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"INDUSTRY 4.0 AND DIGITAL TRANSFORMATION: EMPIRICAL EVIDENCE IN THE VENDING SECTOR IN ITALY"

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"It is not the strongest of the species that survives, nor the most intelligent, but those most responsive to change"

Charles R. Darwin "The origin of species", 1859

SUMMARY

ABSTRACT

The origin of the term Industry 4.0 goes back in Germany. It appeared for the first time at the Hannover Fair in 2011, by a working group presided over by Siegfreid Dais, member of the multinational corporation Robert Bosh GmbH and by Henning Kagermann of Acatech (German Academy of Science and Engineering).

When we talk about Industry 4.0, we refer to the Fourth Industrial Revolution, which is currently taking place. Contrary to the revolutions of 18th, 19th and 20th century, it is not possible to establish a precise starting point to it, but, since it is a revolution, it will bring about a change on a global scale. This thesis addresses the issue of Industry 4.0 and all the contents related to it, from the meaning to the consequences of such an evolution, starting from an historical review of the four revolutions and defining the nine enabling technologies of this industry. In the second chapter, the concept of digital transformation is described in detail, starting from an historical review of the phenomenon and then focusing on how digital forces impact on strategy and therefore on business models. At the end of the second chapter there is a brief illustration of potential 4.0 new business models. In the third chapter it is finally defined the concept of vending, with an historical review of the sector, and the description of the current impact of technologies on vending machines. Finally, it is presented a small sample research I conducted in collaboration with the DT Lab of Padova, to have a better evidence of how vending industry is facing digital transformation brought by the advent of industry 4.0.

FIRST CHAPTER

1. THE FOURTH INDUSTRIAL REVOLUTION AND THE ENABLING TECHNOLOGIES

1.1 THE PATH TO THE FOURTH INDUSTRIAL REVOLUTION

At the advent of the nineteenth century, a new way of wealth production took place with the industrial production or Industrial Revolution.

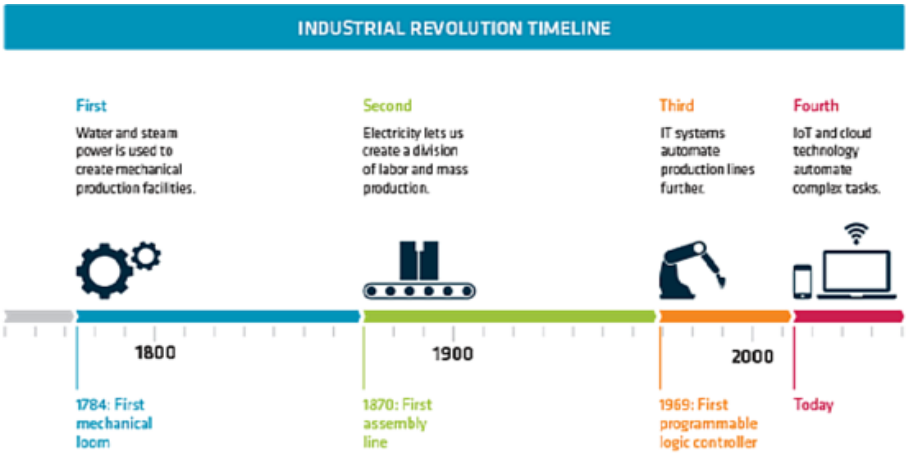
Since the beginning of this insurgent transformation, human technology has enabled several disruptive transformations in industrial production.

The first industrial revolution, that took place between the end of 18th and the beginning of 19th century, was characterized by the introduction of water and steam-powered mechanical manufacturing facilities. The second industrial revolution, between the end of the 19th and the beginning of 20th century, was based on the introduction of electrically powered mass production and the intensive division of labor. Then followed the third industrial revolution, which took place from the 1960s until the 1990s and its main driving force was the use of electronics and information technologies to achieve further automation of manufacture.

Most economists agree that we are entering the fourth industrial revolution, that has as main characteristic the use of cyber-physical systems that is the linkage of real objects and people with information-processing/virtual objects via information networks (Internet of things, 3D printing, artificial intelligence, bioengineering, cloud computing, etc.) but also using nanotechnologies and new efficient and intelligent materials. (Devezas, 2017)

In Figure 1.1 there is a summary of the four industrial revolutions, while in the following sections there will be a more detailed historical review of them.

Figure 1.1 – Industrial Revolution Timeline



(Source: https://mjolner.dk/)

1.1.1 THE FIRST INDUSTRIAL REVOLUTION

The First industrial revolution is not only the end of the modern era, and the subsequent rise of the contemporary era, but represents a breaking point, that in the 18th century, announced the historical shift from an agricultural, artisan and commercial system to an industrial system.

The main innovations in the industrial sector were substantially two: in the energy production sector the steam engine invented by James Watt in 1775 and the subsequent use of the machine in transports and industrial production; in the textile manufacturing field, the mechanical spinning machine by Arkwright in 1979.

The most important changes in technology and in the organization of the production occurred in two sectors: the cotton industry and the iron industry.

As Morris writes: "Even though [the steam] revolution took several decades to unfold […] it was nonetheless the biggest and fastest transformation in the entire history of the world. (Brynjolfsson e McAfee, 2014)

The use of steam as driving force made the machines more efficient in terms of fuel consumption, heat dispersion and the amount of energy produced. This allowed for mass production in large plants. The use of the mechanical spinning machine increased the labor productivity which means an increase in quantity and quality of the products and a reduction of the production costs in relation to manual frames.

The first industrial revolution introduced the first era of the machines; it was the first time that progress was driven by technological innovation, and it was possible to generate huge quantities of mechanical energy. The ability to generate massive amounts of mechanical power was so important that, in Morris's words, it "made mockery of all the drama of the world's earlier history". (Brynjolfsson e McAfee, 2014)

1.1.2 THE SECOND INDUSTRIAL REVOLUTION

After the great depression of the 19th century, Europe and the United States, were the key players of an unprecedented technological development; in 1913 there was a 378% unexpected increase of global manufacturing production in relation to the one of 1875. Many historians refer to these profound transformations between 1870 and 1970 as "Second industrial revolution". The main invention that better explains the turning point compared to the previous century, both in terms of economic and social impact, is electric energy. It represents a distribution way of the energy produced from sources like steam or water, that

could finally be gathered, spread across huge distances and used to heat up, light up and for transports. The second industrial revolution stands out also for the petrol engine and for the replacement of coal with oil as main source of energy. Three novelties were central here: electricity, the internal combustion engine, and indoor plumbing with running water, all of which came onto the scene between 1870 and 1900. (Brynjolfsson e McAfee, 2014)

Substantially these inventions revolutionized the organization of production processes. The innovations simplified the production flow through conveyor belts and increased work productivity through high precision machine tools.

About organizational restructuring, the most important is the rational and scientific use of workers in big plants, through the implementation of principles assumed by Taylor in "*The principles of scientific management"*, aimed at reducing labor costs and increase productivity. These principles were carried out by Henry Ford in 1913 in automotive industry. He reorganized the whole plant around the assembly line, which connects the several stages of the car assembly work, charging workers only with simple procedures with intermediate products. The division of labor and the central position of the assembly line allowed to drastically reduce time and unitary cost of production, ensuring an increase in workers productivity and in volume of outputs, necessary for economies of scale.

Therefore, the Second Industrial Revolution must be considered the era of mass production, characterized by manufacturers prevailing consumers. Henry Ford stated: "Any customer can have a car painted any color that he wants so long as it is black" (Ford, 1922).

1.1.3 THE THIRD INDUSTRIAL REVOLUTION

The Third Industrial Revolution represents the last step that leads to the current industrial system. Even though it involves nearly all fields of the economic-industrial sector, electronics and information technology stand out. The birth of computer and of the transistor represents the first step toward a continuous and swift technological development that gave rise to considerable changes at a social and economic level, affecting both population lifestyle and industrial production organization.

These transformations brought to light the growing difficulties of mass production system due to saturate markets characterized by strong fluctuations in demand and by a deep shift in preferences of consumers, that had become hostile to standardization and more inclined to quality (Battilossi, 2002).

Because of these large enterprises had to give up on the rigidity of standardized production in favour of flexible and automated production systems able to adjust volumes and production features to the unstable demand. This enabled enterprises to reduce total costs and achieve economies not on volumes of production but in the collection, processing and transmission of data.

Such transformation entailed a deep and irreversible break that marked the end of Fordism and the achievement of Japanese model of lean production, based on total quality, bottom-up and just in time information flow (Tunisini, 2014).

This revolution outlines a post-industrial economy, with a wide range of services and an inversion of trend in relation to the previous period: now consumers prevail over manufacturers. This new economy takes advantage of resources as information, knowledge and creativity in order to satisfy an increasingly demanding consumer.

1.1.4 THE FOURTH INDUSTRIAL REVOLUTION: WHAT IS INDUSTRY 4.0?

The term appeared for the first time in 2011 during the famous Hannover Fair, as a project in high-tech strategy of the German Industry, and in the following year was created the Working Group on Industry 4.0, which delivered its final report in April 2013 again at the Hannover Fair. This report defined the Industry 4.0 environment, which includes the strong customization of products under the conditions of high flexibility of mass production (improved automation technology), requiring the introduction of methods of self-organized systems (self-optimization, self-configuration, self-diagnosis, etc.) to get the suitable linkage between the real (machines, workers) and the virtual worlds.

The term was definitively adopted at the 2015 World Economic Forum (WEF) Annual Meeting held in January 2015 in Davos, Switzerland, soon followed by the publication of the book "The Fourth Industrial Revolution," signed by Klaus Schwab, founder and president of WEF. (Devezas, 2017)

Sanders et al. defined Industry 4.0 as "the fourth industrial revolution applying the principles of cyber-physical systems (CPS), Internet and future-oriented technologies and smart systems with enhanced human-machine interaction paradigms". Wolter et al. expanded this view to the entire value chain from the business model to low-level service offerings and work in process, defining Industry 4.0 as "(. . .). The resulting consequences have also an effect on the value chain, the business models, the downstream services and the work in progress". Akeson underlined the need for customization as "(. . .). It is geared towards increasingly individualized customer requirements". These definitions argued that Industry 4.0 consists in

digitalization and communication interaction. Brettel et al. wrote that “Industry 4.0 focuses on the establishment of intelligent products and production processes”. These authors view Industry 4.0 as a digitalization of product and processes through increased intelligence. McKinsey and Company defined Industry 4.0 highlighting the power of big data, cloud computing and the widespread implementation of new technologies “(. . .) driven by four disruptions: the astonishing rise in data volumes, computational power, (. . .) and improvements in transferring digital instructions to the physical world, such as advanced robotics and 3D printing”. Baums, Hofman and Rüsch, Balasingham and Federal Ministry of Education and Research agreed that autonomous system components and decentralized control systems are essential enablers of Industry 4.0: “(. . .) The value networks are subject to decentralized control while system elements (like manufacturing facilities or transport vehicles) are making autonomous decisions (autonomous and decentralized decision making”. However, most researchers recognized that Industry 4.0 is the fourth revolution and will transform the notion of manufacturing. Nonetheless a clear and consistent definition of Industry 4.0 is lacking.

Herman et al. defined Industry 4.0 as a “collective term for technologies and concepts of value chain organization. Within the modular structured Smart Factories of Industry 4.0, CPS monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the IoT, CPS communicate and cooperate with each other and humans in real time. Via the IoT, both internal and cross-organizational services are offered and utilized by participants of the value chain”.

We can understand how industrial revolutions at the end of 19th century and 20th century allowed the human being to not depend on their own strength or on the one of animals, making it possible mass production and providing millions of people with digital skills. Such changes are a forerunner of the Fourth Industrial Revolution. The process of industrialization began with the introduction of mechanical manufacturing equipment at the end of the 18th century.

With the development of the steam engine by James Watt, the way to make goods changed.

It was the beginning of the switch from an agricultural to an industrial society.

Then followed a second industrial revolution that began around the turn of the 20th century and entangled electrically powered mass production of goods based on the division of labor. This revolution was predominantly characterized by organizational changes such as the implementation of Henry Ford's assembly line and the scientific management procedures (Taylorism) based on Frederic W. Taylor. The mass production continued in chemical, electronics, mechanical engineering and automotive industry.

The third industrial revolution, that started during the early 1970s, is characterized by the implementation of electronics and information technology that enabled increased automation of manufacturing processes, as machines gradually replaced a high portion of labor work. Moreover, the productivity of manufacturing processes increased thanks to the introduction of serial production. The third revolution is still present, but it is smoothly transforming into a new age of industrialization, the so called fourth industrial revolution.

There is considerable evidence that the fourth industrial revolution is smoothly taking over. It is often discussed, whether the term "revolution" is justified for the ongoing change. Some people state that a more reasonable definition would be "evolution", as the transformation will take several decades and the main elements, which constitute this transformation process, already exist and only will be developed further. Whereas other people claim that, the term "revolution" is justified, as the transformation has similar characteristics to an epochal transformation due to a most probable paradigm shift in manufacturing.

One definition is certain – it will be an (r)evolution towards digitalization. (Christoph Jan Bartodziej, 2017)

Jacobi and Landherr (2011) highlight that society is switching from an industrialized to a post-industrialized knowledge-based, service-oriented, information-based society.

A first definition of the term Industry 4.0 was made by the FU in 2011. It defines Industry 4.0 as "[…] the fourth industrial revolution, a new level of organization and control of whole value chains over the entire lifecycle of products. This cycle includes the fulfillment of individualized customer requirements and extents itself from idea, real order, development, and manufacturing, delivery to the customer and the recycling process with the involved services. The basis for the development is formed by the availability of all necessary information in real-time through interconnection of all instances, which are involved in value creation as well as through the ability to derive the best possible value stream based on the resulting data. Through the connection of people, objects and systems, dynamic, real-time optimized, self-organizing, cross company value networks will evolve, which can be optimized based on different criteria such as costs, availability and resource efficiency." A more precise definition was made by Acatech in 2013: "[…] the technical integration of CPS into manufacturing and logistics and the use of the Internet of Things and Services in industrial processes. This will have implications for value creation, business models, downstream services and work organization."

Hermann et al. (2015) used a literature review to give a unique definition of Industry 4.0, identifying four key components of Industry 4.0: Cyber-Physical Systems, Internet of Things, Internet of Services, and Smart Factory.

To conclude, Industry 4.0, has the purpose to increase the competitiveness of the manufacturing industry of the future, through the increasing integration of cyber physical systems (CPS), in industrial processes. It means that intelligent machines connected to internet are integrated in manufacturing processes, until now carried out by human beings (Fiandese, 2015). Obviously, manufacturing is still central in the industrial production, but it is not anymore, a sequence of separate phases but a flow immaterially integrated thanks to digital technologies.

1.2 ITALY AND INDUSTRY 4.0: IL "PIANO NAZIONALE INDUSTRIA 4.0"

The Italian industrial system has only a limited number of supply chain leaders with the ability to guide this evolutionary process, and an industrial system
essentially characterized by SMEs, a couple key prestigious universities and research centers and a strong country of origin connotation of products. (Camera dei Deputati, 2017)

The European Commission remarked in the "Country Report 2016" that "In Italy productivity growth is stagnant mainly because of the persistent presence of structural obstacles to the efficient allocation of resources in the economy" and that "The currently underway and planned structural reforms, will help overcome the barriers to investment, and will in time have a positive effect on productivity and GDP growth."

However, it is important to stress that the total productivity growth also significantly depends on human capital and on the ability to innovate. Fiscal incentives on R&D activities are irrelevant and uncertain and this negatively affect private investments on innovation. Furthermore, the Italian system for research and Innovation has a very insufficient cooperation between academia and the business world. In 2016, the Italian House of Representatives carried out a fact-finding survey in which strengths and weaknesses of the Italian industrial system were analyzed in terms of digitization together with the opportunities and threats deriving from the global context.

The result is the elaboration of five main pillars upon which a national Industry 4.0 strategy can be developed:

- Setting-up of a governing body and the identification of the goals to achieve;

- Achievement of the enabling infrastructures through the implementation of the broadband Internet plan, smart electric networks, Digital Innovation Hubs, a public digital administration and the diffusion of fifth generation wireless connectivity.

- Outlining of a training and education system focused on the development of digital competences in all fields.

- Reinforcement of research in academic autonomy and international research centers;

- Leveraging the opportunities provided by the Internet of Things for open innovation, open standards, interoperability and a system promoting Made in Italy.

