

The business must be constantly reviewed to be aware of changes that may occur in the development of technologies that increase the value proposition of the company as well as in customers.

31% of Spanish organisations used collaborative platforms due to the situation caused by the pandemic. 61% of the companies stated that they had carried out an innovation in business models due to its impact. (INCIPY, 2021)

4.4. People

The heart of an organisation is its people, and the various changes that digital transformations need require leadership capable of launching a new way of working, communicating and collaborating.

- Digital Workplace and Internal Communication

Digital impact is changing internal communication in companies. Knowledge can be accessed more easily and networking is becoming more collaborative.

It is essential to streamline internal digital communication and to link the change with new, more bidirectional and interactive digital channels.

65% of the organisations used digital tools to be able to work in networks and groups, and 57% claimed that they were implementing new telework and flexibility policies that would be maintained after Covid-19. (INCIPY, 2021)

- Digital Employer Branding

Covid-19 has changed how to attract new talent and how to engage internal talent. There are new employer branding strategies and formulas that adapt to a new employee, who interacts in digital environments.

26% of the organisations took advantage of the potential of digital fields to attract talent; 9% had already adapted their employment websites; and 4% used the role of workers as brand ambassadors. (INCIPY, 2021)

- Training and Digital Knowledge

Companies will not be able to be competitive if they lack digital talent since, today, it is essential to incorporate it through the development of digital knowledge and skills. Only 32% of companies offered training programs to their employees. (INCIPY, 2021)

As a final conclusion, the organisations that carry out their operations in Spain passed in Digital Maturity, reaching 5.7 points out of 10 in 2021. Year after year, this index has been growing steadily, with a clear advance in 2020, providing an improvement in the four existing stages of digital maturity: Basic, Initial, Strategic and Innovative-Disruptive. (INCIPY, 2021)

This has been possible thanks to the drive for transformational leadership, which is committed to accelerating digitization even in a pandemic environment. 74% of companies sped up their roadmap and 62% decided to increase their budget for Digital Transformation projects and technology due to the Covid-19 crisis. (INCIPY, 2021)

In addition, it was possible to observe how Spanish organisations accelerated both the definition and the implementation of their Digital Transformation strategies for 2021 due to the impact generated by the Covid-19 pandemic.

Despite all of the above, only 15% of Spanish organisations have already implemented a Digital Transformation plan, and 38% were developing plans to become an agile organisation. For these reasons, companies in our country are still far from being able to develop disruptive business models. (INCIPY, 2021)

5. PHASES OF THE DIGITAL TRANSFORMATION OF INDUSTRIAL COMPANIES

Organisations have to reinvent themselves in order to respond to the various challenges presented by an environment characterised by the digital economy.

A digital company is a company that has a long-term strategic vision, is customer-centric and uses technology and data to continuously innovate. (García, 2022)

Digital transformation is a business cultural change that takes place through technology. Therefore, first of all, the company's vision must be based on a new digital culture that is known to all members of the organisation.

In addition, this transformation will entail the automation of processes, reducing costs, human errors and time. Digitization will also make it possible to obtain information on the processes, thus improving decision-making.

There are several steps that, in spite of the fact that digitization is unique for each organisation, should be taken into account to begin this transformation:

- Determining what “digital transformation” means for the company

This is necessary because there is no universal definition of digital transformation. To do this, it is essential to take into account the different variables that can influence the business, such as, among others, the level of digital maturity, customers and competition.

In this way, in addition to knowing its meaning, we will know why it is necessary and what it is trying to achieve. (Redacción, 2021)

- Assessing its current capabilities

In order to do this, everything that is being used must be examined, such as technology and even employees, to see how the organisation operates today.

Companies that do not take this step into account are either under- or over-transformed. (Redacción, 2021)

- Setting how it will go digital

Once the objective and capabilities have been established, the different existing digital transformation alternatives will be evaluated.

The strategy chosen can be a simple change, or, on the contrary, a combination of internal and external transformations. The only thing to bear in mind is that this strategy must bring value to the company and its customers. (Redacción, 2021)

- Getting the right participation

In order for the project to be carried out and work, once the digital strategy has been thought out, the executives must accept it.

Although at first glance it may seem like a simple step, acceptance can take time. For this reason, it is advisable that, once a solid project is devised, it should be implemented as soon as possible. (Redacción, 2021)

- Creating a roadmap

With the right strategy and executive buy-in in place, the transformation plan needs to be analysed in a practical way and an efficient roadmap developed.

As not everything should be changed at once, it is essential to create a roadmap to clearly determine the time when each thing will happen. (Redacción, 2021)

- Ensuring the availability of suitable skills

The organisations must have the right expertise and skills to be able to drive their digital transformations. The fact of not having them leads to failure and generates negative income. (Redacción, 2021)

- Preparing the whole business

It is just as important and essential to create the strategy as it is to communicate the company's vision and plan.

Without good communication, the organisation will certainly not obtain the desired acceptance from its employees. Transparency among the members of the company is necessary, as well as providing them with adequate training and showing them a clear structure. (Redacción, 2021)

- Starting up digital transformation

When all of the above steps have been taken, the company can now carry out its plan and have a successful digital transformation. (Redacción, 2021)

In the following paragraphs, the five most important dimensions according to Lean Digital Industry 4.0 will be explained.

- Business and Market Strategy

This refers to the definition of the internal culture of the organisation and its way of facing the new challenges. To this end, the degree of motivation of all members of the company in order to be able to face this transformation process is identified.

In addition, there is an assessment of the way they relate to other agents who are also involved in this process, and of their knowledge of Lean principles and Industry 4.0. (Pérez, 2019)

- Processes and Operations

This area is in charge of carrying out an evaluation of the industrial company's production system. The study focuses on existing flexibility, optimisation, management and control measures.

Moreover, this dimension has a strong link with Lean principles because it highlights the adoption of aspects such as, among others, continuous flow, value chain or task assessment. (Pérez, 2019)

- Products and Services

Nowadays, a very relevant factor for industrial organisations is to succeed in producing an innovative or differentiated product which provides a differential value to the customer. This area is in charge of checking that the organisation adapts to this new trend.