Carlo Calenda, the Italian Minister of Economic Development, used these words to define the National Plan: "The Plan provides for a wide array of consistent and complementary measures promoting investment in innovation and competitiveness - all measures that have proved their effectiveness in the past have been strengthened under a "4.0" logic, and new measures have been introduced to meet new needs. […] we have planned measures that every company can put in place automatically […] and, above all, without any restrictions in terms of its size, sector or location. As demonstrated by the considerable financial resources that have been committed to the Plan in the coming years, this Government is offering enterprises that want to grow and innovate a new deal."

The Plan, ""Piano Nazionale Industria 4.0 2017-2020" issued in September 2016 includes both key and complementary guidelines for leading the change.

Among the so-called key guidelines there are:

- Innovative investments (total investments € 37 billion, among which 24 billion private and 13 billion public investments).

  The most urgent actions concern the subsidization of private investments on technology and Industry 4.0 products, the intensification of private expenditure on research, innovation and development and the implementation of the financial support to Industry 4.0, Venture Capital and start-ups.

  The current objectives in terms of investments are:

  +10 € billions: from 80 to 90 billion in 2017 in private investments;

  +11,3 € billions: in R&D&I private expenditure focused mainly on I4.0 by 2020;

  +2,6 € billions: in early-stage private investments by 2020.

The current main initiatives implemented are:

- Hyper-depreciation: for depreciation purposes, investments in new tangible assets, devices and technologies enabling companies' transformation to "Industria 4.0" standards will be valued at 250% of the investment value.
- Super-depreciation: for depreciation purposes, investments will be valued at 140% of the investment value.

  Both hyper and super-depreciation support and offer incentives to companies that invest in new capital goods, tangible assets and intangible assets for the technological and digital transformation of their production processes, thus investing in growth.
- "Nuova Sabatini": The Nuova Sabatini initiative offers more credit to those who innovate, supporting businesses requesting bank loans to invest in new capital goods, machinery, plant, factory equipment for use in production and digital technologies. It entails a contribution partially covering interest paid by business on bank loans of between 20,000 and 2,000,000 euros, granted by banks approved by the Ministry of Economic Development, and it's available to all micro, small and medium enterprises in Italy operating in any sector.
- Tax credit for R&D: The Government deems it important to encourage private investment in Research and Development for product and process innovation and to ensure the competitiveness of enterprises in the future. This is why the Plan provides for a 50% tax credit on increases in R&D costs up to an annual limit of €20 million a year per recipient, estimated on the basis of the average expenditure on Research and Development between 2012-2014, even if companies experience losses. This provision too is aimed at rewarding those who invest in the future.
- Patent box: Another optional special taxation system is applicable to income from the use of intangible assets: industrial patent rights, registered trademarks, industrial designs and models, copyrighted know-how and software. The reason for its establishment resides in the need to offer an incentive for bringing back to Italy intangible assets currently held abroad by Italian or foreign companies while making the Italian market more attractive to long-term domestic and international investors by offering a special rate of taxation for incomes deriving from the use of intellectual property rights.
- Innovative start-ups and SMEs: A series of funding initiatives, exclusion from the application of some regulations and other facilitations have been devoted to the support of innovative enterprises at all stages of their life cycle and to the development of Italy's startup ecosystem as well as the spreading of a new business culture based

on teamwork, innovation and openness towards international markets. The initiatives apply to newly-established unlisted limited companies with an annual value of production below 5 million euros, whose company purpose is clearly related to innovation.

- Competences (total investments € 900 million, among which 200 private and 700 public).

The following are the measures being taken due to the lack of specific know-how and competences:

- The spread of Industry 4.0 culture through the "Digital School" and the "Work-School Alternation" initiatives;
- Provision of specific curricula and dedicated technical high school institutes to develop Industry 4.0 competences (objective: 200000 university students and 3000 managers specialized on Industry 4.0 subjects);
- Empowerment of Clusters and Doctorates for research financing (1400 PhDs with Industry 4.0 focus);
- Setting up of Competence Centers and Digital Innovation Hubs.

Other complementary initiatives involve:

• Broadband Internet coverage: 100% of businesses covered at 30 Mbps and at least 50% at 100 Mbps by 2020 through both private and public investments;

• Fondo Centrale di Garanzia: reform and re-funding for the year 2017 with focus on I4.0 investments coverage;

• Made in Italy: strong investment on digital sale chains and augmented support for SMEs;

• Development contracts: negotiation and supply of customized funding based on ad hoc requirements;

In the meantime, the Government also declared its eagerness to guarantee private investments, fund the considerable innovation investments, enforce and innovate the safeguard of international markets, support the salary-productivity exchange through corporate decentralized contracting.

Awareness represents a main priority, thus the Government intends to organize presentations and showings of recent technological advances for digital manufacturing, benefits, innovation, productivity and competitiveness gains, targeting business managers for SMEs; plan an I4.0 roadshow with seminars for SMEs awareness; targeted assistance for high-potential SMEs to guide the design and implementation of a transition plan toward I4.0; and last but not least, a national communication plan both through web and press.

1.3 TECHNOLOGIES OVERVIEW

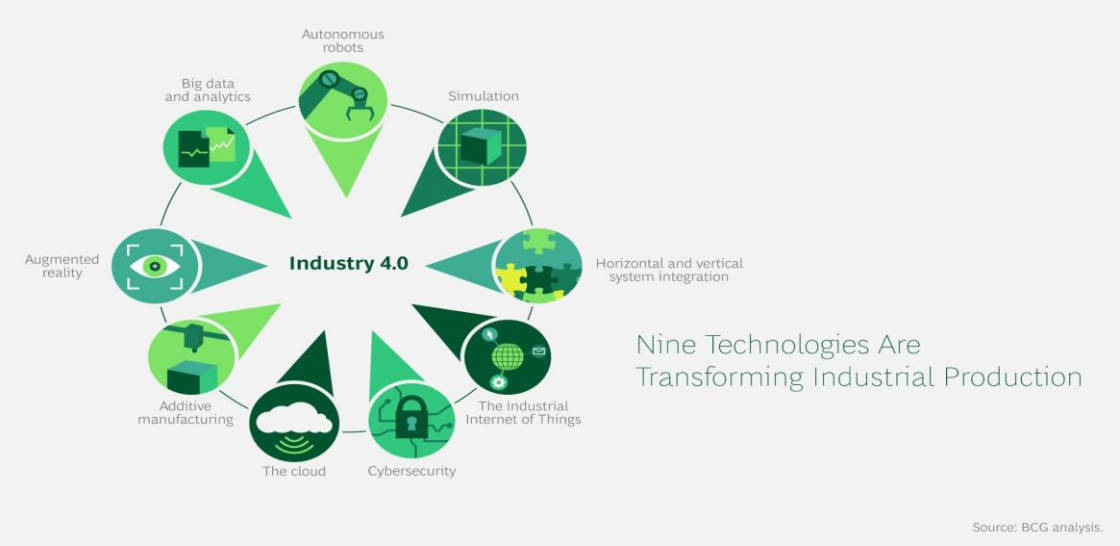
Digital manufacturing is the result of the evolution of digital technologies that, with a view to constant innovation, are increasingly modifying the management of manufacturing production. The technologies involved in this change are many and the first important thing to stress is that these will be connected to each other, creating a real ecosystem that is the innovation and strength of this revolution. (Wired, 2016)

From a research of the Boston Consulting Group, it emerges that the Fourth Industrial Revolution focuses on the application of some enabling technologies inside of the new factory. Some of these technologies represent concepts already existent but that have never overcome the division between applied research and production systems; others are radical innovations, also called destructive, as they are able to wipe away the previous productive paradigms. (The Boston Consulting Group, 2015)

The Boston Consulting Group has defined the main nine enabling technologies that represent the pillars of the evolution of industry 4.0: Big Data Analytics, Autonomous Robots, Simulation, Horizontal and Vertical System Integration, the Industrial Internet of Things, Cybersecurity, the Cloud, Additive Manufacturing, Augmented Reality. (Figure 1.3)

These technologies represent the tools that, if well mixed, will allow the evolution of the industry towards an intelligent model, where work tools are connected to the network and also interconnected. Below, we will see in detail what these enabling technologies are and how they can contribute to the innovative wave of industry 4.0.

Figure 1.3 The Nine Enabling Technologies



1.3.1 BIG DATA AND ANALYTICS

“In an Industry 4.0 context, the collection and comprehensive evaluation of data from many different sources—production equipment and systems as well as enterprise- and customer-management systems—will become standard to support real-time decision making.” (Boston Consulting Group)

The evolution of information systems and the growth in the use of the Internet and social networks has caused an explosion in the amount of available data relevant to the activities of the companies. Therefore, the treatment of these available data is vital to support operational, tactical and strategic decisions. There are still some challenges that need to be considered and mitigated, namely the privacy of information, the existence of qualified human resources to work with Big Data and the promotion of a data-driven organizational culture. (Fernando Almeida, 2018) With the term Big Data, we refer to new information and communication technologies able to process and manage, at low cost, huge amounts of data, both structured and not, collected and analyzed with tools that transform them into related and easily interpretable information.

The ability to manage all this information together will allow real-time and predictive data analysis in order to obtain both decision-making and production processes on faster, more flexible and efficient production and consumption, and the development of on-demand production systems with the ability to provide the consumer with customized and immediate answers. The manufacturing sector is currently finding itself inundated with an increasing amount of data from different sources, and there is a need to gather all those data and organize them using the analytics provided by the data sets to support management’s decision-making. This is very useful for the business when it comes to optimization of production quality and service, reduction of energy consumption and improvement of efficiencies in the production process.

Data are collected from the different phases of the fore-mentioned production process and then analyzed in correlation with each other in order to identify phases with redundant processes that could be streamlined.

There are six Cs in big data and analytics with respect to the Industry 4.0 environment. They are:

- Connection, which pertains to sensors and networks
- Cloud computing
- Cyber, which involves model and memory
- Content/context

• Community, or sharing and collaboration between and among stakeholders
• Customization
(Gilchrist, 2016)

1.3.2 AUTONOMOUS ROBOTS

Robots will eventually interact with one another and work safely side by side with humans and learn from them. These robots will cost less and have a greater range of capabilities than those used in manufacturing today. (Boston Consulting Group)
The advanced manufacturing solution means the adoption of advanced, interconnected and modular production systems that allow flexibility and performance.
The application of such systems, which can be quickly programmed, allows the machines to evolve towards greater autonomy, flexibility and collaboration, both with each other and with human beings, creating robots with increased cognitive abilities. Its adoption allows, in the industrial sector, greater production efficiency through a reduction in errors, time and costs and an improvement in productivity and safety of workers, as well as in processes.
The use of robots in the manufacturing process is no longer new; however, robots are also subject to improvements and evolution. Creators of these robots are designing them to be self-sufficient, autonomous, and interactive, so that they are no longer simply tools used by humans, but they are already integral work units that function alongside humans. (Gilchrist, 2016)

1.3.3 SIMULATION

“Simulations will be used more extensively in plant operations to leverage real-time data and mirror the physical world in a virtual model, which can include machines, products, and humans. This will allow operators to test and optimize the machine settings for the next product in line in the virtual world before the physical changeover, thereby driving down machine setup times and increasing quality.” (Boston Consulting Group)
The adoption of interconnected technologies and machines will make it possible to implement effective simulations on the different production lines in order to optimize industrial processes.
These simulations will leverage real-time data usage to reflect the material reality in a virtual model, which will allow operators to test and optimize the setting of the production process machinery in the virtual world even before the physical world. In this way it will be possible

to implement corrections in the production process of a given product without affording the huge costs deriving from learning-by-doing, reducing machine set-up time and increasing the quality of industrial processes and of outputs.

Previously, if manufacturers wanted to test if a process was working efficiently and effectively, trial and error was required. Industry 4.0 uses virtualization to create digital twins that are used for simulation modeling and testing, and they will play more major roles in the optimization of production, as well as product quality. (Gilchrist, 2016)

1.3.4 HORIZONTAL AND VERTICAL SYSTEM INTEGRATION

"With Industry 4.0, companies, departments, functions, and capabilities will become much more cohesive, as cross-company, universal data-integration networks evolve and enable truly automated value chains." (Boston Consulting Group)

The adoption of interconnected technologies, able to analyze big data and create open systems for sharing data and information in real time, will allow digitization and integration along the value-chain, in order to create efficient automated chains able to reduce inventory and time costs through a better coordination of the various activities.

Integration, which will take place both horizontally - across the entire organization, from product development to purchase, production, logistics and services - and vertically, involving all key partners in the value chain, from suppliers to companies and consumers.

Having fully integrated OT and IT systems is something that Industry 4.0 aims for. The goal is to create a scenario where engineering, production, marketing, and after-sales are closely linked. Similarly, companies in the supply chain will also be more integrated, giving rise to data integration networks, collaboration at automation levels, and value chains that are fully automated. (Gilchrist, 2016)

1.3.5 INDUSTRIAL INTERNET OF THINGS

"Industry 4.0 means that more devices—sometimes including unfinished products—will be enriched with embedded computing. This will allow field devices to communicate and interact both with one another and with more centralized controllers, as necessary. It will also decentralize analytics and decision making, enabling real-time responses." (Boston Consulting Group)

The innovation brought by the industrial internet, also known as the Internet of Things (IoT), introduces a new form of interaction, no longer limited to people, between people and objects,

called Man- Machine Interaction (MMI), and also between objects and objects, called Machine to Machine(M2M).

The IoT represents the first authentic evolution of the Internet and its application, it allows to create a network of physical objects (things) that inherently have the necessary technology to detect and transmit, through the Internet, information about their own state or about the external environment. The internet industry is composed of an ecosystem that includes the objects, the equipment and sensors necessary to guarantee communications, applications and systems for data analysis. Through its use, the supply-chain is shortened and synchronized, improving time to market and the ability to respond to the variable consumer demand, allowing scale production even for very small batches.

The fields in which it is applicable are very varied, including industrial applications, logistics, remote assistance and environmental safeguard.

Embedded computing and networking will connect transducers and devices, and these are an essential part of Industry 4.0. The industrial Internet of Things will make this possible, since transducers and field devices designed for the IoT and equipped with low-power radio networking to enable them to interact and communicate with each other, while also becoming connected with a gateway to a control and management layer, will become ubiquitous throughout the Smart Factory and supply chain. (Gilchrist, 2016)

1.3.6 CYBER-SECURITY

"With the increased connectivity and use of standard communications protocols that come with Industry 4.0, the need to protect critical industrial systems and manufacturing lines from cybersecurity threats increases dramatically. As a result, secure, reliable communications as well as sophisticated identity and access management of machines and users are essential."
(Boston Consulting Group)

The increased connectivity implied by the innovation of Industry 4.0, the need to protect industrial systems and production lines from cyber-attacks has recently grown exponentially.

The term cyber-security includes technologies, processes, products and standards necessary to protect connections, devices and data from unauthorized accesses, guaranteeing the necessary privacy and security in network operations and on open systems.

The data show that attacks and cyber threats continue to impact a large number of manufacturing companies, which in response are showing increasing attention to the issue of security, with investments in technologies and internal teams specialized in cyber-security.

To address this, cybersecurity measures have to be put in place that recognize the new vulnerabilities and challenges that integrating industrial control processes and systems with the Internet produces. (Gilchrist, 2016)

1.3.7 THE CLOUD

"More production-related undertakings will require increased data sharing across sites and company boundaries. At the same time, the performance of cloud technologies will improve, achieving reaction times of just several milliseconds. As a result, machine data and functionality will increasingly be deployed to the cloud, enabling more data-driven services for production systems." (Boston Consulting Group)

Cloud is a common, flexible and open-by-design IT infrastructure to share data, information and applications through the internet in order to follow the transformation of business models with the necessary capacity. Cloud computing skills flexibility, continuous releases of services with cycles of life reduced to months, progressive innovation and transversality.

Cloud computing enables flexibility, continuous releases of services with cycles of life reduced to months, progressive innovation and transversality; the development of a cloud computing technology platform composed of a series of modules that allow the interoperability of solutions, even heterogeneous, both open and proprietary, can give impetus to new digital processes and new ways of interacting between companies, citizens and public administration and to the development of Smart Cities; the main drivers for the adoption of the cloud will be the explosion of IoT and of the data collected by sensors and other objects, the consequent growth of big data, the pervasiveness of the social and the development of data about the consumer. (X Commissione Permanente Parlamento italiano, 2016).