To this end, it assesses its capacity to manufacture innovative products, as well as the importance of design and quality in each of the products. These aspects mentioned above refer to Industry 4.0, but Lean principles are also taken into account. An example would be to carry out a study of the way in which a product is adapted to the customer's demands, trying to avoid wastage. (Pérez, 2019)

- Human Factor

This area focuses on the workforce, one of the most relevant aspects of any organisation. As has already been mentioned several times, in the Lean methodology, the organisation's employees are considered essential to the success of the transformation.

In order to evaluate this dimension, the study focuses on several aspects such as collaboration and participation among the organisation's employees, degree

of authority when carrying out different actions, optimization of tasks and jobs and training of employees in Lean concepts and digital skills. (Pérez, 2019)

- Marketing and Customer Relationship

The last area focuses on the marketing phase and on collaboration and communication channels with customers. This dimension is closer to an Industry 4.0 approach, but it also affects Lean aspects. The more information there is, the more accurately production can be brought closer to the actual demand, affecting storage. (Pérez, 2019)

Having explained the five most important dimensions according to Lean Digital Industry 4, there are four different levels of companies, depending on their degree of digital maturity.

1) LAGGING

- Business and Market Strategy

The organisation knows how important it is to carry out changes in the production process in order to guarantee its sustainability. Although it is aware of the concept of Lean Manufacturing and Industry 4.0, it does not use this knowledge in the organisation.

The organisational structure it shows is basic because it does not set out the responsibilities necessary to be able to undertake a transformation process. (Pérez, 2019)

- Processes and Operations

Very few production processes are automated; the tasks performed by employees are not standardised; the data set is mostly collected manually; and no software is used to control production. (Pérez, 2019)

- Products and Services

No new functionalities are introduced in the services or products offered through digital media. The services associated with the products, as well as a protocol to motivate innovation actions, are non-existent. (Pérez, 2019)

- Human Factor

The staff do not have sufficient digital skills to be able to develop in a digital environment and the organisation does not have the necessary mechanisms to

enable workers to participate in the improvement of production processes. (Pérez, 2019)

- Marketing and Customer Relationship

The channels used by the company to communicate with its customers are the traditional ones and the relationship it maintains with them is solely commercial. Furthermore, no studies are carried out to predict how the market will behave or how satisfied customers will be with the product they receive. (Pérez, 2019)

In short, these organisations carry out some digital initiatives in a scattered and independent way. (INCIPY, 2021)

2) COMPETITIVE

- Business and Market Strategy

The organisation's strategy shows, informally, the need to transform the way it operates, but it does not include a budget line. Investment is made to improve the workers' performance and there is a department in charge of improving this aspect. (Pérez, 2019)

- Processes and Operations

The plant has several automated processes, but there is no connection between them. Production data are collected manually and then inserted into a software application, which will carry out a basic analysis.

In addition, the maintenance that is carried out is preventive and corrective, which means that information on the problems detected and the response given is not collected. (Pérez, 2019)

- Products and Services

The organisation is aware of the advantages of introducing digital devices in its products. Innovation actions are initiated even if there is no protocol for action. (Pérez, 2019)

- Human Factor

A large part of the employees do not have sufficient digital skills to be able to develop in a digital environment, but the organisation actively encourages staff training.

In addition, several workplace suitability studies have been carried out and various mechanisms are in place to encourage employee participation. (Pérez, 2019)

- Marketing and Customer Relationship

The channels used by the company to communicate with customers are limited. Estimates are made of how the market is likely to behave, taking into account the results of past years.

Surveys are also conducted in order to measure the degree of customer satisfaction with the product received. (Pérez, 2019)

In short, companies have already started to implement some digital plans in certain areas of the organisation, but they have not done so in an integrated or managed way. (INCIPY, 2021)

3) **ADVANCED**

- Business and Market Strategy

Although not formalised, the digital transformation process is included in the organisation's strategic plan. Moreover, the organisation is aware of the benefits of using Lean Manufacturing principles and has initiated and accelerated their implementation.

There is a specific budget to develop several actions in order to improve operational excellence and a person in charge of coordinating these actions. (Pérez, 2019)

- Processes and Operations

At least 70% of production processes are automated and devices enabling connectivity between processes have been introduced.

Preventive maintenance is carried out, incorporating a protocol to analyse the reasons for errors and solve the problems inherent in the production system. (Pérez, 2019)

- Products and Services

The organisation has increased the functionalities of the various products it offers after introducing digital devices. It has also expanded the catalogue of services associated with the products.

Innovation is an essential element for the business and the actions that give rise to it have been systematised. (Pérez, 2019)

- Human Factor

A large part of the company's workforce does not have sufficient digital skills to be able to develop in a digital environment, but the organisation actively promotes its training.

In addition, the suitability of the workplace has been studied and there are mechanisms in place to provide incentives to staff when they participate. (Pérez, 2019)

- Marketing and Customer Relationship

Communication channels with customers continue to exist, with the prevailing use of digital media. The relationship between the producer and the customer is not only based on a commercial relationship, but goes beyond this, taking into account the customer's suggestions when designing products.

Customers provide information on product usage and consumption, and this is analysed in order to make predictions about future product behaviour. (Pérez, 2019)

In short, organisations implement the Digital Transformation Plan in an integrated Customer Centric oriented manner. (INCIPY, 2021)

4) LEADER

- Business and Market Strategy

The business model is focused on delivering value to the customer and the organisation's corporate culture is oriented towards continuous improvement, collaboration and non-resistance to change. The organisation has defined a digitalisation strategy with a budget specifically allocated, based on Lean principles to achieve a higher level of performance.

These actions are reviewed once a year using various indicators and, in addition, specific roles related to transformation have been established. (Pérez, 2019)

- Processes and Operations

The combination of Lean principles and technological enablers in the manufacturing process results in agility, flexibility, production runs and short lead times. 90% of the production processes are automated, and the equipment is networked transferring information.

Maintenance is preventively and systematically carried out, but for the most important equipment a predictive system is used. For this, unplanned errors are analysed in order to find their origin. (Pérez, 2019)

- Products and Services

The process of innovation in services and products is carried out collaboratively with several external entities. This results in lower costs and shorter development times, and the innovations generated are disruptive.

Products that have new functionalities, which are related to the digital world or smart products, are shown. As a consequence, services related to the information collected and that produce new revenue streams have been formed. (Pérez, 2019)

- Human Factor

Employees are well trained, both in digital skills and Lean techniques, but the company is constantly updating their knowledge.

Tools are available to collect workers' initiatives, assess them and, finally, apply the solution that best suits the organisation. (Pérez, 2019)

- Marketing and Customer Relationship

The channels through which the producer and the customer communicate, both digital and traditional, are actively used. In this way, customer information can be gathered and its needs anticipated.

In addition, the customer is responsible for devising the most relevant product specifications, i.e. taking part in its design. (Pérez, 2019)

In short, companies that are already a digital platform or have developed their digital business. They are innovative, connected, agile, flexible, open and collaborative companies which are continuously adapting to all the changes that come their way. (INCIPY, 2021)

6. STAKEHOLDERS

Digital transformation is a strategic and cultural change that affects the company's technology, processes and organisational model.

When talking about digital transformation, people think about business models, operations, culture, strategy, organisation and, above all, technology, but what about the relationship between organisations and their stakeholders? (Nunky, 2022)

The concept of *stakeholder* was proposed by the American philosopher Robert Edward Freeman in the 1980s to refer to the people or groups of people who are affected by the actions of an organisation. For this reason, before making any strategic decision that affects the organisation, it is necessary to think and reflect on the impact it may have on all these groups. (Tomas, 2020)

There are different types of stakeholders and they can be differentiated between primary and secondary, as well as internal and external. (Tomas, 2020)

Primary and secondary stakeholders

This classification refers to how relevant the actors are to the basic functioning of the organisation.

Primary stakeholders are essential due to the direct economic link they have with the organisation. Within this category, the following types stand out:

- **Shareholders**, who provide the capital necessary to get the organisation up and running.

There is often confusion between the term *shareholder* and the term *stakeholder* because, apart from being pronounced similarly, both concepts are closely related.

A shareholder, as explained above, is someone who holds shares in the organisation. Therefore, it is a type of stakeholder.

- **Corporate partners**, with the same interest, who are related to profit.
- **Workers**, who provide the labour force to enable the organisation to present its products and services.
- **Customers**, on whom it depends whether the project is viable or not.

Secondary stakeholders, on the other hand, do not have a direct economic link to the organisation but are affected by its activities. Within this category, the following types stand out:

- **The competition:** other organisations that manufacture or market similar products and services.
- **The market in general:** the best-understood example is publicly listed organisations.
- **The media:** they are responsible for reporting on the organisation's activities and have interests that are related to transparency.
- **Financial institutions:** they ensure transparency and solvency
- **Suppliers and subcontractors:** they do not work directly with the organisation but their economic activity depends on it.
- **Political parties, churches and trade unions:** they have different interests, which are related to labour and social rights, legality or respect for values.

Internal and external stakeholders

This classification focuses on the relationship that stakeholders have with the organisation, i.e. whether they are part of the company or are interested in third parties.

Internal stakeholders would be the managers, suppliers, employees, customers and owners. On the other hand, external stakeholders would be entities such as competitors, environmentalists and other interest groups, public administration, customer advocates, the media, among others.

Not all stakeholders influence the strategic decisions of an organisation in the same way and, moreover, not all of them benefit from the results obtained in the same way.

In order to assess the impact of a particular stakeholder on the organisation, both the impact on the company's projects and the stakeholder's position or attitude towards them must be taken into consideration.

As mentioned above, some stakeholders have a decisive impact when it comes to defining, executing, accepting and managing the organisation's plans, while others are more substitutable or secondary. In the same way, not all of them are impacted in the same way by the company's activity.

As for the stance or attitude towards the organisation's projects, it should be borne in mind that there are stakeholders who benefit from the company's good results and

others who have the opposite relationship. Shareholders, for example, would be in the first category and competitors in the second. (Tomas, 2020)

Today, stakeholders prefer two-way communication to the one-way communication of the 20th century. This new communication brings together the benefits of the physical world and social technologies, listening to their feedback in order to have a conversation with them, providing them with content that is important to them, and obeying new compliance requirements related to data protection, fraud related to new regulations, transparency criteria and risk reduction. (Nunky, 2022)

All this means that there has been a huge increase in specialised knowledge (design, digital communication, SEO, analytics, etc.), dedicated resource needs (artificial intelligence capabilities associated with understanding and responding to voice, active listening tools aimed at the dynamic matrix of stakeholders, automatic content creation) and technologies (Machine Learning, AI, Big Data, Deep Learning, Computer Vision) to be able to meet this new demand in a personalised and efficient way. (Nunky, 2022)

Currently, it is essential that the stakeholder map be properly documented and that communication policies be implemented with all stakeholders, taking into account the criteria of immediacy, transparency and sustainability.

At a very simplified level, it can be stated that the digital revolution is affecting the relationship between organisations and their stakeholders on three different levels: innovation, communication and technology.

We will now look at some of the most relevant stakeholders and see how these three levels are changing the way they relate to each other, both their expectations and the one-way relationship that has always existed. (Nunky, 2022)

- **Customer**

Both customer behaviour and their way of communicating have changed, which is why they demand a different experience. Communication, innovation and technology are revolutionising business models and both the needs and expectations of customers are changing.

In order to achieve this, organisations need to focus on Customer Experience and Customer Centric, building on concepts such as P2P and H2H. (Nunky, 2022)

P2P is one of the oldest communication networks in computing, since it was created after the invention of personal computers. It is a decentralised model of

communication in which there is no need for a central server, but each user acts equally and can have the role of customer or server.