The large data sets involved in Industry 4.0 means data sharing will be not only desirable but imperative to leverage the full possibilities within the value chain. However, few manufacturing plants will have the storage capacity to store and analyze the vast amounts of data collected. Fortunately, cloud service providers do have the capacity and can create private clouds suitable for manufacturing data storage and processing. (Gilchrist, 2016)

1.3.8 ADDITIVE MANUFACTURING

"Companies have just begun to adopt additive manufacturing, such as 3-D printing, which they use mostly to prototype and produce individual components. With Industry 4.0, these additive-manufacturing methods will be widely used to produce small batches of customized

products that offer construction advantages, such as complex, lightweight designs." (Boston Consulting Group)

Additive manufacturing is the name used to describe the technologies that allow the production of three-dimensional physical objects, of any shape and customizable without waste, starting from a digital model.

With industry 4.0, the application of additive-manufacturing technologies, such as the 3D printer, will be widely used to produce small batches of customized products, even in distant and different production sites, thus allowing cost optimization across the logistics and distribution chain.

Additive manufacturing such as 3D printing enables manufacturers to come up with prototypes and proof of concept designs, which greatly reduces design time and effort. Additive manufacturing also enables production of small batches of customized products that offer more value to customers or end users, while reducing cost and time inefficiencies for the manufacturer. (Gilchrist, 2016)

1.3.9 AUGMENTED REALITY

"Augmented-reality-based systems support a variety of services, such as selecting parts in a warehouse and sending repair instructions over mobile devices. These systems are currently in their infancy, but in the future, companies will make much broader use of augmented reality to provide workers with real-time information to improve decision making and work procedures." (Boston Consulting Group)

Augmented reality means the enrichment of human sensory perception through information, which would not be perceptible with the five senses, generated through sensory inputs such as sound, video or GPS data. The adoption of such technology allows the use of digital technology to add data and information, in real time, to the vision of reality and facilitate, for example, the selection of products and spare parts, or more generally any decision concerning the production process thus improving work procedures. Digi-Capital analysts believe that augmented reality will experiment a real boom in the next 5 years, reaching a turnover of 120 billion dollars in 2020. (X Commissione Permanente Parlamento italiano, 2016)

SECOND CHAPTER

2. DIGITAL TRANSFORMATION AND BUSINESS MODELS

In this chapter we will define digital transformation through a literature review, describing the key drivers and its impact on strategy. Then follows an overview of the concept and of the several definitions of business model over years, with a brief more detailed description of the Business Model Canvas. Therefore, innovation of business model, its barriers and opportunities are discussed. Finally, the impact of digital transformation on business model and the potential industry 4.0 business models are described, with a brief focus on smart products.

2.1 WHAT IS DIGITAL TRANSFORMATION?

How can we best define what digital transformation is? Perkin Neil and Abraham Peter conceived three foundational truths:

1. Digital transformation is inevitable. Change is happening whether you like it or not. You can either choose to respond or get left in its wake.
2. Digital transformation is about more than technology. It is also about strategy, process, culture, behaviors and people.
3. Digital transformation involves fundamental and comprehensive change. It is the reinvention of the way in which a company operates.

The authors also cite Clayton Christensen that had a useful way of framing an organization's capabilities (what it can and cannot do), defining three broad areas:

a) Resources (tangible ones like buildings and headcount, intangible ones like brands and IP);

b) Priorities (the consensus on what's right to do, the values, and the strategy;

c) Processes (the formal or informal way in which the work gets done).

This is useful since these aspects are mutually exclusive in that a part of a business cannot fit into more than one of the categories but are also collectively exhaustive (put together the three categories account for everything inside of the business). So digital transformation is fundamental in all three of these areas.

We can read from "Building the agile business through digital transformation" Perkin ans Peter that digital and business consultancy Altimeter defined digital transformation as:

“the realignment of, or new investment in, technology and business models to more effectively engage digital customers at every touchpoint in the customer experience lifecycle”. Thanks to this definition we understand that the shift required in not only technology, but also business models and customer experience. Yet it perhaps does not emphasize enough the changes to processes, ways of working and culture. So, bearing in mind Clayton Christensen’s way of summarizing the entire capabilities of an organization, Perkin and Peter conceived the following definition: “The transformation and reinvention of the resources, priorities and processes of a company in order to be fit for purpose in a digitally empowered world”. (Perkin Neil, Abraham Peter, 2017)

Schallmo and Williams (2018) broke the definition of “digital” down as following:

• Creating value at the new frontiers of the business world

• Optimizing the processes that directly affect the customer experience

• Building foundational capabilities that support the entire overall business initiative

In a Capgemini Consulting publication in cooperation with MIT Sloan Management, Westerman et al. (2011) defined digital transformation as “the use of technology to radically improve the performance or reach of enterprises.” Although the definition highlights the broad sense of the term, it fails to include the important ingredients for achieving digital transformation. It is important to stress the requisite elements that lead to digital transformation because without them, true digital transformation is not possible. The implementation of technologies into business processes is only a small part of digitally transforming a business. Technologies need to create additional value for the customers, the business itself, and other essential stakeholders. “To succeed in digital transformation, leading companies focus on two complementary activities: reshaping customer value propositions and transforming their operations using digital technologies for greater customer interaction and collaboration” (Berman, 2012). Digital transformation is also defined as a sustainable, company-level transformation via revised or newly created business operations and business models achieved through value-added digitization initiatives, ultimately resulting in improved profitability. (Schallmo and Williams, 2018)

2.1.1 BRIEF HISTORICAL REVIEW OF DIGITAL TRANSFORMATION

The digital transformation of enterprises can be dated back to the 1960s with the release of the then completely new mainframe computers. In the 1980s, e-mail began to spread in companies and then PCs made their appearance and, with them, IT applications in server mode and desktops. These innovations have brought new gains in productivity, but also, and far more than in the previous period, a significant transformation in the way employees work. A new milestone was met in the 1990s with the mass implementation of management software integrated in large enterprises, the emergence of CRM tools and the Business Intelligence (BI). However, what we should mainly consider is the development of the Internet; the digital transformation is no longer confined to the internal operations of companies. It starts to modify, sometimes in a radical manner, the commercial approach on the part of the companies vis-à-vis their customers, but also the relations with suppliers and partners. This trend has not slowed down its growth since the change in millennium. Since then, the pace of technological innovations involving digital technologies has been transformed into successive waves that rather appear more like a tsunami: the appearance and the distribution in record-breaking times of smartphones, including at the same time several innovations such as the ability to access the Internet in a mobile fashion and the geolocation of mobiles, big data and cloud computing. Other innovations in digital technologies are already available (connected objects, 3D printing, etc.) or still at the research stage (quantum computer, etc.) and no one is yet able to exactly foresee their uses and therefore their impact on companies' business. Today the digital transformation has transformed society as a whole, and not just companies. (Leignel, Ungaro, Staar, 2016)

In the retail industry, mass media advertising campaigns were considered important digital channels to reach customers in the 1990s and 2000s, even though purchases were still primarily made inside brick-and-mortar stores, often with cash. From 2000 to 2015, the rise of smart devices and social media platforms led to a drastic sea change in the methods customers used to communicate with businesses, and also the expectations customers had with regards to response times and multi-channel availability. Businesses started to see that they were now able to digitally communicate with their customers on an individual basis, and often in real time. An ever-growing selection of digital payment options such as PayPal also contributed to more and more online commerce and opportunities for web-based points of sale. Nowadays, there is a focus on mobile devices and on creating value for customers by leveraging the kinds of personalized customer data that mobile technologies can generate on a massive scale. Businesses are taking advantage of this personalized information and are able to better tailor

their products, communications, and interactions to fit customers' specific needs. (Schallmo and Williams, 2018)

As we are exploring the concept of digital transformation, a distinction is needed between the the terms "digitization" and "digitalization" because they are not interchangeable.

- *digitization*: transformation from analog to digital, i.e. the transformation of some type of analog or physical artifact into a digital artifact. The first example would be taking a photograph and turning it into a digital photograph. The second example would be a synthesizer, that creates sound through "continuous variables such as changing voltages" rather than binary 1s and 0s. Cisco has defined digitization as "the connection of people, process, data and things to provide intelligence and actionable insights enabling business outcomes". One of the definitions used for digitization is: "the goal is to create and deliver new value to customers, not just improve what is already being done or offered". (Schallmo and Williams, 2018)

- *digitalization*: this term was firstly used in a 1971 essay published in the North American Review. Robert Machal talked about the "digitalization of society" with regards to the limitations and potential for computer-aided research. A digital business consultancy, I-SCOOP (2016), defines digitalization as follows: "Digitalization means the use of digital technologies and of data (digitized and natively digital) in order to create revenue, improve business, replace/transform business processes (not simply digitizing them) and create an environment for digital business, whereby digital information is at the core." Digitalization is also defined as fundamental changes made to business operations and business models based on newly acquired knowledge gained via value-added digitization initiatives. (Schallmo and Williams, 2018)

Which are the main objectives of digital transformation? Of course, obtaining new data and using this data to reimagine old, rule-based processes. A more data-oriented approach allows for the opportunity to gain new knowledge and in turn reimagine innovative business models and operations. For example, Airbnb turned its attention from processes to data. In fact, Airbnb does not own its own physical assets (e.g. hotels). Instead of only making processes more efficient or quicker, which is the aim of automation, digital transformation requires individuals to rethink old processes and reimagine new processes and decisions. (Schallmo and Williams, 2018)

In Figure 2.1 are illustrated selected definitions referring to digital transformation.

Figure 2.1: defintions of digital transformation (Schallmo and Williams, 2018)

Reference	Definition
BMWi (2015: 3)	Digitization stands for the complete networking of all sectors of the economy and society, as well as the ability to collect relevant information, and to analyze and translate this information into actions. The changes bring advantages and opportunities, but they create completely new challenges
Bowersox et al. (2005: 22ff)	Digital Business Transformation is a "process of reinventing a business to digitize operations and formulate extended supply chain relationships. The DBT [Digital Business Transformation] leadership challenge is about reenergizing businesses that may already be successful to capture the full potential of information technology across the total supply chain"
Westerman et al. (2011: 5)	"Digital Transformation (DT)—the use of technology to radically improve the performance or reach of enterprises—is becoming a hot topic for companies across the globe. Executives in all industries are using digital advances such as analytics, mobility, social media, and smart embedded devices—and improving their use of traditional technologies such as ERP—to change customer relationships, internal processes, and value propositions"
Mazzone (2014: 8)	"Digital Transformation is the deliberate and ongoing digital evolution of a company, business model, idea process, or methodology, both strategically and tactically"
PwC (2013: 9)	Digital transformation describes the fundamental transformation of the entire business world through the establishment of new technologies based on the internet with a fundamental impact on society as a whole
Boueé and Schaible (2015: 6)	We understand digital transformation as a consistent networking of all sectors of the economy and adjustment of the players to the new realities of the digital economy. Decisions in networked systems include data exchange and analysis, calculation and evaluation of options, as well as initiation of actions and introduction of consequences

2.1.2 HOW DIGITAL FORCES IMPACT ON STRATEGY

Digital transformation is not about technology - it is about strategy and new ways of thinking. Transforming for the digital age requires your business to upgrade its strategic mindset much more than its IT infrastructure. (Rogers, David L., 2016) We have empirical evidence of that looking at the roles of technology leadership. A Chief Information Officer's traditional role is using technology to optimize processes, reduce risks, and better run the existing business. There is however an emerging role: the Chief Digital Officer. He is much more strategic, focused on using technology to reimagine and reinvent the core business itself. We know that strategy has five key domains: customers, competition, data, innovation, value. Rogers and David L. illustrate how digital forces are reshaping them:

1. *Customers*: In the digital age, we are moving to a world best described not by mass markets but by customer networks. In this paradigm, customers are dynamically

connected and interacting in ways that are changing their relationships to business and to each other. This is forcing businesses to rethink their traditional marketing funnel and reexamine their customers' path to purchase. Rather than seeing customers only as targets for selling, businesses need to recognize that a dynamic, networked customer may just be the best focus group, brand champion, or innovation partner they will ever find.

2. *Competition*: digital "disintermediation" is upending partnerships and supply chains - our longtime business partner may become our biggest competitor if that partner starts serving our customers directly. At the same time, we may need to cooperate with a direct rival due to interdependent business models or mutual challenges from outside our industry. Most importantly, digital technologies are supercharging the power of platform business models, which allow one business to create and capture enormous value by facilitating the interactions between other businesses or customers.

3. *Data*: most data available to businesses it is being generated in unprecedented quantities from every conversation, interaction, or process inside or outside the businesses. With social media, mobile devices, and sensors on every object in a company's supply chain, every business now has access to a river of unstructured data that is generated without planning and that can increasingly be utilized with new analytical tools. These "big data" allow firms to make new kinds of predictions, uncover unexpected patterns in business activity, and unlock new sources of value. Data is a vital part of how every business operates, differentiates itself in the market, and generates new value.

4. *Innovation*: traditionally, innovation was managed with a singular focus on the finished product. Because market testing was difficult and costly, most decisions on new innovations were based on the analysis and intuition of managers. As digital technologies make it easier and faster than ever to test ideas, we can gain market feedback from the very beginning of our innovation process and even afterward. This new approach to innovation is focused on careful experiments and on minimum viable prototypes that maximize learning while minimizing cost. Assumptions are repeatedly tested, and design decisions are made based on validation by real customers. In this approach, products are developed iteratively through a process that saves time, reduces the cost of failures, and improves organizational learning.

5. *Value*: traditionally, a successful business was one that had a clear value proposition, found a point of market differentiation (e.g., price or branding), and focused on executing and delivering the best version of the same value proposition to its customers

   year after year. In the digital age, relying on an unchanging value proposition may lead to challenge and eventual disruption by new competitors. The only sure response to a shifting business environment is to take a path of constant evolution, looking to every technology as a way to extend and improve value proposition to customers. Rather than waiting to adapt when change becomes a matter of life or death, businesses need to focus on seizing emerging opportunities, divesting from declining sources of advantage, and adapting early to stay ahead of the curve of change. (Rogers, David L., 2016)

Figure 2.2 illustrates the changes in strategic assumptions as businesses move from the analog to the digital age.

Figure 2.2: Changes in strategic assumptions from the analog to the digital age (Rogers, David L., 2016)

Changes in Strategic Assumptions from the Analog to the Digital Age

	From	To
Customers (chapter 2)	Customers as mass market	Customers as dynamic network
	Communications are broadcast to customers	Communications are two-way
	Firm is the key influencer	Customers are the key influencer
	Marketing to persuade purchase	Marketing to inspire purchase, loyalty, advocacy
	One-way value flows	Reciprocal value flows
	Economies of (firm) scale	Economies of (customer) value
Competition (chapter 3)	Competition within defined industries	Competition across fluid industries
	Clear distinctions between partners and rivals	Blurred distinctions between partners and rivals
	Competition is a zero-sum game	Competitors cooperate in key areas
	Key assets are held inside the firm	Key assets reside in outside networks
	Products with unique features and benefits	Platforms with partners who exchange value
	A few dominant competitors per category	Winner-takes-all due to network effects
Data (chapter 4)	Data is expensive to generate in firm	Data is continuously generated everywhere
	Challenge of data is storing and managing it	Challenge of data is turning it into valuable information
	Firms make use only of structured data	Unstructured data is increasingly usable and valuable
	Data is managed in operational silos	Value of data is in connecting it across silos
	Data is a tool for optimizing processes	Data is a key intangible asset for value creation

Innovation (chapter 5)	Decisions made based on intuition and seniority	Decisions made based on testing and validating
	Testing ideas is expensive, slow, and difficult	Testing ideas is cheap, fast, and easy
	Experiments conducted infrequently, by experts	Experiments conducted constantly, by everyone
	Challenge of innovation is to find the right solution	Challenge of innovation is to solve the right problem
	Failure is avoided at all cost	Failures are learned from, early and cheaply
	Focus is on the "finished" product	Focus is on minimum viable prototypes and iteration after launch
Value (chapter 6)	Value proposition defined by industry	Value proposition defined by changing customer needs
	Execute your current value proposition	Uncover the next opportunity for customer value
	Optimize your business model as long as possible	Evolve before you must, to stay ahead of the curve
	Judge change by how it impacts your current business	Judge change by how it could create your next business
	Market success allows for complacency	"Only the paranoid survive"

2.1.3 WHAT ARE THE DRIVERS OF DIGITAL TRANSFORMATION?

Digitalization opens up limitless possibilities, but it also calls for a profoundly different way of thinking and an extensive transformation of organizations, processes and corporate culture. This is because companies are facing considerable new requirements in the digital age - particularly when it comes to information technology. (Ferri, 2017)

- *Agility*: companies must not only identify and respond to the opportunities and risks of digitalization, they must also adapt quickly to changing market and competitive conditions. They must be able to implement, test, refine, and then potentially abandon, new ideas very rapidly. Agile IT is essential to this. The new approach is "build-measure-learn-improve", or even "try-fail-learn-improve". Contrary to the approach taken by traditional IT organizations, the goal here is not to develop the optimal system for the next ten years, but rather to implement an idea as fast as possible and optimize it in a continual learning process. Even though technology can't solve every problem, cloud computing is ideal for ensuring the agility, scalability and flexibility required here.