The user only needs to download software that connects his or her computer to the other people who are part of the Peer to Peer network in order to be able to communicate with them. (Sanz, 2019)

H2H focuses on eliminating the inefficiencies of regular advertising to make the organisation's product more approachable and accessible, rather than providing a complex selling experience.

A new stage of marketing, which attempts to remove the wall brought about by the separation between buyer and seller, has been created. (Zabalza, 2017)

- **Suppliers**

These are the ones that have evolved the most and have adapted the best to new technologies. In addition, they have changed the way they communicate with customers, as is the case with Collaborative Economy and 3D printers.

In addition to affecting the manufacturing process, 3D printers drastically break the logistical concept. This fact affects both trust, as it is a process that can be repeated, and the lack of the need to have suppliers close by.

Their size is not a relevant aspect either because, in the Collaborative Economy, no matter how small the organisation is, if it has a good reputation, they will buy anyway.

In short, suppliers carry out innovations both in the products they offer, in the way they do it and in the way they are. By using innovative technologies they are making themselves known in a different way. (Nunky, 2022)

- **Society**

Connectivity brings about changes in society since it revolutionises certain aspects such as, among others, education and health.

Smartphones, for example, have revolutionised the world, causing society to change and evolve much faster than organisations do. (Nunky, 2022)

- **Management**

Due to digitalisation, companies are becoming so strong that they must be regulated with GAFA (Google, Amazon, Facebook and Apple) in mind. Among

other things, these organisations can elude tax payments through their economic flows, compromise markets and have a large amount of data at their disposal. (Nunky, 2022)

- **Employees**

Today, workers have changed. They are asked to have different skills and they want different ways of working, organisations that are flexible, committed and that allow them to evolve. (Nunky, 2022)

To sum up, the relationship between organisations and their stakeholders has changed a lot:

- Communication has gone from being almost one-way to having to listen to stakeholders, to learn and, finally, to talk.
- Expectations have shifted from trying to increase shareholder value to trying to achieve transparent and sustainable growth.
- The way of governing shifts from a focus on legal and financial criteria to transparency, globalisation, innovation, diversity, disruption and speed of change.
- Stakeholder involvement does not only imply employees, customers, shareholders and others, but it also gives rise to complaints, crises and recommendations.
- Information has a different value. In the traditional model, it could not be copied or distributed, but in the digital world, intelligence is a source of value that increases when it is shared and data is an asset.

7. COVID-19

Covid-19 has prompted organisations to rethink their strategies and make intensive use of digital tools in order to be able to buy and sell via the Internet or implement teleworking, among other things. (Henriquez, 2020). In this way, companies can evolve towards a new reality in which digital predominates. (Zelada, 2022)

The digital transformation process has been going on in Spain for a few years now, but Covid-19 has accelerated the speed and pace of change. (Zelada, 2022). In the past,

digitalisation was seen as an extra to increase profits and productivity, but today it has become a requirement for the survival of organisations. (Henriquez, 2020)

Covid-19 has served as an instrument to measure how ready both the public and private sectors were on the road to digital transformation. Companies have responded immediately to be able to develop and deploy digital solutions and automate solutions and processes in the cloud, among other things. All organisations that have not done so have been forced to halt their operations. (Zelada, 2022)

Deloitte's model balances the needs of organisations and advises not to focus solely on today in order to maintain competitive advantage. This model is composed of the following three phases:

1) Respond. Prepare to maintain business continuity

In the first phase, organisations manage the current situation and try to maintain business continuity. Both digital platforms and technology are essential to keep the company running using a variety of collaboration and connectivity tools to keep up with business needs. (Zelada, 2022)

2) Recover. Learn and emerge stronger

Kinetic leaders need to take the initiative and, learning from the current crisis, develop and implement strategies. Organisations need to be agile in order to recover and focus on their digital capabilities, in order to find a new normal. (Zelada, 2022)

3) Grow. Prepare for the new normal

The digital transformation that has been driven by a global pandemic is not the scenario expected by technology leaders. Conducting process re-engineering with a focus on digitisation and having long-term strategies is highly relevant. (Zelada, 2022)

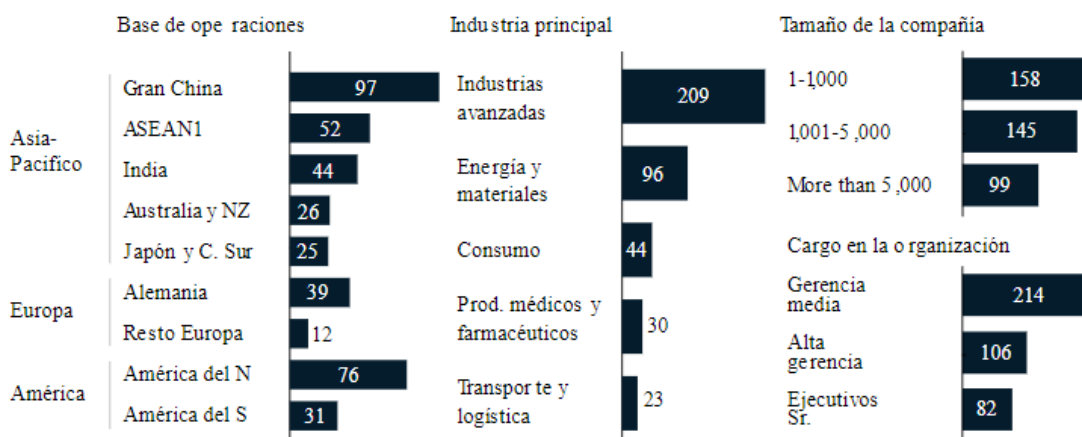
In 2020, due to the biggest economic and health crisis in recent history, organisations found it necessary to take extraordinary measures to protect their workers and their business in order to continue operating. Some companies had to struggle to maintain their operations with almost no raw materials or employees. Others had to cope with high demand. (Agrawal et al., 2021)

After analysing the results of the new McKinsey survey, it was possible to observe the victory of the organisations that were already making use of digital technologies, a

reality check for those that were just starting to use them and a warning for those that had not yet started their journey towards Industry 4.0.

Industry 4.0 progress has been measured through this global survey of manufacturing companies since 2017. In the latest survey, more than 400 companies from around the world participated. The graph below shows the leaders' perspectives six months after the start of Covid-19. 94% of those who participated reported that Industry 4.0 had helped them keep their organisations running during the crisis, and 56% claimed that digital technologies had become a key factor in overcoming the crisis. (Agrawal et al., 2021)

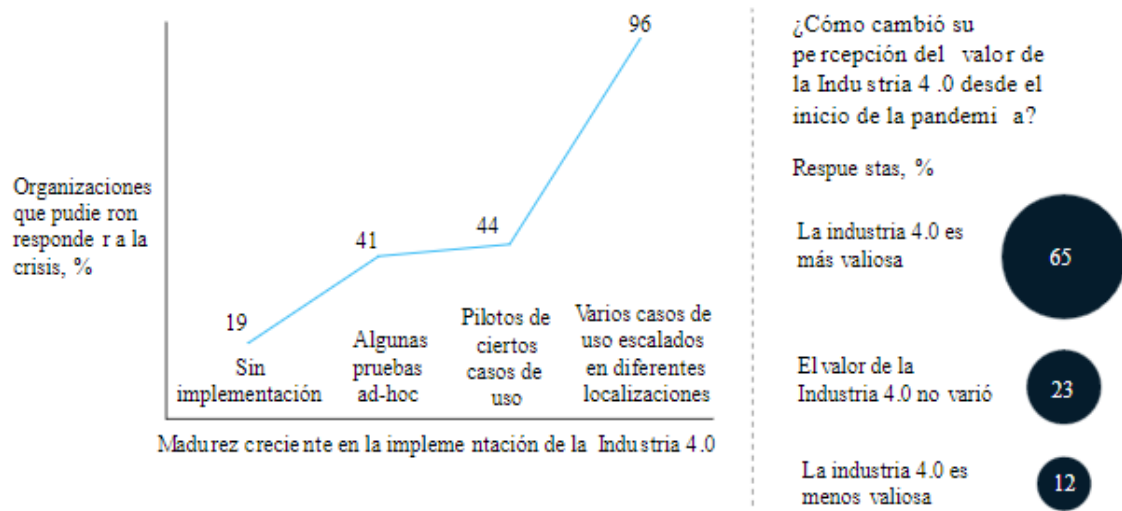
Figure 7: Progress in post-Covid Industry 4.0 initiatives in different countries and industries



Source: Agrawal et al., (2021)

Those organisations that made use of digital technologies before the pandemic hit were better positioned to respond to the crisis. For example, a North American personal protective equipment company that wanted to expand by installing a new production line was able to do so using remote assistance based on augmented reality. (Agrawal et al., 2021)

Figure 8: Crisis responsiveness according to the maturity level of companies



Source: Agrawal et al., (2021)

This success story and many others have increased enthusiasm for the potential of Industry 4.0, closing a two-year period of stagnation. Approximately 65% of respondents were much more optimistic about digital technologies than they had been a year before.

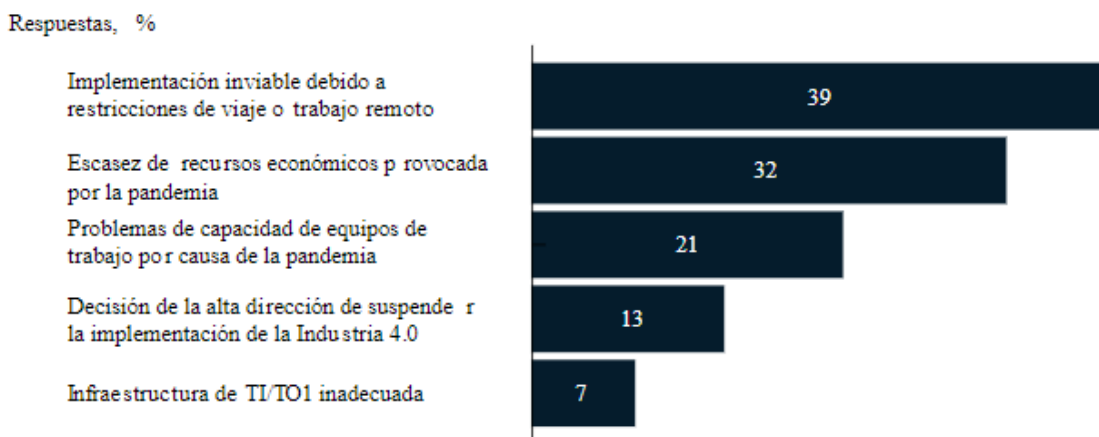
As mentioned above, Industry 4.0 technologies proved very useful for the organisations that used them first, so that they were able to cope with the crisis. It was also the pandemic that forced organisations to reassess the progress of their own digital transformation.

Compared to the previous year, this research states that there was a drop in the self-assessment of the organisations participating in the analysis of their level of maturity. The set of companies that claimed they had been able to use digital technologies successfully decreased by more than 40%, reaching levels comparable to those of 2017. (Agrawal et al., 2021)

The variation that can be perceived is due to two possible causes. The first is that digital technologies are measured by how useful they can be in difficult times such as the current Covid-19 crisis, rather than by their potential to add value during good or normal times. The second is that testing digital platforms in the midst of the crisis may have shown organisations that they should go further than they imagined in order to achieve an acceptable level of scalability in their implementations.