- *Ability to Innovate*: The ability to innovate is another essential challenge in the age of digitalization. Companies in the past focused on creating and marketing existing products and services more efficiently using (IT-based) process optimization. A fundamental cultural shift and new forms of collaboration and leadership are required in order to mobilize all of the innovative power in a company. The need for rapid innovation places new demands on IT because IT is often at the heart of innovations, thus playing an important role as an enabler.

This demands and promotes a new kind of culture which focuses on customer-centered activities, continuous change and sharing. Interactivity is the keyword – both within a company and with customers. An IT department is the ideal organization to coordinate the work because IT-driven innovations are increasingly at the core of new services, products and business models in the digital age.

- *Simplicity*: The key aim is to produce simple, intuitive applications and products. Simplicity and user-friendliness are demanded at every stage of digitalization, starting with the digital workplace (user experience) and going all the way to the digital transformation of the customer front-end (customer experience). Most IT departments today are struggling to maintain and operate their legacy systems, so they have limited resources available for innovation. They suffer under the complexity of their IT landscape which has evolved over the years through adaptations, expansions and integration measures. Furthermore, most systems were developed to support existing organizational units. The new IT must be lean IT, meaning that it should encompass simple, efficient, appropriate processes and forms of organization.

2.2 WHAT IS A BUSINESS MODEL?

"There's not a single business model…There are really a lot of opportunities and a lot of options and we just have to discover all of them" - Tim O'Reilly, CEO, O'Reilly

The concept of Business Model is relatively recent, so that there is not yet a unique and consistent definition commonly accepted. In the following section is introduced the concept of business model and its origins, together with a selection of some of the most known and significant business model definitions that literature has provided in recent decades.

2.2.1 BUSINESS MODEL DEFINITIONS: LITERATURE REVIEW

The business model concept became widespread with the advent of the Internet in the mid-1990s. Ghaziani and Ventresca (2015) searched for the use of the term in general management articles from 1975 to 2000, using the ABI/INFORM database, and found 1,729 publications that contained the term business model. Of these, only 166 were published in the period 1975-1994; the remaining (1,563) belonged to the period 1995-2000, revealing a dramatic increase in the incidence of the term. Some scholars supposed that the extensive use of the concept since the mid-1990s, may have been driven by the advent of the Internet (Amit & Zott, 2011), rapid growth in emerging markets and interest in "bottom-of-the-pyramid" issues and the

expanding industries and organizations dependent on postindustrial technologies (Perkmann & Spicer). (Zott et al., 2011)

Taking into consideration the definitions of business model over the years, there is heterogeneity among them. Stewart & Zhao referred to business model as a statement; Applegate, Weill & Vitale as a description; Morris, Schindehutte & Allen, Shafer, Smith & Linder as a representation; Dubosson-Torbay, Osterwalder & Pigneur and Timmers as an architecture; George & Bock, Osterwalder, Pigneur and Tucci as a conceptual tool or model; Amit & Zott as a structural template; Afuah & Tucci as a method; Afuah as a framework, Brousseau & Penard as a pattern and Seelos & Mair as a set. Surprisingly, however, the business model is often studied without an explicit definition of the concept. Of the 103 business model publications reviewed by Zott et al. (2011), more than one third (37%) do not define the concept at all, taking its meaning more or less for granted. Fewer than half (44%) explicitly define or conceptualize the business model, for example, by enumerating its main components. The remaining publications (19%) refer to the work of other scholars in defining the concept. Moreover, existing definitions only partially overlap, giving rise to a multitude of possible interpretations. (Zott et al., 2011)

Figure 2.3 summarizes some of the most prevalent definitions of business model linked to the articles that have adopted them.

Figure 2.3 Business Models definitions (based on Zott et al. 2011 and Taran 2012; Georg Stampfl, 2014)

Author, Year	Definition
Timmers (1998)	The business model is "an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues."
Venkatraman & Henderson (1998)	"An architecture along three dimensions: customer interaction, asset configuration and knowledge leverage."
Selz (1999)	"A business model is architecture for the firm's product, service and information flows. This includes a description of the various economic agents and their roles. A business model also describes the potential benefits for the various agents and provides a description of the potential revenue flows".
Stewart & Zhao (2000)	A "business model is a statement of how a firm will make money and sustain its profit stream over time".
Linder & Cantrell (2000)	"The business model is the organization's core logic for creating value".
Hamel (2000)	"A business model is simply a business concept that has been put into practice. A business concept has four major components: Core Strategy, Strategic Resources, Customer Interface and Value Network."
Amit & Zott (2001)	A business model unveils "the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities."
Petrovic et al. (2001)	A "business model describes the logic of a business system for creating value that lies behind the actual processes".
Weill & Vitale (2001)	"A description of the roles and relationships among a firm's consumers, customers, allies and suppliers that identifies major flows of product, information and money and the major benefits to participants".
Chesbrough & Rosenbloom (2002)	A business model is "the heuristic logic that connects technical potential with the realization of economic value".
Magretta (2002)	Business models are "stories that explain how enterprises work. A good business model answers Peter Drucker's age old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?".
Osterwalder et al. (2005)	A conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, to generate profitable and sustainable revenue stream".
Morris et al. (2005)	A business model is a "concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets".
Chesbrough (2006)	"The business model is a useful framework to link ideas and technologies to economic outcomes." "It also has value in understanding how companies of all sizes can convert technological potential (e.g. products, feasibility, and performance) into economic value (price and profits)." "Every company has a business model, whether that model is articulated or not".
Johnson et al. (2008)	Business models "consist of four interlocking elements, that, taken together, create and deliver value": customer value proposition, profit formula, key resources, and key processes.
Skarzynski & Gibson (2008)	"The business model is a conceptual framework for identifying how a company creates, delivers, and extracts value. It typically includes a whole set of integrated components, all of which can be looked on as opportunities for innovation and competitive advantage".
Casadesus-Masanell & Ricart (2010)	"A business model is […] a reflection of the firm's realized strategy."
Teece (2010)	"A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value."
Zott & Amit (2010)	A business model is "a system of interdependent activities that transcends the focal firm and spans its boundaries".

Schallmo states that a business model is the basic, underlying logic of a company which describes what benefits are provided to customers and partners. A business model answers the question of how the benefits provided by the company also flow back into the company in the form of revenue. The value created enables a differentiation from competitors, the consolidation of customer relationships, and the formation of competitive advantage. A business model involves the following dimensions and elements:

- the *customer* dimension contains the customer segments, customer channels, and customer relationships.

- the *benefit* dimension includes products, services, and values.

- the *value-added* dimension includes the resources, skills, and processes.

- the *partner* dimension includes partners, partner channels, and partner relations.

- the *financial* dimension includes revenues and expenses.

The objective is to combine the business model elements in such a way that they mutually reinforce each other. Thus, it is possible to achieve growth in a way that is difficult for competitors to imitate. (Schallmo and Williams, 2018)

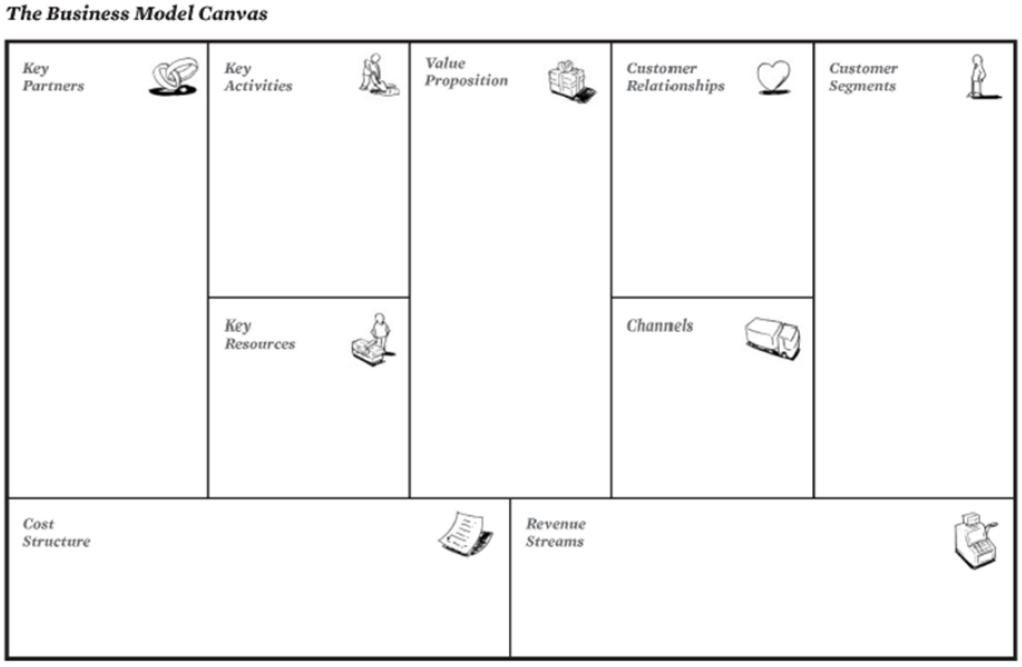
2.2.2 BUSINESS MODEL CANVAS

A recent contribution to the field of business model conceptualization is Osterwalder et al.'s Business Model Canvas (2010). Here the value proposition links the infrastructure of the company (down-stream activities and management to execution) with the customer (distribution and after sales relationships). In comparison to Bell et al. (1997), Osterwalder et al. (2010) get somewhat closer to the goal of identifying the 'how' of the business model, because they place the value proposition at the center of the model as an aligning feature between infrastructure interrelations such as competences, partner network and value configuration, and customer interrelations such as customer relationships, distribution channel, and target customers. The Business Model Canvas is a template from which to discuss the "how's" and "why's" of the activities and choices made by a company in order to achieve a sustainable position in their industry. The model does not prescribe any particular starting point for the analysis, or any particular order of discussion. Rather, it prompts the user to focus on natural connectivities between the nine building blocks. (Nielsen, C. & Roslender, 2012)

Regarding what are the elements of a business model, Osterwalder and Pigneur (2010) developed the Business Model Canvas, that has become a well-established framework for practitioners and firms to describe their business models and analyse them in order to find new strategic alternatives. The model is composed of nine building blocks, that cover the different types of firms' economics, from marketing to production to finance, namely: Value propositions, distribution channels and customer relationships; key resources, key activities and key partners; revenue streams and cost structure. (Paiola, 2018)

This tool resembles a painter's canvas—Preformatted with the nine blocks—which allows you to paint pictures of new or existing business models. The Business Model Canvas (Figure 2.4) works best when printed out on a large surface, so groups of people can jointly start sketching and discussing business model elements with Post-it® notes or board markers. It is a hands-on tool that fosters understanding, discussion, creativity, and analysis. (Osterwalder and Pigneur, 2010)

Figure 2.4: The Business Model Canvas (Osterwalder and Pigneur, 2010)



2.2.3 THE NINE BUILDING BLOCKS

Customer Segments

The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve. Customers comprise the heart of any business model. Without (profitable) customers, no company can survive for long. In order to better satisfy customers, a company may group them into distinct segments with common

needs, common behaviors, or other attributes. A business model may define one or several large or small Customer Segments. An organization must make a conscious decision about which segments to serve and which segments to ignore. Once this decision is made, a business model can be carefully designed around a strong understanding of specific customer needs. Customer groups represent separate segments if:

• Their needs require and justify a distinct offer

• They are reached through different Distribution Channels

• They require different types of relationships

• They have substantially different profitabilities

• They are willing to pay for different aspects of the offer

(Osterwalder and Pigneur, 2010)

Value Propositions

The Value Propositions Building Block describes the bundle of products and services that create value for a specific Customer Segment. The Value Proposition is the reason why customers turn to one company over another. It solves a customer problem or satisfies a customer need. Each Value Proposition consists of a selected bundle of products and/or services that caters to the requirements of a specific Customer Segment. In this sense, the Value Proposition is an aggregation, or bundle, of benefits that a company offers customers. Some Value Propositions may be innovative and represent a new or disruptive offer. Others may be similar to existing market offers, but with added features and attributes. (Osterwalder and Pigneur, 2010)

Channels

The Channels Building Block describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition. Communication, distribution, and sales Channels comprise a company's interface with customers. Channels are customer touch points that play an important role in the customer experience. Channels serve several functions, including:

• Raising awareness among customers about a company's products and services

• Helping customers evaluate a company's Value Proposition

• Allowing customers to purchase specific products and services

• Delivering a Value Proposition to customers

• Providing post-purchase customer support

(Osterwalder and Pigneur, 2010)

Customer Relationships

The Customer Relationships Building Block describes the types of relationships a company establishes with specific Customer Segments. A company should clarify the type of relationship it wants to establish with each Customer Segment. Relationships can range from personal to automated. Customer relationships may be driven by the following motivations:

• Customer acquisition

• Customer retention

• Boosting sales (upselling)

In the early days, for example, mobile network operator Customer Relationships were driven by aggressive acquisition strategies involving free mobile phones. When the market became saturated, operators switched to focusing on customer retention and increasing average revenue per customer. The Customer Relationships called for by a company's business model deeply influence the overall customer experience. (Osterwalder and Pigneur, 2010)

Revenue Streams

The Revenue Streams Building Block represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings). If customers comprise the heart of a business model, Revenue Streams are its arteries. A company must ask itself: “For what value is each Customer Segment truly willing to pay?” Successfully answering that question allows the firm to generate one or more Revenue Streams from each Customer Segment. Each Revenue Stream may have different pricing mechanisms, such as fixed list prices, bargaining, auctioning, market dependent, volume dependent, or yield management. A business model can involve two different types of Revenue Streams:

1. Transaction revenues resulting from one-time customer payments

2. Recurring revenues resulting from ongoing payments to either deliver a Value Proposition to customers or provide post-purchase customer support

(Osterwalder and Pigneur, 2010)

Key Resources

The Key Resources Building Block describes the most important assets required to make a business model work. Every business model requires Key Resources. These resources allow an enterprise to create and offer a Value Proposition, reach markets, maintain relationships with Customer Segments, and earn revenues. Different Key Resources are needed depending on the type of business model. A microchip manufacturer requires capital-intensive production facilities, whereas a microchip designer focuses more on human resources. Key resources can be physical, financial' intellectual, or human. Key resources can be owned or leased by the company or acquired from key partners. (Osterwalder and Pigneur, 2010)

Key Activities

The Key Activities Building Block describes the most important things a company must do to make its business model work. Every business model calls for a number of Key Activities. These are the most important actions a company must take to operate successfully. Like Key Resources, they are required to create and offer a Value Proposition, reach markets, maintain Customer Relationships, and earn revenues. And like Key Resources, Key Activities differ depending on business model type. For software maker Microsoft, Key Activities include software development. For PC manufacturer Dell, Key Activities include supply chain management. For consultancy McKinsey, Key Activities include problem solving. (Osterwalder and Pigneur, 2010)

Key Partnerships

The Key Partnerships Building Block describes the network of suppliers and partners that make the business model work. Companies forge partnerships for many reasons, and partnerships are becoming a cornerstone of many business models. Companies create alliances to optimize their business models, reduce risk, or acquire resources. We can distinguish between four different types of partnerships:

1. Strategic alliances between non-competitors

2. Coopetition: strategic partnerships between competitors

3. Joint ventures to develop new businesses

4. Buyer-supplier relationships to assure reliable supplies

(Osterwalder and Pigneur, 2010)

Cost Structure

The Cost Structure describes all costs incurred to operate a business model. This building block describes the most important costs incurred while operating under a particular business model. Creating and delivering value, maintaining Customer Relationships, and generating revenue all incur costs. Such costs can be calculated relatively easily after defining Key Resources, Key Activities, and Key Partnerships. Some business models, though, are more cost-driven than others. So-called "no frills" airlines, for instance, have built business models entirely around low-Cost Structures. (Osterwalder and Pigneur, 2010)

2.3 BUSINESS MODEL INNOVATION

In Chesbrough's (2010) words: "a mediocre technology pursued within a great business model may be more valuable that a great technology exploited via a mediocre business model". This means that firms' Business Models have to be innovated in order to unleash and exploit technological opportunities. (Paiola, 2018)

Ideas for business model innovation can come from anywhere, and each of the nine business model building blocks can be a starting point. Business model innovations affect multiple building blocks. Osterwalder & Pigneur identify four innovation drivers: resource-driven, offer-driven, customer-driven, and finance-driven. Each one can be the starting point for a business model change and can have a strong impact on the other eight building blocks.