In short, the organisations that did not have the various Industry 4.0 tools in place before Covid-19 arrived have received a wake-up call. The survey indicates that, in addition to facing problems throughout the duration of the pandemic, the lack of previous experience, obsolete technological infrastructure and cash shortage caused by the crisis, are making it difficult for them to converge with the rest. (Agrawal et al., 2021)

Figure 9: Reasons for suspending the implementation of Industry 4.0 projects

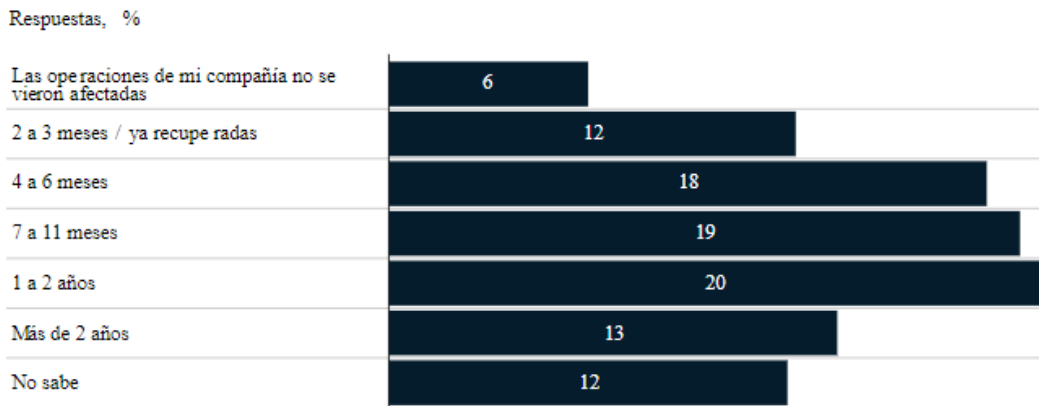


Source: Agrawal et al., (2021)

56% of respondents who had not implemented digital technologies before Covid-19 arrived found it much more difficult to respond to the crisis because they did not have digital tools to support them.

Many organisations, despite the challenges posed by the current context, are pressing ahead with their transformation plans, and Industry 4.0 is one of the most relevant topics. At the same time, executives say that progress is costing them dearly. Companies that have had to put Industry 4.0 projects on hold since the pandemic began have faced a number of challenges. These include difficulties of access due to forced shutdowns and the introduction of remote working; limited financial resources; and the reallocation of equipment to other more important and urgent matters. With the exception of China, where more than a third of respondents believe their operations are fully recovered from the impact of Covid-19, almost a third of respondents are convinced that it will take a year or more for organisations to recover. (Agrawal et al., 2021)

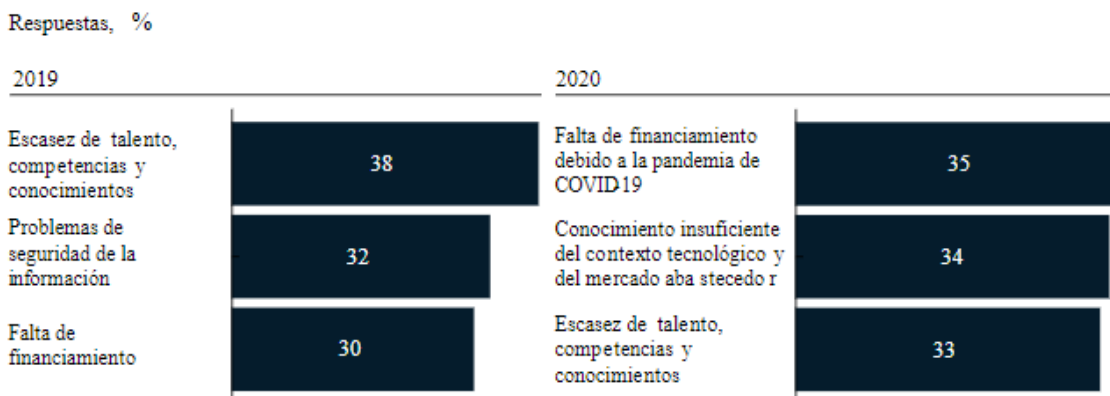
Figure 10: Full recovery time of production and supply chains



Source: Agrawal et al., (2021)

Comparing the results with those obtained in the 2019 survey, it has been possible to appreciate a shift in the perceived challenges for all Industry 4.0 initiatives. The top constraint in 2020 was lack of funding, which ranked third two years before the pandemic. In addition, knowledge, staff and skills constraints dropped from first to third place. (Agrawal et al., 2021)

Figure 11: Challenges faced by companies in implementing Industry 4.0 solutions



Source: Agrawal et al., (2021)

The crisis forced and continues to force organisations to rethink their operational strategies and to adjust both the business problems they want to address and the Industry 4.0 technologies they want to use.

Due to the particularities of the pandemic, flexibility and agility in operations have become the main strategic priorities, rather than increasing productivity or lowering costs. (Agrawal et al., 2021)

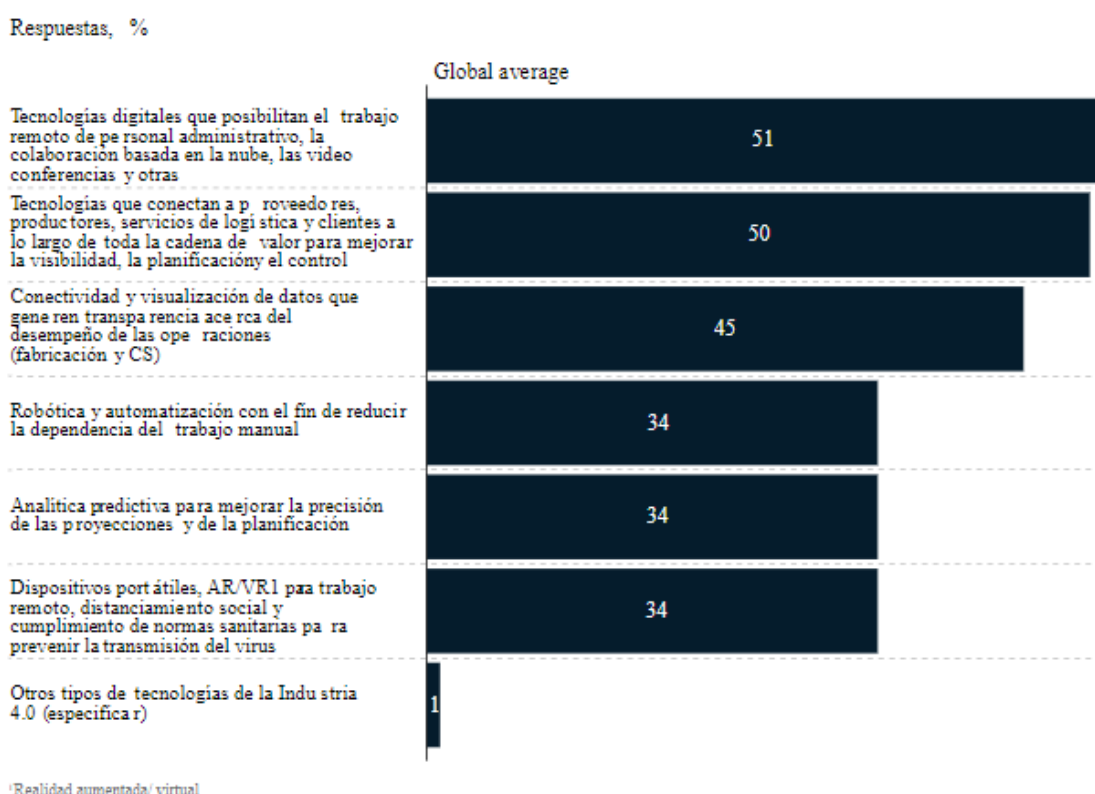
Figure 12: Main strategic goals regarding the implementation of Industry 4.0



Source: Agrawal et al., (2021)

In addition, half of the respondents started to prioritise the use of technologies that enable collaboration and remote working. Technologies that make it easier to provide visibility and collaboration across the supply chain are also emerging. (Agrawal et al., 2021)

Figure 13: Key focus areas for Industry 4.0 technologies



Source: Agrawal et al., (2021)

In addition to a major shift in organisational priorities, there was convergence across sectors. The most important drivers of digitisation varied by sector in 2019, according to the 2019 survey, but during the pandemic, efficiency and flexibility were paramount for all sectors and locations.

While objectives may be aligned, there are large differences in terms of maturity between sectors. Organisations in the transport and logistics sector were the only ones that claimed to have made significant progress over the last year, with 17% of participants successfully using digital technologies, compared to 8% the previous year. Therefore, companies need to look beyond their sectors in order to find better digital practice. (Agrawal et al., 2021)

In relation to industry, the pandemic crisis has changed the rules of the digital game. The pandemic accentuated the value of Industry 4.0, but it also showed the limitations of current programmes and raised the bar for measuring success.

The transition to a new normal after Covid-19 has changed the context for many companies' digital projects. Many organisations lacked the necessary funding to invest

in technology due to unforeseen costs and loss on sales. The crisis has also increased the pressure on talent.

The crisis changed the strategic context and affected several sectors in different ways. The aerospace industry, for example, had to cope with a long period of sluggish activity. Medical products and FMCG, on the other hand, struggled to meet growing demand. Furthermore, sectors with long supply chains were forced to take flexibility and resilience into account, almost on a par with efficiency and costs. (Agrawal et al., 2021)

Given the current context, the best option for many organisations is to pursue a strategy focused on Industry 4.0-based transformations. As few companies will have the resources and time at their disposal to be able to tackle digital experimentation, it will be much more effective to prepare a strategic roadmap of their Industry 4.0 ambitions, choose several digital uses related to one or two key objectives, and pursue an agile and rapid process to aggressively scale new technologies.

Companies will need to be both pragmatic and ambitious. The pandemic has heightened the message that digital solutions have a greater impact when they expand beyond a company's borders and encompass more of the supply chain. (Agrawal et al., 2021)

Organisations will need to consider the trade-offs they make between scalability and speed. Quick fixes can lead to accelerated implementation of digital solutions, but projects that start this way need costly re-engineering work to get them up and running at scale after a period of time. These problems can be reduced if smart technology choices are made early in the project lifecycle.

Still, there are no quick fixes to talent and organisational challenges. Companies will need to have the right processes and human resources at their disposal in order to sustain their ambitions. The post-pandemic economic backdrop could make it easier to hire staff with critical skills that businesses will need in the coming years in areas like IoT engineering or data science. It is for this reason that the development and deployment of new solutions is urgent, an aspect that will require organisations to adopt agile work methods, making use of small, multi-functional equipment and fast processes.

Facing a complicated transition to the new post-Covid-19 normality may cause a large number of organisations to slow down or completely stop their digital transformations around the world, even if it would be a mistake. Therefore, it is believed that the most appropriate option for most organisations would be to focus their digital initiatives on

the most strategically important opportunities and to wish to gain scale at a good pace. (Agrawal et al., 2021)

8. EUROPEAN AND STATE SUPPORT

Covid-19 has shown that there is a serious lack of institutional support from the European Union for the digital transformation of economies, and therefore of organisations, as well as an absence of a plan aimed at stimulating the competitiveness of business networks. (WOKI, 2021)

As mentioned above, digital technologies allow organisations to find new ways of doing business, ways to engage with their employees and customers and to increase their productivity.

Large companies have the tools and means to undertake technological change at their disposal. On the other hand, organisations with fewer than 250 employees, which account for 99% of the total, face a number of difficulties related to technical skills, financing and barriers to accessing particular services or products. (Varea, 2022)

Even so, the future of SMEs is no longer incompatible with artificial intelligence, data analytics or the Internet of things. Putting these in place will require a change of mindset towards a more flexible way of thinking and a financial investment.

In our country, according to the GoDaddy 2021 Digitalisation Observatory report, less than 20% of these organisations are fully digitalised. (Varea, 2022)

The Next Generation EU Funds are the European Union's response to the Covid-19 crisis, in an initiative that seeks to financially support EU members through credits worth a total of 750,000 million euros, which will be allocated between 2021 and 2026.

In order to manage this distribution of aid, Spain has created the Recovery, Transformation and Resilience Plan (PRTR), which will have an investment of 140,000 million euros from the Next Generation EU Funds. This will make it easier both to recover economically after Covid-19 and to modernise the Spanish economy. (Wolters Kluwer, 2022)

In the first phase of the plan, 70,000 million euros in direct transfers are expected to be implemented from the second quarter of 2021 to the end of 2023, through calls for

subsidies, tenders and aid from the various ministries, autonomous communities and local councils.