- *resource-driven*: resource-driven innovations originate from an organization's existing infrastructure or partnerships to expand or transform the business model.

- *offer-driven*: offer-driven innovations create new value propositions that affect other business model building blocks.

- *customer-driven*: customer-driven innovations are based on customer needs, facilitated access, or increased convenience. Also, these kind of innovations affect other business model building blocks.

- *finance-driven*: innovations driven by new revenue streams, pricing mechanisms or reduced cost structures that affect other business model building blocks.

- *multiple-epicenter driven*: innovations driven by more than one driver can have significant impact on other building blocks.

(Osterwalder & Pigneur, 2010)

Chesbrough in his article "Business model innovation: Opportunities and barriers" analyzes the innovation of the business model. He concentrates on two aspects: the barriers that could be an obstacle to the process, such as the conflicts that may occur with existing assets and business models and then the need for awareness in the understanding of the barriers; and the analysis of opportunities, those processes that can be effective in overcoming these barriers: the experimentation, the effectuation and the importance of a successful leadership in the process of change. (Chesbrough, 2010)

2.3.1 BARRIERS TO BUSINESS MODEL INNOVATION

Chesbrough introduces the issue of barriers to innovation by asking a question: "Why do not companies experiment with new potential business models before reaching a breach point caused by external innovations?" This is not possible because companies face important barriers to experimentation with new business models. An example is the study conducted by Amit and Zott (2011). By choosing the business model as a unit of analysis, the authors have identified the novelty, lock-in and efficiency as the fundamental aspects at the basis of the business model's innovation. However, these can often conflict with the more traditional configurations of corporate assets. The authors have therefore identified a barrier in the conflict between novelty and tradition. (Chesbrough, 2010)

Christensen, professor of Business Administration at the Harvard Business School, published in 1997 the book "The Innovator's Dilemma", in which he explains the theory of disruptive innovation. Christensen assumes that in every market, given the variables of time and performance, there is a trajectory of growth in the performance of the use of a product or technology by consumers. This trend, however, is different depending on the consumers. For some of them a low level of performance may be enough, while for others it is necessary a high level of performance. When a disruptive technology enters the market, it initially offers a very low but constantly growing performance. In the early stages, the new innovation is not considered by the two different kind of consumers. In fact, on one hand, most of the market does not react positively due to the low quality proposed. However, the new technology is perfectly in line with the standards of that market segment that has no particular requirements. This niche of consumers, identified in low quality, could be attracted by the fact that it is offered a technology at advantageous prices or with new features not present in previous products. On the other hand, there are medium-demanding consumers. So, companies are not fostered to innovate due to the disengaged response of their customers, and in addition they do not realize that disruptive innovation is constantly growing up to reach a level of quality

that meets even most demanding performance expectations. Chesbrough defines disruptive innovation as a barrier to the innovation of the business model. In fact, the origin of the tension created by disruptive innovation is the conflict between the business model already established for the existing technology and the one necessary to exploit the emerging disruptive technology. (Chesbrough, 2010)

2.3.2 BUSINESS MODEL INNOVATION OPPORTUNITIES

According to Christensen and Amit and Zott, managers easily identify the correct business model, but its development is obstacled by the conflict with the previous business model, or the assets configuration at the basis. Chesbrough's researches demonstrated that managers are confused about the correct business model, and confusion is a third type of barrier. Chesbrough provides the tools that allow to overcome the barriers, understanding the opportunities and allowing a change of the business model. (Chesbrough, 2010)

Experimentation

Experimentation consists in undertaking tests in order to explore emerging markets with new potential configurations of a business model elements and can allow companies to understand in advance the rest of the market and to generate new tools that can arouse the process of change. There are several parameters to consider, including the costs of carrying out the test, the costs in case of failure, the time required to obtain the results and the amount of information obtained. Chesbrough, citing Thomke, explains that a distinction between failures and errors is needed: the formers are a natural consequence of the experimentation process and may be useful; the latter are experiments that lack a solid organizational base to obtain new results useful for the analysis. Companies should therefore strive to develop processes that provide high precision, in the shortest time and lowest costs possible, aiming to achieve overall results thanks to a series of "failures" that can lead to the possible alternative of business model. Osterwalder uses a scheme that separates the nine building blocks of business model, with the aim of analyzing the relationships between them. Tools such as maps prove to be very useful to explain a business model, but they cannot support experimentation and innovation by themselves. To do this, managers need organizational processes and enough authority to set out the experiments, and the ability to make decisions based on the results of the tests. (Chesbrough, 2010)

Effectuation

A second tool that allows to overcome the barriers is effectuation, which assumes that the future, even though unpredictable, can be controlled through human action. It contrasts with another form of reasoning: causality, which assumes that the future is theoretically predictable on the basis of previous events. In the case of causality, the objectives to be reached are determined in order to find useful resources. The effectuation, instead, determines the objective on the basis of the resources already in possession. Concerning business model innovation, the players do not study the market until they make decisions and consequent actions that allow to have new information. This means that they do not study the market until they implement it. There is a strong propensity to effectuation in cases where there may be insufficient data to analyze a new business model: without direct actions, no new data would be available. This occurs with emerging opportunities, which generally do not have a wide variety of data that can be used for evaluation. Therefore, the new data needed will be generated only through experimental actions. In these cases, tools such as mapping are very useful; in fact, they provide representations of both current and future business models, allowing managers to quickly deduce many of the probable implications brought by that change. (Chesbrough, 2010)

Leadership in the Management of Change

The third process for the innovation of business model is the management of the change within the organization. Christensen compares the process to a puzzle: although the staff is composed of different players, the business model will require a strong interaction between operations, marketing, sales and accounting; the experimentation of the business model could easily lead to conflicts with some of these functions. Regarding coordination and organization of the change itself, we can distinguish the approaches of the general managers, depending on whether they operate in small or large companies. In fact, the heads of small businesses are more skilled in the organization, especially if companies are of their own ownership; small companies have advantages due to a unity of intent and dedication, which means a rapid decision-making process and a high flexibility and adaptability to changing environmental conditions. However, since there is an overlap between the founder, owner and controlling interest, it may happen that the latter is reluctant not only to share decision-making power, but also to make changes to entrepreneurial and managerial resources. In addition, it may happen that the current business model is perceived as familiar and comfortable to be changed with a potential and alternative model that is unknown and potentially risky. Because of this situation, the owner could react with measures that slow down the experimentation process.

Instead, in the case of large companies, the interfering figure could be identified by the general managers of specific businesses. Although they have the authority to carry out the change, they typically make changes from one position to another every two or three years, a period too short to formulate an experiment and develop deductions and interpretations and then restructure the analysis in order to drive a transformation that leads to a new business model. There are strong barriers for companies to the innovation of the business model, but the right one is that of an experimental attitude towards the innovation of the business model. Leaders can authorize the launch of high fidelity, low costs, rapid execution and experiments that generate information. These new data will be reflected in new models and leaders must have the power to act on these results and overcome the barriers that surround and protect the existing business model. The leadership process must address the many constituencies involved within the organization without being involved and influenced in a negative way by the problems between them. (Chesbrough, 2010)

2.4 DIGITAL TRANSFORMATION OF BUSINESS MODELS

Digital transformation is not about technology, it is about change. In a digitized universe, businesses need to renovate and change their organizations, including their business models, people, structures, critical competencies, and cultures. In fact, the relationship with customers depends on creating new digital ways for them to interact with the company. Digital transformation is not really about digital. Technologies are the vehicle. Given that every enterprise can use these digital technologies, they don't always offer a competitive advantage. The key is *differentiating your business* by offering customers something new and compelling, enabled by the vehicle that digital offers, and creating a destination that customers want to visit. Weill & Woerner call this process *creating the next- generation enterprise*.

There are six key questions that leaders must consider and then use Digital Business Model framework to lead to a successful transformation:

1. Threat: How strong is the digital threat to your business model?
2. Model: Which business model is best for your enterprise's future?
3. Advantage: What is your competitive advantage?
4. Connection: How will you use mobile technologies and the internet of things (IoT) to connect and learn?
5. Capabilities: Are you buying options for the future and preparing for the necessary organizational surgery?

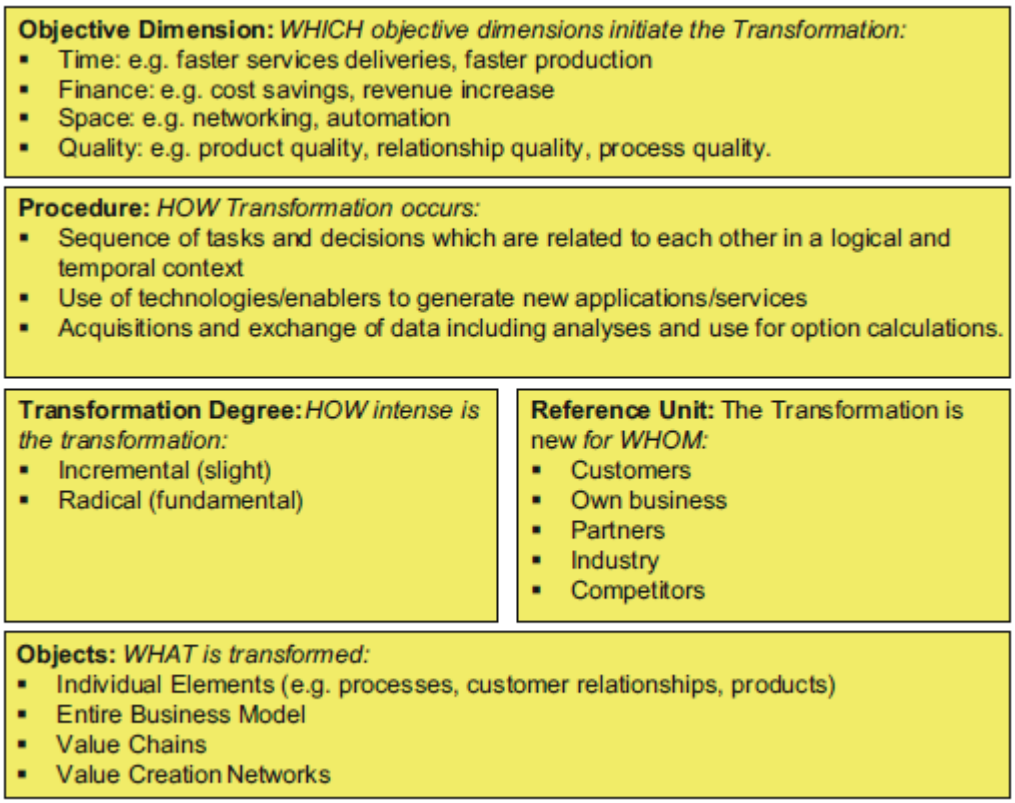
6. Leadership: Do you have the leadership at all levels to make transformation happen?

Enterprises need to answer, with actionable decisions, the six questions above just and then iterate, course-correct, and learn from their actions to go to the next step in the continuous journey of reinvention. It is this willingness and flexibility that differentiates success from failure. (Weill & Woerner, 2018)

2.4.1 DIGITAL TRANSFORMATION APPROACHES

The digital transformation of business models relates to individual business model elements, the entire business model, value-added chains, as well as the networking of different actors in a value-added network. The degree of the digital transformation relates to the incremental (marginal) as well as the radical (fundamental) change of a business model. The reference unit with regards to the level of novelty is primarily the customer, but it can also affect its own business, partners, industry, and competitors. The digital transformation of business models is based on an approach which includes a sequence of tasks and decisions that are related to one another in a logical and temporal context. It affects four target dimensions: time, finance, space, and quality. (Schallmo & Williams, 2018)

Figure 2.5: Digital transformation of business model definitions and components (Schallmo & Williams, 2018)



Innovation of a business model includes changes in individual business model elements (e.g., customer elements, services, etc.) or changes to the entire business model. The digital transformation of business models is based on existing business models, with a change of their elements or creation of new ones. Schallmo & Williams (2018) illustrate three existing digital transformation approaches that are the basis for a Roadmap to the digitalization of a business model.

A. ESSER'S APPROACH

Esser defines five phases that outline the development plan for a digital transformation strategy and its implementation: analysis, strategy, design, organizational impact and transformation.

1. *Analysis*

Analysis focuses on four areas: customers, competitors, markets, and business capabilities. Customer needs and values are analyzed and segmented. Competitors are described and measured by their current market performance and positioning. Newcomers to the market are also considered. Market is analyzed based on its size, potential, limitations and future developments. Finally, available business capabilities are gathered.

2. *Strategy*

It includes the definition of market position, the decision on how to differentiate the business, and the selection of the customer target group.

3. *Design*

Design is based on three areas: vision for the customer experience, i.e. a statement about what the business would like to achieve; value proposition, that answers the question of how and with what services can capture customers; identification of opportunities, that assesses current and new design ideas.

4. *Organizational Impact*

Organizational impact refers to the people, the structure, and the culture within the business. It is included an examination of processes and systems, and the definition of governance and control.

5. *Transformation*

The transformation ultimately dictates the Roadmap and program management. In addition, internal communication as well as change management are planned. Lastly, branding and external communications are defined. (Schallmo &Williams, 2018)

B. PRICEWATERHOUSECOOPERS' APPROACH

PricewaterhouseCoopers (PwC) defines six phases for digital transformation:

1. *Strategy*

The strategy is developed in the first phase, and the effects of digital dynamics should be understood here. The company's current position is determined, and a new business model is designed. Therefore, safety assessment, value-creation analysis, legal and tax ramifications are considered. Finally, corporate culture and human capital are analyzed.

2. *Design*

The second phase is the design of the transformation Roadmap. Here, the collaboration model, the value-creation network, and the operating model are defined. In addition, the target architecture, the transformation plan, and the target model for corporate culture are determined. Lastly, the tax and legal aspects are modeled.

3. *Construction*

The third phase is construction, which completes the development of a digital business platform. Here, governance is introduced, and a platform or application is developed. The operating model and business/IT services are adapted based on this construction. Digital security and skill management are also defined.

4. *Implementation*

The implementation phase initiates the previously developed business platform. Quality assurance and employee training are rolled out to ensure a successful transition.

5. *Operation*

In this phase, new business models are considered while in operation as running systems. Here, governance, the platform, application management and reporting play a vital role.

6. *Review*

The last phase is review, which includes performance monitoring and optimization. Service level adjustments are made and operational optimizations as well as optimizations to the business model are carried out.

C. BOUÉE AND SCHAIBLE'S APPROACH

Bouée and Schaible describe a digital transformation master plan that is specifically designed to address a digital future.

1. *Analysis of the Influence of Digital Technology on the Industry*

In this phase, different future scenarios are forecast and potential changes in value chains are analyzed. Therefore, technologies are categorized, and relevant market participants are evaluated. Here several changes are frequently identified.

2. *Comparison with Current Position of the Company*

In this phase there is the analysis of opportunities and risks for the existing business. Furthermore, affected products, customers, and regions are analyzed. Digital capabilities such as human resources or partnerships are defined, and the digital business strategy is established. Resulting implementation and competence gaps are identified.

3. *Implementation of the Roadmap*

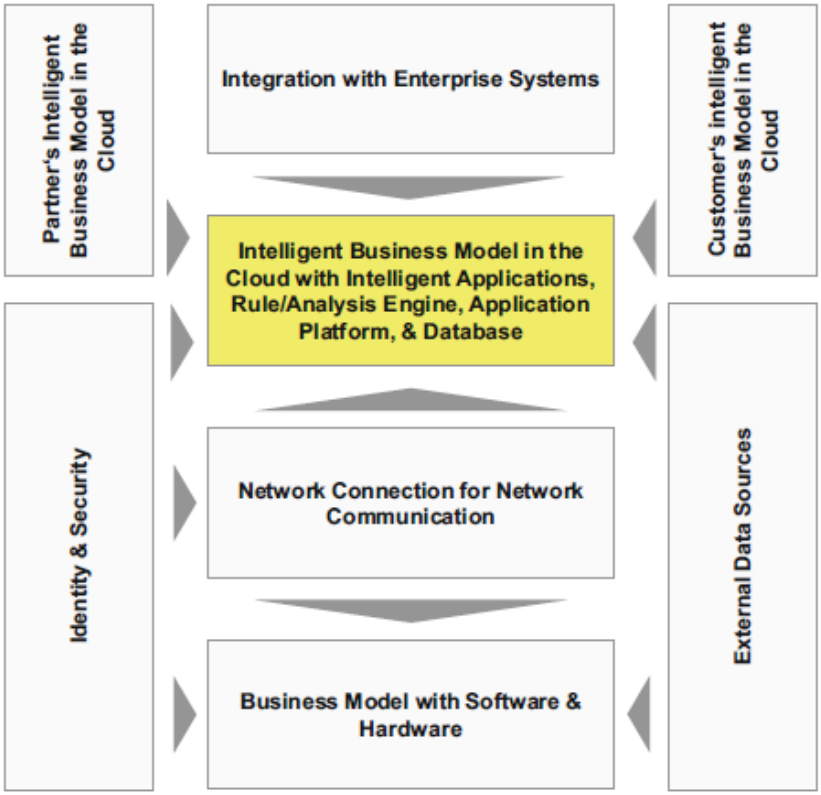
In this phase, relevant options for the future scenarios are defined. For example, digital skills in need of further development are identified and cooperative market participants are discussed. The Roadmap for the digital transformation of business models has five phases: digital reality, digital ambition, digital potential, digital fit and digital implementation.

- *Digital Reality*: in this phase, the company's existing business model is outlined, along with a value-added analysis related to stakeholders and a survey of customer requirements.
- *Digital Ambition*: based on the Digital Reality, objectives are defined for the digital transformation. This phase determines which objectives should be considered for the business model and its elements and with which priority.
- *Digital Potential*: best practices and enablers for the digital transformation are established. It is a starting point for the design of a future digital business model. The different options that emerge for each future business model element are combined and connected in a logical manner.
- *Digital Fit*: it looks at options for the design of the digital business model. These options are evaluated to determine Digital Fit with the existing business model. This ensures that customer requirements are met and that business objectives are achieved. The evaluated options are then prioritized.
- *Digital Implementation*: it includes the finalization and implementation of the new digital business model. It also includes the design of a digital customer experience and a digital value-creation network, which describe the integration of the new business model with partners. The resources and capabilities are also identified in this phase.

The process model aims to enable the digital transformation of business models. In addition to the application of the entire model, it is also possible to customize the process model by combining or skipping individual phases and activities. (Schallmo & Williams, 2018)

In the ideal scenario, the processes described above conclude and result in an intelligent business model which is characterized by a sophisticated technological infrastructure that is integrated into a cloud. The starting point for this ideal scenario (Figure 2.6) is a business model with products, services, processes, etc., using hardware and software. The software includes embedded operating systems, software applications, and an advanced user interface. The hardware includes embedded sensors and processors, network connections and antennas, in addition to traditional mechanical components. The engine analysis contains rules, business logic, and big-data analysis capabilities. It provides information and enables new insights into products, services, processes, etc. The intelligent business model within the cloud is tied to corporate systems and linked to intelligent business models by customers and partners within the cloud. In addition, there is a network with external data sources. Within the framework of connection-to-connection enterprise systems, tools are used that deliver data from intelligent, networked business models to core systems. External data sources include connections to information from external sources that serve as a database (e.g., weather, traffic, energy prices, social media, geo-location) for business model functions. User identities and security are ensured with tools that facilitate the management of user profiles and system access. The objective is to secure the business model, network connectivity, and cloud components. (Schallmo & Williams, 2018)

Figure 2.6: Intelligent business model including technological infrastructure (Schallmo & Williams, 2018)



2.5 POTENTIAL 4.0 BUSINESS MODELS

The operational benefits that enabling technologies of Industry 4.0 potentially allow to obtain on individual building blocks have an impact on the critical success factors underlying the value propositions and, therefore, on the strategic dimensions. The potential impact of Industry 4.0 on critical success factors and, therefore, on strategic dimensions, allows to design new value propositions to create new business models. The latter have in common the opportunities that the enabling technologies offer in terms of collection, use and sharing of data. In fact, data becomes a strategic asset that helps generate value and allows to create offers based on integration and new services.

Bagnoli et al. (2018) recognized 12 potential 4.0 business models, that is possible to group on the basis of the impact that the related operating benefits have on critical success factors and, therefore, on strategic dimensions, in four meta-business models 4.0.:

- *smart factory business model*: linked to the strategic dimension of Operational Excellence 4.0. This meta-business model 4.0 aims to solve the meta-strategic paradox "serial production-singular production" to obtain a unique product, customized through a standardized industrial production process. The smart factory business model consists of the following industry 4.0 business models:

    - smart manufacturing;
    - mass customization;
    - productive hubs & spokes;

- *servitization business model*: linked to the strategic dimension of Product Leadership 4.0. This meta-business model 4.0 aims to solve the meta-strategic paradox "tangible product-intangible product" to sell the intangible qualities of tangible goods, but also the tangible qualities of intangible services. The servitization business model consists of the following industry 4.0 business models:

    - add-on hardware services;
    - add-on software services;
    - everything as-a-service services;

- *data-driven business model*: linked to the strategic dimension of the Familiarity with the Customer 4.0. This meta-business model 4.0, used mainly by companies operating in Customer-to-Business (C2B), i.e. in sectors where new products are developed starting from

data generated by customer experience, aims to solve the paradox of "knowledge exploitation-knowledge exploration" to exploit existing knowledge by generating the financial resources necessary to explore new (customer) knowledge, but at the same time to explore new knowledge to generate the intellectual resources necessary to exploit existing knowledge. The data-driven business model is divided into the following industry 4.0 business models:

- smart customer experience;
- direct data monetization;
- indirect data monetization;

-platform business model: linked to the strategic dimension of the Ecosystemic Leadership 4.0. This meta business model 4.0, adopted especially from companies operating in consumer-to-consumer (C2C), aims to solve the paradox "producer-consumer" to ensure that the final consumer of goods and services is not limited to the role of passive consumer, but actively participates in the different phases of the production process taking the role of prosumer (crasis between pro-ducer and con-sumer). The platform business model is articulated in the following industry 4.0 business models:

- smart product;
- smart innovation;
- broker & technology platform. (Bagnoli et al., 2018)

2.5.1 SMART PRODUCTS AND BUSINESS MODELS

With the rise of IoT, the growing number of smart and connected products entered into the market, change industry domains and the structure of competition. With service-driven business models, they are reshaping industry boundaries and creating entirely new industries (Porter and Heppelman 2014). Based on PTC 2017, smart, connected product capabilities can be grouped into four categories:

- *Monitor*: Sensors and external data sources enable monitoring of the product's condition, operation, and external environment to generate alerts and actionable intelligence.
- *Control*: Software built into the product enable control and personalization.
- *Optimize*: Monitoring and controlling capabilities enable optimization algorithms to enhance product performance and perform remote service and repair.

- *Automate*: Combination of monitoring, controlling and optimization capabilities enhanced with software algorithms and business logic allows the product to perform autonomously.

Smart and connected products having enhanced capabilities allow the radical change in business models. A shift from a product-based to service-centric business models has emerged (Porter and Heppelman 2014). This transformation forces the companies to differentiate their value chain alignment, set new strategic decisions to cope with competition, redefine the organizational structure and change their application success factors. Value propositions, revenue streams, and technologies are the primary determinants of smart and connected product business models. (Ustundag & Cevikcan, 2018)

Dijkman et al. adopted Business Model Canvas to the IoT business models. In this study, key partners in IoT models are hardware producers, software developers, and other suppliers, data integration, launching customers, distributors, logistics and service partners. The main activities are customer development, product development, implementation/service, marketing/sales, platform development, software development, partner management, logistics. Key resources are physical resources, intellectual property, employee capabilities, financial resources, software, and relations. Value propositions are newness, performance, customization, getting the job done, design, brand/status, price, cost reduction, risk mitigation, accessibility, convenience/usability, comfort, and the possibility for updates. Customer relationship components are personal assistance, dedicated assistance, self-service, automated service, communities, and co-creation. Channels are sales-force, web sales, own stores, partner stores, and wholesaler. Customer segments are mass market, niche market, segmented, diversified and multi-sided platforms. Cost structures are product development cost, IT cost, personnel cost, hardware/production cost, logistics cost, marketing, and sales cost. Asset sale, usage, rental, subscription, licensing, installation and advertising fees are the main revenue streams. (Ustundag & Cevikcan, 2018)

If we consider Industry 4.0 from a purely technological point of view, it could seem that only a maturation of already existing technologies is in place, such as additive manufacturing, autonomous robots, augmented reality, cloud computing, industrial IoT, Big data & analytics, cyber security and vertical and systemic integration horizontal. Consequently, many companies see Industry 4.0 as a way to increase internal efficiency according to a logic of incremental innovation. The real substantial novelty, the real game changer is the industrial IoT, the internet brought into productive things and resources. Thanks to IoT technologies objects become smart, smart objects, they can be connected to digital networks and

communicate, transmitt and receive data in digital format. This the real transformation in place. (Bagnoli et al., 2018)

THIRD CHAPTER

3. WHAT IS VENDING: AN EMPIRICAL EVIDENCE

3.1 VENDING HISTORICAL OVERVIEW

The term “Vending” identifies the channel of automatic distribution, a great Italian excellence. Italy is a world market leader thanks to the presence of the main manufacturers of distributors and payment systems, thanks to important product brands and service management companies that have a business model that is considered one of the most advanced in the world. Today, after the main utilities, such as electricity, gas and water, the most widespread installations are the 2.5 million "coffee machines”. However, there is still a low awareness of the fact that vending is one of the great Italian excellence. Following the main market trends, consumers are oriented towards consumption outside the home, so a bright future is potential for this sector. Italian vending is essentially linked to three different professional figures: a manufacturer who builds a vending machine, a manufacturer who makes available the products suitable for consumption and a manager who purchases products and machines and installs them, guaranteeing the service. Over the years this supply chain was joined by retailers and service companies, but the essence of vending is always strictly dependent on this characteristic "trinity". A common error is to think that automatic distribution in our country began in 1945 with the installation of Coca-Cola vending machines. The Italian vending, as we conceive it today, took place in 1963 with a machine named E61, a product (coffee beans) and some pioneers who “invented” a new profession, the manager, by installing these distributors in some large industrial realities. Ernesto Valente, called “Mr. Faema”, sole director of the company of the same name, introduces this “new” reality that today satisfies 22 million Italians through over 6 billion consumptions per year. Before, there was nothing and there was no local refreshment break service. Faema (founded in 1945 under the name of Fabbrica Apparecchia Elettro-Meccaniche e Affini) in the 1960s was one of the most famous brands in the world in the sector of coffee machine production for coffee shops. In 1963 the founder of Faema had the idea to create a vending machine that was inspired by the E61, even maintaining the same name.

Figure 3.1: E61 of Faema ((Fontana, 2015)

This was a remarkable entrepreneurial challenge for managers. They had to buy a machine that could cost a few million of the old Lira (previous Italian currency), find a location where to install it and learn to do the complex technical maintenance. In 1967, with Antonio Adriani, the FAS was born, a company that is still a reference point for snack and food machines. In 1968 the first prototype of an "all-Italian" snack machine was released, with the technical characteristics to be a reference model throughout the world. For managers this was a crucial step: in the years of the economic boom new consumption trends started to spread and there was demand for other products in addition to coffee. Once identified the emerging product, the FAS concentrated on it, respecting the principle that: "everything can be sold through vending machines".

Figure 3.2: The first FAS distributor ((Fontana, 2015)

Therefore, the first oil crisis of 1973 generated a very strong inflation in Italy. One of the side effects of this situation was the gradual disappearance of the currency, especially in the 50 and 100 Lira coinage (mostly used in vending machines). For the automatic distribution, the absence of money was a huge complication. However, Italian vending had the strength to turn it into an opportunity. In fact, the first companies exclusively dedicated to payment systems were born (they accepted special coins replacing the money), which in the following years would have become industrial excellence of the made in Italy and which would have offered managers different solutions to overcome the problems related to the use of money. COGES, a company born in 1977, started the activity with only one employee and produced the first electromechanical coin validators. By the end of the 1970s, it is now clear the interdependence of the three categories of the vending supply chain and only through dialogue between the three components it is possible to overcome the crisis and restart the economy.

To protect the interests of managers and builders, two associations, ANIDA and ANIE, were in place, but in May 1979, approximately thirty of the most representative operators of Italian vending met at the headquarters of the "Unione dei Commercianti" in Milan with the purpose of laying the foundations for the establishment of a new Association: CONFIDA, acronym of Italian Confederation of Automatic Distribution, in which all operators could finally merge, regardless of their belonging to the supply chain. While the already cited "Faema's E61" was the main tool that allowed managers in 1963 to begin the adventure of Italian vending, the "1X", produced by Unoper of Gattinara, was the machine that gave rise to the OCS (Office Coffee System) segment, a fundamental step for the entire history of vending.

The reasons are the following. The tertiary sector was beginning to strengthen, and employment was shifting from industry to services. This caused the exponential increase of much smaller companies with less employees. The tertiarization index of the economy exceeded 70% in the most advanced countries and was above 60% in Italy. The rise of many companies with 3-10 employees, changed the needs of the managers that needed a different business model to be able to seize the opportunity to offer a service within these small companies. This is the reason why "1X" was the answer. With a low initial investment, they could amortize the cost of the machine even in case of a limited number of consumptions. Furthermore, its small size made it possible to place it even in smaller offices. However, the real problem was the service. It was not feasible to serve hundreds of small offices, guaranteeing one or more weekly checks, as usual. The costs would have been unsustainable. For this reason, the creation of a single-dose coffee, enclosed in a plastic pod, able to deliver a

quality product through a dedicated machine, changed the rules of vending sector. The "1X" was a tool able to spread a proximity service in any office with a winning business model.