This plan is structured around four main axes, ten levers and thirty components that bring together investments and reforms in detail. The four main axes or objectives are Social Cohesion, Digital Transformation, Gender Equality and Economic Transition. The ten levers are explained through their components.

One of the most important objectives of the Recovery Plan is for the self-employed and SMEs to become the main beneficiaries of these financing actions. In this way, their fundamental role in the economy will be recognised and they will be able to face the increased competitiveness and productivity challenges caused by the Covid-19 crisis. (Wolters Kluwer, 2022)

Digitalisation is one of the most relevant aspects of the European Commission and one of the main axes of the Recovery Plan. It offers several investment programmes to ease the digital transition and accelerate SME innovation, implemented through calls for subsidies by the Ministry of Economic Affairs and Digital Transformation and the Ministry of Industry, Trade and Tourism.

This set of investments will go hand in hand with the Digital Spain Strategy 2025 and the SME Digitisation Plan 2021-2025, so that professionals and micro-SMEs can have digital tools at their disposal to support them in their technological innovation and digitalisation process.

Three investments made to innovate and digitise SMEs will be mentioned below. (Wolters Kluwer, 2022)

- Agents of Change Programme

The programme will subsidise small and medium-sized companies for the costs of hiring a digital transformation professional. The government will be able to support at least 15,000 small and medium-sized companies, with between 10 and 249 employees.

It has a budget of 300 million euros, which can reach a maximum amount of 20,000 euros for the organisation if it hires the expert for at least one year.

The requirement for organisations to have access to this program is that the contracts have a duration of at least 6 months. If this is between 6 and 12

months, the amount of the subsidy will be proportional to the length of stay of the professional. (DPD, 2022)

- Accelerate SME 2.0

It consists of an extension of the infrastructure to support the digitalisation of SMEs with training and advisory services to improve their competitiveness and continue growing. To this end, a network of *Acelera Pyme* offices has been consolidated. (Red.es, 2021)

- Digital Kit Programme

This is a large-scale subsidy programme for the basic digitisation of SMEs.

It has a budget of 3,067 million euros and its main objective is to provide the self-employed and SMEs in Spain with the digital tools they need to increase their scale, enter new markets and develop their full potential.

The beneficiaries of the first call for aid will be SMEs with between 10 and 49 employees, with a total amount of 500 million euros. (La Moncloa, 2021)

Therefore, the specific objectives of the aid provided for in the European Recovery Fund for digitisation are, among others, to promote the digital skills of the population, encourage the implementation of new technologies, direct the deployment of 5G and ensure connectivity.

Based on figures, one and a half million small and medium-sized companies, including the self-employed and micro-businesses will be provided with digital tools. Online commerce will also be stimulated until it reaches a quarter of the business volume of SMEs in the year 2025, as today it does not even reach 10%. In addition, the digital skills of 80% of the population will be increased to improve integration into the digital economy. Finally, the aim is to ensure that half of the administrations' dealings with citizens are solved through applications. (Varea, 2022)

9. CONCLUSION

Over several decades, industry has used various Lean Manufacturing principles and tools to improve business productivity and simplify the complexity of operations, eliminating any inefficiencies.

Industry 4.0 started to gain importance when organisations appreciated the increasing complexity of ecosystems and the market, as it could become the solution to address this complexity.

Industry 4.0 maximises the effectiveness and efficiency of companies through the appropriate organisation of all production resources. By achieving the sustainable and continuous optimisation of processes, the satisfaction of all the company's agents can be increased.

Organisations will gradually be digitised in order to remain competitive and positioned in the markets through the use of enabling technologies. To this end, it is essential that the competent bodies take into account the political, social and ethical frameworks that society needs in order to be able to use these technologies in the right way.

Based on Lean Digital Industry 4.0, there are four different levels of companies according to their degree of digital maturity. The laggard carries out some digital initiatives but in a diffuse and independent way; the competitive one starts to implement some digital plans in some areas of the company, but does not manage or integrate them; the advanced one implements the Transformation Plan in an integrated way oriented to Customer Centric; and the leader develops its digital business and continuously adapts to all the changes that are presented to it.

It is worth mentioning that the degree of digital maturity achieved by Spanish organisations a year ago was 5.7 points out of 10, but few companies implemented a Digital Transformation plan. For this reason, our country's organisations are still far from the highest stage of digital maturity.

Digital transformation also affects the relationship that organisations have with their stakeholders on three different levels: innovation, communication and technology. In the case of customers, for example, companies have to focus on Customer Experience and Customer Centric, based on concepts such as P2P and H2H.

In relation to Covid-19, this has caused the speed and pace of the Digital Transformation of companies to accelerate, as it was previously considered an extra to

increase profits and productivity, but at present it has become a requirement for survival. In short, the pandemic implied a warning to companies that had not yet started their journey towards Industry 4.0 because those that had already opted for it emerged victorious.

It was Covid-19 that showed that there is a great lack of institutional support from the European Union for the digital transformation of organisations. The EU's response to this crisis was the Next Generation Funds, in which one of the four axes was Digital Transformation. Three of the investments that were carried out were the Agents of Change Programme, Accelerate SME 2.0 and the Digital Kit Programme.

In conclusion, it should be noted that for organisations wishing to move further towards Industry 4.0, sustainability will have to become one of the objectives to be achieved. As we know, sustainability is about reducing negative impacts on social, environmental and economic relations.

Therefore, any investment made by a company must be socially and economically sustainable and, extending this concept to the conservation of the planet and the environment, it must not be exempt from responsibility towards the environment. For this reason, it is likely that the services and products that are generated will maintain their value for as long as possible, reducing the use of raw materials, energy and resources, using mostly sustainable materials.

Moreover, in order to achieve this goal, companies must increase the use of financial and natural elements, as well as human resources, on an equal basis. In this way, both the image projected by the organisation and its reputation will be considerably improved.

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