Figure 3.3: 1X (Fontana, 2015)

In 1989 an event gave a strong impetus to the vending sector: Lavazza purchased the Unoper. The acquisition changed the history of this market, because a powerful operator as Lavazza decided to invest in a project still not fully developed and to exploit a system able to offer a product as coffee packaged in single-dose pods. For the first time, a brand universally recognized by consumers (Lavazza was the first in Italy with a brand awareness of 96%) entered a system dedicated to vending. The automatic distribution still suffered from a not always positive perception by the consumer and, to overcome this limitation, it was essential to refer to a consolidated brand, a signal of guarantee, quality and reliability. The consumer perception began to improve significantly. The coffee machine became an irreplaceable meeting point for moments of relaxation thanks also to its aesthetic values, achieved through a successful design which had a decisive weight in the sector. In 1995 Lavazza launched the "EP 2100" model on the market, better known as "Lavazza Pininfarina". Pininfarina is perhaps the most famous designer in the world and his projects have always been the symbol of design and Italian style. This machine has been in production for 15 years and still represents an important part of the installed and working OCS machine park. (Fontana, 2015)

Figure 3.4: Lavazza Pininfarina Ep 2100 ((Fontana, 2015)

The Fiscal law of 1995 established the obligation to install on all distributors payment systems with magnetic card that could be monitored by the tax authorities. The Association was actively committed to block this impractical law proposal. In 1996 CONFIDA participated in a meeting at the Ministry of Finance and strongly supported the practical and economic inapplicability of fiscal magnetic cards. The main lines of intervention of the Association were the activities connected to the CE marking, the definition of communication protocols between distributors and peripheral devices and the advent of the new European currency. (CONFIDA, 2010)

One of the turning points in the history of automatic distribution in Italy is represented by a meeting of the CONFIDA Executive Committee on 26 February 1997 in Milan. For the first time it was discussed whether it was possible to manage the sector fair directly and through the use of internal resources. Almost all exhibitors at that fair were also associated. The name chosen for the event was "Venditalia", that nowadays is universally recognized as the leading international vending fair, a point of reference for Automatic Distribution, which takes place every two years in spring. On January 1, 2002, Euro was the new currency in circulation. For vending it was a huge problem. Hundreds of thousands of machines had to be updated very quickly, through the introduction of payment systems able to accept the new currency. The first months of 2002 involved strong commitment for the whole sector which, without any contribution from the State, invested 150 million euros and took over the entire conversion of the new currency into vending. Over the years the world of management companies was consolidating on increasingly advanced business models. In 2004, vending generated a turnover of around 1.5 billion euros, with 70% of the market made up of around 1,800

companies with a turnover of less than 1.8 million euros. The pulverization of management companies, that is a characterizing element of sectors with companies mainly dedicated to proximity services and the dominant model in vending, began to disappear and larger companies start to arise. These new realities could guarantee the refreshment break in larger areas and benefit from all the advantages of large organizations (economies of scale, synergies, investment potential, privileged relationships with suppliers, etc.). In the early 2000s were created the first large vending management groups, through the consolidation and merging of some of the main companies in the sector. The situation, however, was destined to change because private equity funds noticed the great results of the main management companies and their great availability of liquidity thanks to the peculiar business model (they received fees before paying the suppliers). In 2003 Quadrivio SGR and San Paolo IMI Private Equity completed the first MBO operation in Italian vending, acquiring the majority of the Argenta Group. The world of finance had definitively entered the vending sector. Vending wanted finally to “step out of the shadows” and this complicated objective was finally achieved by President of CONFIDA Lucio Pinetti during his mandate (2010-2014), through a long series of activities that paid attention to the communication of vending values. Pinetti was also one of the first to understand the importance of undertaking initiatives to enhance the vending sector addressed to the end consumer. In the first year of his mandate, the Managing Committee of CONFIDA authorized the investment of one million euros for a communication project through national media (TV, newspapers, radio and internet) that could spread the values of vending to its customers. In 2012, Italian vending, like all the main sectors of the Italian economy, suffered the consequences of a strong economic crisis that affected consumption for the first time even in automatic distribution, causing a general suffering of the entire supply chain. The need to "invent" something different arises for the sector, focusing above all on innovation and on the identification of new potential markets. Innovation and the intersection of different commercial experiences could be the engine of new applications and complementary commercial proposals. Vending therefore decide to expand out of offices, to become an available technology so that every component of the sector could use it. Vending machines starts having inside a computer, contents and a connection to a network. It is possible to start talking about a transition to the "Digital Vending Network". The last but not least change in vending happened with the overcoming of its main dogma: the “manufacturer-producer-manager” trinity. In fact, there is a fourth fundamental figure that is inextricably part of the vending supply chain, the final consumer. Operators have always been concerned about meeting only the needs of their direct customers. It is necessary to understand and respond consistently to the needs of the final

consumer, offering him a range of products and services to which he is really interested. Consumers' satisfaction and loyalty must always be the ultimate goal of corporate strategies. That is why one of the most important results of CONFIDA was the agreement signed with Adiconsum, the association of consumers with over 122,000 associates, established in 1987 on the initiative of CISL. The final consumer thus becomes the first partner of the Automatic distribution. (Fontana, 2015)

3.2 VENDING MACHINES: A GENERAL OVERVIEW

What is the definition of a vending machine? According to the "Business Dictionary" definition it is an "electronic machine used to disperse a product to a consumer after a certain amount of money has been put into the machine. Vending machines are commonly used to disperse beverages and snack items, but in recent years companies have introduced vending machines that disperse other items, even including electronic items such as digital cameras or iPods." (BusinessDictionary)

"The earliest known reference to a vending machine is in the work of Hero of Alexandria, an engineer and mathematician in first-century Roman Egypt. His machine accepted a coin and then dispensed holy water. When the coin was deposited, it fell upon a pan attached to a lever. The lever opened a valve which let some water flow out. The pan continued to tilt with the weight of the coin until it fell off, at which point a counterweight snapped the lever up and turned off the valve." (Wikipedia, 2019)

3.2.1 SMART VENDING MACHINES

Like mobile phones switched into smartphones, vending machines have also, evolved into smart vending machines, even if more slowly. This development has been fostered by new technologies at a lower cost, such as large digital touch screens, internet connectivity, sensors, advanced payment systems, and several identification technologies (NFC, RFID, etc.). "Smart vending machines enable a more interactive user experience and reduce operating costs while improving the efficiency of the vending operations through remote manageability and intelligent back-end analytic." (Wikipedia, 2019)

In industry practice, a machine is loaded with inventory and then is essentially abandoned until the next scheduled loading time. No sales or inventory information is sent back during the intervening period, and no employees are even able to perform a visual check as the machines are not at the replenishing firm's location. However, technology is now available that can provide inventory level information for remote sites. (Ketzenberg et al., 2012)

Technology has changed consumer behaviour. The amount of time spent in front of a screen is constantly increasing, and it is affecting the way consumers respond to traditional, old school marketing practices and impulse purchases. Vending operators need to secure the technology in which they invest, reflects consumer behavior. According to Allied Market Research, technological advances such as wireless communication and remote management could help making this possible. “The integration of biometric security services such as fingerprint recognition, which ensure secured financial transactions, would boost the market growth”. (Vending International)

Vending is experiencing a real digital revolution. We talk about smart vending or Vending 4.0 in relation to vending machines that integrate touch screens, telemetry systems that allow remote control of the machine and applications that allow payment via mobile. Automatic distribution is oriented to a future without money. Currently, 84% of the machines allows to pay in a cashless way (with a USB key), 3% with a credit card and 2% with an application. But the latter are growing at a fast pace. "Italian companies that are world leaders in the production of vending machines - underlines the president of CONFIDA Massimo Trapletti - are betting on the development of mobile and contactless payment and they bet in particular on applications, that allow to communicate with the consumer, analyzing his preferences with the aim of improving the shopping experience”. (Beverfood, 2018)

Vending is also a growing sector. Today 11% of the coffee produced globally is consumed at the vending machine, with about 150 billion of consumptions yearly. The most interesting market is that of "smart" machines. According to the study of Persistence Market Research “Intelligent Vending Machines Market: Global Industry Analysis 2012–2016 and Forecast 2017–2025” the global market of smart vending machines, that are intelligent and connected, should exceed USD 15 billion in 2025. A CAGR growth of 15.3% is expected during the forecast period. Italy, according to CONFIDA, collected 3.5 billion euros in 2017 thanks to Europe's first machine park, slightly increased by + 0.65% in 2017. There are over 810 thousand vending machines in Italy, positioned at first place in Europe by number of vending machines, followed by France with 590 thousand vending machines and from Germany with 550 thousand. Distributors are mainly placed in industry (35%), followed by private offices (15%), commerce (13%), schools and universities (13%), hospitals (11%), public offices (6 %) and places of transit (4%) and leisure (3%). Investments in 2017 grew significantly (+ 12.1%), driven by the provisions concerning "Industry 4.0". (Beverfood, 2018)

At Venditalia, 57 out of 300 exhibitors come from foreign countries (including France, Spain, Germany, England, Holland). "The automatic distribution - explains the President of

CONFIDA Massimo Trapletti - is Made in Italy". The Italian vending machine companies in fact, export on average 70% of their production abroad. Italy has over 810 thousand vending machines installed (while France only 590 thousand and Germany only 550 thousand) and 3,000 management companies that offer a quality and certified service. (Venditalia.com) Vending is a considerable distribution channel: in 2017, the turnover of the automatic market exceeded the amount of 1.8 billion euros, reaching 5 billion consumptions with an increase of + 1.31% compared to the previous year. (CONFIDA)

	Valore 2017	Δ vs. 2016 %
Fatturato	1.865.378.753 €	+1,87%
Consumazioni	5.023.305.419	+1,31 %
Parco Macchine	810.630	+0,65 %

Figure 3.5: CONFIDA

Therefore, what has changed since 1963? Distributors have become more efficient, with a switch from coins to notes and then to USB keys; but in recent years, what has made the difference is the fact that these distributors have become "smarter". Thanks to the Internet connection, in fact, the machine can communicate in real time with a central, reporting on its operation, on which products have been sold, on the state of the warehouse and even on the collection. Furthermore, the new smart vending machines are characterized by numerous sensors that give the possibility to keep track of the temperature inside the vending machine or to detect any disruption in the delivery of the product. These elements greatly facilitate maintenance by the distributor operator that knows when a specific customer needs to fix a problem or needs a restock, making this activity more efficient and more economical. Internet also allows payments through credit cards or other payment systems that require a real-time verification and also makes it possible, for example, to choose the product through the smartphone, pay and withdraw the products purchased at the first vending machine available. (Beverfood, 2018)

"The vending of the new era - says Massimo Trapletti, president of CONFIDA - has a precise objective: to change the customer experience of the consumer by transforming the distributors into interactive tools". The new technologies "expand the offer" and "allow the consumers to create a product based on their own tastes"; moreover, through telemetry it is possible a "constant control on the machines to activate both the refueling procedures and the maintenance interventions". Together with technological development, the automatic distribution sector is constantly increasing the level of product quality, expanding its offer also with organic, environmentally sustainable foods and drinks. (Beverfood, 2017)

Today vending machines companies are increasingly leveraging on technology to effectively predict consumer demand patterns and to strategically position their vending machines to meet their needs; the use of technology allows to maximize supply chain efficiencies. Of course, data collected from customers make vending machines serve better the market. (ProfitableVenture.com)

Vending machines are data-rich and operationally companies have full control of the supply chain. This means power and control to make changes in the market while at a retail outlet the decision is ultimately controlled by the store owner. The race for optimal replenishment or shelf space is the most challenging problem in global consumer retail industry, costing suppliers and retailers 400 billion dollars in lost sales per year. Optimal product replenishment for retailers is the most relevant issue. This is a global problem: USA, Europe, Japan, LATAM, etc. – all face this problem. (Grinevich, 2019)

Manufacturers are for example adopting touchscreen technology for automatic interaction between users and the machine. Touchscreen interfaces are nowadays common in phones, tablets, laptops, cars, thermostats and smart watches. This screen technology provides machines with a better aesthetic appeal and vending operators utilize it for larger screen advertisements and sell advertising space at a more premium price. Touchscreen technology, together with advancements in telemetry and payment technology play an important role in vending. To satisfy consumer demand and offer the most forward-thinking solutions, operators must keep fast pace as these new technologies are having an increasing role in the sector. (Vending International)

The internet connection not only allows to accept payments with credit cards and other payment systems that require a real-time verification but also makes it possible to separate the moment of payment from that of the supply of the goods. For example, it is possible to choose what to buy through the smartphone, even when not in proximity of the machine, make the

payment and simply withdraw the products purchased from the nearest vending machine. Moreover, since the connection also allows to download contents, it is feasible to put on the distributor new contents, creating a real virtual showcase able to change continuously based on the time slot and the type of customer. Thanks to increasingly efficient connections and the right hardware, the most advanced smart vending machines are also able to put the customer in touch with a salesman hundreds of miles away, by videoconference, making the shopping experience more interesting. In some cases, managers of vending machines decide to share the Internet connection with passers-by, turning the machine into a huge "Wi-Fi hotspot". This makes it possible for people to interact directly with their smartphone. Some decide to offer gaming experiences where it is possible to win the products in the machine as a reward; others to present discounts and other customized advantages (which are definitely preferable within the privacy of a smartphone screen, instead of being shared on a large screen). All these technologies are able to radically transform the experience of interaction with the vending machine, substantially improving it with benefit on both the consumer and the vendor who chooses to use it in its distribution strategy. These technologies are also an important point of contact, through which people build an opinion in relation to the brand he is interacting with. (Tazzioli, 2017)

3.2.2 IOT SOLUTION SYSTEMS AND VENDING MACHINES

According to the Polytechnic of Milan, vending machines represent one of the best applications of "Internet of Things" and this is the reason why we speak of "smart vending" or "vending 4.0". The market of vending machines connected to the network and equipped with cutting-edge technologies should reach a value of 15 billion dollars by 2025 globally. The payment is one of the aspects on which the producers have invested the most, with the aim of reducing the costs related to the transport of cash and of significantly improving the user purchase experience. In Italy, 84% of the machines installed accept cashless payment methods, without cash, and more and more machines are being used to pay via app, in addition to credit and debit cards. (Tinaba, 2018)

“The term IoT refers to the combination of sensors, actuators, distributed computing power, wireless communication on the hardware side and applications and big data analytics on the software side.” These sensors consent to collect and analyze a huge amount of data, used to enhance the efficiency and performance of systems and networks. Companies need to analyze and make sense of IoT data using real time and predictive analytics. It is necessary to integrate IoT application into existing business processes and IT infrastructures. In the end,

companies could be able to deploy new business models, shifting the value from product to services. By 2020, the digital universe should count 44 trillion gigabytes. This amount of data can benefit in monetary terms only if companies are committed to capture and analyze these data in order to discover new perceptions about customers, products, markets and operations. This depth analysis of data can allow a fundamental shift in the way companies operate and generate revenues. The constant connection of companies permits to offer their customers a "product utility as a service", with a shift of the value from product, to the service this product provides. The relationship between products and services is being gradually taken into consideration by companies. Thanks to IoT chances for higher revenue streams, improved processes and operational efficiency, higher market performance and increased customer loyalty. Another significant point is the diversification of existing revenue streams by creating new services and new revenue sources on top of traditional products. IoT also allows organizations to make dynamic, real-time decisions about pricing, logistics, sales and support. Thanks to network connectivity it is possible to identify each machine, track inventory stock levels, carry-on real-time test marketing, and track trends and drinking preference, adapting the options consequently. Smart vending machines show the impact that IoT has on revenue streams and business models. Through a network of connected devices, it is easier to dispense new products more productively, also thanks to enhanced security, user customization, smart payments and a continuous monitoring of inventory and consumption patterns. Kasznik and Johnson propose five examples of enhanced economic returns, profitability and an improved user experience using connected vending machines: digital content delivery, smart payments, social commerce, inventory management, maintenance and energy savings. Intelligent software solutions allow for a greater impact of digital contents in every screen of a vending system. Through these contents, vendors create a direct connection with consumers. This allows to remotely manage messages and create a customized content almost in real time. New sources of revenues for the payment platforms are provided through Near Field Communication (NFC) payments, credit or debit cards and mobile wallet applications such as Google Wallet. This offers a better user experience that enhance usage and customer loyalty. About the inventory management, the right decisions can be made through sensor data and built-in intelligence. Connected platforms allow the tracking of shipments and to collect consumer data so that smart inventory decisions are based on the data collected from the vending machine and from outside sources. In addition, it is possible for vendors to remotely identify, diagnose, and repair machines, allowing to maximize productivity and profitability. (Kasznik, Johnson, 2015)

The International Vending Alliance (IVA), the largest global network with 1.9 million vending machines in more than 70 countries, has selected Sierra Wireless (a provider of integrated solutions for the IoT) for its IoT platform in support of its vending service delivery. IVA's smart "black box" solution, enables in the vending industry new business models and customer experiences, such as cashless payment, touch screens, targeted advertising, online monitoring and more efficient management. "To compete with consumers' ever-increasing digital expectations, the vending industry needs to reimagine how we interact with our customers," says Martijn van den Hazenkamp, CEO of IVA. "IVA's global network has been actively involved in the creation of a new smart vending solution that will change how vending machines operate so that data can be used to drive sales and customer satisfaction. We teamed up with Sierra Wireless, a global leader in IoT, to develop the vital connectivity and data collection requirements in the solution. Working together, we will modernize the vending experience." By connecting and collecting data from its retail assets, IVA can now provide transformative services, such as preventative maintenance, restocking optimization, automated merchandising, advertising, loyalty programs and more. (Zenobia Hegde, 2018)

Another example of IoT solution is Vendmanager, a vending management system (VMS) which processes data that comes in and outputs it "in the right way to the right people at the right place". Vendmanager Datakey reads data from the machine and transmits it via Bluetooth meaning no cables, no hassle and no fuss. The fast growth in the use of IOT and other technologies in general has presented vending operators with huge opportunities for intelligent machine control and reporting. For example, Perk Dynamics has developed the IVACS (Intelligent Vending Administration and Control System) which is a secure, modern, Azure cloud-based IOT platform for commissioning and managing vending machines at high scale. It provides the capability to define vending machines hardware (interface boards and, payment systems), software configuration, product load, advertising material etc. Configuration details such as product details, ingredients, prices, product media (such as images and video files) can be remotely updated either immediately or at a scheduled point in time allowing planning of brand refreshes, advertising campaigns and price changes. (Vending International)

Among the Italian companies involved in the development of IoT systems for the "machine" sector there is the group Sitael. They are the authors of the MatiPay system, which allows the connection of vending machines. "MatiPay - explains Sitael - is already installed on over 12 thousand distributors, which will become more than 30 thousand by 2019". Several Italian and foreign operators have transformed their distributors into smart and interconnected

devices, able to communicate in real time with a cloud platform integrated in a management program accessible to operators, for the detection of any disruption and for an efficient management of the warehouse. A special alert system allows the operator to launch recovery systems, analyze errors and define accurately performance improvement procedures. "The system is also able - Sitael underlines – to allow detailed business reporting activities to support the decision-making process". (Finotto, 2018)

3.2.3 HYPER-DEPRECIATION AND VENDING

In 2018 MISE (Ministry of Economic Development) has extended the tax incentive of hyper-depreciation to 250%, established by "Piano Nazionale Industria 4.0", also to vending machines. (CONFIDA)

Automatic distributors of finished products and / or for the administration of food and beverages fully constitute, in fact, "automatic shops", being able to provide the service autonomously and automatically. As such, they can benefit from the 250% hyper-amortization. However, it will only be applicable to the latest generation distributors, the so-called "smart" distributors. The benefit will be applied to all investments made within 31st December of 2018, or to those completed by 31st December of 2019, only if, by the former date, the order is accepted by the seller and a down payment of at least 20% of the acquisition cost has occurred. The Mise also ratified the retroactive nature of the benefit, which can be used by operators who purchased assets in 2017. (Finotto, 2018)

With the circular of 23rd May of 2018, the Ministry of Economic Development established that vending machines are comparable to "automated warehouses interconnected with factory management systems". To benefit from the subsidies, they must be new generation ones and must satisfy the interconnection requirement, or they must be able to exchange information in a bidirectional way with the internal and/or external systems of the company, both inbound and outbound, and satisfy also the current and future tax compliance standards (electronic transmission of fees). The subsidies are available also for can also for instrumentation and components used for the modernization or revamping of vending machines already belonging to the company. To benefit from the subsidy, the assets must be allocated to production facilities located in Italy. If, during the period in which the company is benefitting the hyper-amortization, these assets are transferred to production facilities located abroad, even if belonging to the same company, the portion of hyper-depreciation utilized must be recovered. (Vending News, 2019)

To benefit from the subsidy, the vending machines must comply with the new tax legislation of the sector which came into force on 1st April of 2017, i.e. the "Electronic storage and electronic transmission of vending machine fees", which provides for a periodic data transmission from the vending machine to the Revenue Agency. (Vending News, 2018)

However, regardless of the economic sector to which the company belongs and the final outcome of the business activities, the possibility of benefitting from the increase (by 150%) of the fiscally deductible amortization shares presupposes that the tangible (or intangible) assets part of investments are attributable to one of the items included in Annex A (or in Annex B) of the law no. 232 of 2016 and satisfy the interconnection requirement. The circular also clarifies that vending machines of finished products and / or for the administration of food and beverages fully constitute "automatic shops", being able to provide autonomously (and automatically) the service, the sale of finished products and/or the administration of food and drink (physically) contained inside. Based on this classification, it is considered for simplicity, that the assets in question, although could be potentially classified in other items of Annex A, for the purposes of the amortization regulation, to "automated warehouses interconnected with factory management systems" and, therefore, ascribable to point 12 of the first group of Annex A. The compliance with requirements established must in any case be verified by means of a technical appraisal issued by an engineer or an industrial expert enrolled in the professional registers or by a certificate of conformity issued by an accredited certification body (except for the possibility of producing, in the case of goods with an acquisition cost not exceeding 500,000 euros, a self- certification declaration made by a legal representative). It is important to clarify that, in order to satisfy the interconnection requirement, vending machines must be able to exchange information in a bidirectional way: incoming - receiving remotely instructions / indications such as, for example, the modification of data and machine configuration parameters and / or the variation of the product price list - and outgoing - communicating information actions such as, for example, machine components, accounting, product quantities or other logistic and diagnostic information. All these benefits must also be considered subordinate to the condition that the automatic distributors satisfy the tax compliance standards (current and future) provided by the regulatory provisions established by the Director of the Revenue Agency in accordance with art. 2, paragraphs 2 and 4, of Legislative Decree n. 127/15. Technical specifications attached to the provisions of 30th June 2016 and 30th March 2017 clarify that the

preparation, the seal and the electronic transmission of the file containing the data to be sent to the Revenue Agency are possible also for vending machines that have a master system not yet connected to the network, but still able to exchange incoming and outgoing data via wireless communication ports (such as, for example: IrDA, bluetooth, infrared). (Ministero dello Sviluppo Economico, 2018)

3.3 EMPIRICAL EVIDENCE IN THE VENDING SECTOR IN ITALY

In order to have an empirical evidence of how digital transformation has impacted in the vending sector, we conducted a small sample research, taking in consideration 8 companies in the vending sector that are facing technological disruption, to have an overview (to be further developed) about how vending sector in Italy is adapting (or not) to changes in act, which are the measures they are adopting and which the possible barriers to innovation. The research is divided into two parts: 3 face-to-face interviews (Company X, Y and Z) of about 30 minutes each one, and 5 questionnaires on Google Forms, made up by 8 questions, in collaboration with the DT Lab of Padova. The interview was composed by the following general open questions (in some cases adjusted depending on the company interviewed):

- In which year were technologies related to Industry 4.0 adopted?
- Are innovative skills already present or still to be developed?
- Which are the major challenges or obstacles to developing digital skills in your company?
- In which areas are you currently using Big Data analysis? In which areas does your company intend to use it in the next 3 years?
- What are the major concerns regarding data security?
- What are the main benefits you have gained or expected in the next 3 years?
- What are the main innovations that affected vending machines?
- What type of partner have you selected for the digital transformation process?
- Are projects in place with financial partners for the integration of physical and digital touchpoints?
- How has your organizational model changed? What were the first steps taken? What are the areas of greatest interest?
- What are the new jobs created with the advent of Industry 4.0?

3.3.1 COMPANY X

The first company interviewed is Company X, leader in the sector of coffee vending machines, automatic vending machines and food vending machines both in Rome and throughout Lazio. The interview took place via a Skype conversation with the Sole Director of the company. He says that they have been adopting technologies related to industry 4.0 since 2016, but not in all possible fields, because consumers still don't have a full willingness to use them, as for example in the case of apps. Making an example, he explains that they have a large enough customer with around 800 employees and that they have made available payment systems connected to the network with the possibility of using the application for the purchase at vending machines, but only 8 out of 800 employees have downloaded it. He believes that the future does not include applications but that is fundamental direct interaction with the machine. He thinks that company is ready for this digital transformation but is convinced that a continuous training and updating is necessary, because what today can appear innovative tomorrow will be old; this is the reason why their resources and the technical division of the company are in a continuous training. Of course, they have changed the way of doing training, taking advantage of digital. For the training courses they use WhatsApp, because employees do not have a common work timetable and therefore a common training was very difficult. In this social channel they upload specific videos followed by learning verification questionnaires. Although, they intend to integrate this system, in order to also obtain a return of information from the operators. Training must be organized on the essential requirement of bi-directional information in order to receive feedback from the operators on service issues, so to analyze and correct them. He also believes that change is a great challenge and to face change it is absolutely necessary to abandon one's certainties. The biggest obstacle in developing digital skills, in his opinion, is the resistance of employees to consider the new as something that improves the activity and not as something indicating that what has been done until now was wrong. For this purpose, they have made a flow chart to make clear tour resources that there is the need to comply with change. For what concerns Big Data, he emphasizes their big potentiality, explaining that today they maybe exploit only 10% of it, but that their goal is to use big data combining them with a concept of product category. In fact, in the current industry, especially in vending, being they B2B-oriented, they have a special relationship with customer. The client, with whom they sign a contract, is practically the company buyer, but actually he is not the main customer, role that is up to the end users. Today they have very few data on users. The

Polytechnic University of Marche was the first to carry out a study on the behavior of the final consumer in front of the vending machine. Facts emerged that the company absolutely did not consider, for example the stock breaking leads to a remarkable reduction in consumption. They were used to restock the distributor when there was a good stock break, i.e. when most products had been sold. They discovered that there can be a 40% reduction on sales, because the user, in front of a distributor with 10 empty springs, perceives it as inadequate and this is therefore a big disincentive for consumption. So, in his opinion, the analysis of the data is just at the starting point of its possible potentiality. About data security he specifies that here is concern, but at the moment these kind activities are managed in Cloud by third-party companies, so that the data collection is performed through detection tools connected to the network, therefore data flow into platforms that are not of the company but of third-party companies, which have assured the integrity of the data. It is not their priority today, but surely it is a problem that exists. Now, the company is setting up a new data collection system, as they have realized that having "clean" data without any influence by third party company it is almost an unattainable purpose. Regarding their expectations from this digital revolution, he answers that they expect to be able to interact with the end user. The vending machine has a very big limitation that is precisely the communication with the user; through big data and digitalization they expect to reduce this gap. We also foresee, by collecting data, to be able to offer what the customer is looking for, with huge improvements. Data collection is basically carried out to achieve two objectives: the first is to understand the customer's demand, offering him the right answer, while the second is that, by interpreting the customer's needs, they will be able to sell more and, in this way, increase revenues. About the main innovations that have affected vending machines, he thinks that the most important is represented by digitization such as the adoption of touchscreens on the machines that were previously equipped only with simple buttons. Regarding payments, contrary to their expectations, they have seen that the digitization of payment systems has favored payment and accessibility to vending machine, but this did not happen via smartphone. They noticed that the greatest innovation on the payment system connected to the network is given by the contactless technology of the NFC, surprisingly not through the use of smartphone, but for example through the work badge which is equipped with a technology called “Mifare”, that includes readers connected to the network having a microchip with a unique code that allows to open your account in the Cloud. In his opinion, the near future will be characterized by Artificial Intelligence. Virtual assistants as Cortana, Google Assistant, Siri, Alexa and more generally the Cloud, will represent the

technological partner for the future. The Artificial Intelligence, through the connection to the Cloud, will allow a totally different purchase experience of the consumer at vending machines. To exploit all the purpose of digital transformation they entered into a partnership with a company, Pagita, which is a start-up created by talented young people who have studied their own network-based payment system, which the company is testing before introducing it. Company's strategy is to merge first line manager experience with the technological and digital knowledge of this third-company. Pagita has already completed a first project, called "Smart-Hug", which is a new vending business model that the company is evaluating in the operational phase. For what concerns the organizational model he declares that the organizational chart has not changed, the functions have remained the same, but the company had to implement the work, that is what has really changed. Taking into consideration a very trivial example, before, their technicians used a device less developed than a palmtop, while today they use a laptop because the systems necessitate a more developed device to be addressed. Therefore, this has been the big change. Finally, in his opinion, this digital transformation has not introduced new figures within the organizational chart, but the already existent jobs have undergone a shift in their usual activities. For totally new jobs the company may need, it refers to third-party companies, because they think that in a world changing at a such fast pace it is risky to hire as an internal resource a figure that tomorrow could no longer be useful. So, it is much less risky to use third-party companies, specialized in that kind of activity.

3.3.2 COMPANY Y

The second company interviewed has over 50 years' experience in the payment industry, it is at the forefront of innovation when it comes to new technologies and products targeted to increase end-user satisfaction. The newest payment system of the company offers six areas of connectivity separated between payment options, cash and cashless, in addition to diagnostics, software uploads and security. This creates an ecosystem inside the vending machine that allows technologies, operators and consumers to work together. The interview took place via Skype, with the Sales Director of Italy. He specifies that it is a company that basically provide operators with the technology to enter Industry 4.0; they are a 4.0 equipment supplier. To make a vending machine included in industry 4.0, the operator buys company's products. They have been offering technology as a product for about two years, having products that satisfy the requirements of industry 4.0. The crucial point was that they were a company focused mainly on offline products, such as hardware. So, to develop a product with the requirements of industry 4.0 they carried out a transformation

of the business model, shifting from “only hardware” to “hardware plus services”, that is software. This was the main issue for the company, which had to structure itself in such a way to develop skills it had not before. Regarding Big Data he affirms that data is mainly used for telemetric reasons. Through the data provided to the management systems they are able to predict supplies, machine failures and a series of information that improve the efficiency of the operators. About the issue of the security of the data he thinks it is not a real issue given that data is not sensitive and, taken individually without the initial information, it is difficult to go back to some sensitive data by taking part of the data. Of course, the issue of security is present, as for example large companies need to keep data internally. Concerning the main innovations that have affected vending machine, as a supplier of these innovations, he made a list in order of importance (in his opinion): telemetry, mobile payment, payment by credit card and touch screen. With respect to the issue of resorting to partners for the supply service he explains that they produce the whole supply chain, being world producers of payment systems, they have no partners who provide them, except for some international partner for very specific technologies. They are basically a supplier of great realities. Regarding the organizational model, instead, in his opinion, nothing has changed because they sell products and services and they don't use them. Concerning potential new jobs created by the advent of industry 4.0, he says: “Unfortunately, I think there was no change in vending, and this should help operators understand that there is a need for evolution, including technical jobs, with specific skills, but the sector has been subjected in recent years to a series of regulations and therefore a temporary stop has occurred in industry 4.0.”

3.3.3 COMPANY Z

The third and last company interviewed is a company located in Umbria, market leader in the automatic distribution of food and beverages. The interview was a face-to-face one and took place with the Operations Manager of the company. He affirms that technologies related to Industry 4.0 are a recent thing. Last year they started the planning phase, in order to be ready in the present. Regarding innovative skills he states that everything needs to be developed because it is something completely new, not only for their company, but for the whole sector. Certainly, the major obstacles they found in development of digital skills are in the Human Resources area, that is the first in order of importance, because it involves a type of activity, in which the contribution of personnel by the staff is crucial, given that people do all the activity. On what concerns the products, the infrastructures, the distributors, the remote control systems there are some difficulties, some specific skills that

must be recovered but it is an issue much easier to solve than that of human resources, where there is the need to change modus operandi, that means not only reviewing the processes, but also review the way people work and consequently the way of thinking. Regarding Big Data analysis currently, most of it is made on production, on loading and technical assistance. In the future data analysis will surely go towards the consumer, collecting more data on the consumer, data that today they do not have in the amount they need. Only once achieved this point, having more market data, they will also move more towards marketing and data analysis. About the issue of data security, he thinks that if data analysis is carried out correctly evaluating the cost / benefit and the risk analysis, there should not be concerns. He thinks that a right balance should be found in considering the possible risks about security. He says: "If I had to make a drastic choice on IT infrastructures today, I wouldn't put everything in the Cloud, but I wouldn't even take everything in-house." Regarding the benefits they expect he underlines the improvement of productivity and then the level of service quality. He says they currently are in a market phase in which consumer is changing. They expect to be able to keep up with how quickly the consumer will change and, moreover, also to guarantee a truly punctual and also health service for him, thanks to collection of data, through which, for example it is possible to know if the end user is allergic to a type of product. In this way, vending machine could stop the consumer from buying a certain kind of product. Unfortunately, in Italy, what is missing is a recognition of the vending sector. "If you talk about a coffee at vending machine, the first idea is that it is not a quality coffee." It is a cultural issue: in fact, in a country like Japan used to automatisms, these innovations have spread out earlier and faster than in Western Europe. In relations to the main innovations that have affected vending machines he explains: "Historically in the past an innovation has been the rechargeable USB key, which in those years was an incredible innovation. Then the credit card was spread but, probably for cultural reasons, it has never caught on so well. I think that an innovation that will make the difference will be the App, that allows to dialogue with the vending machine and pay the consumption with the App itself. Another important innovation that will take place, will be the machine interface that can lead the consumer towards a different experience, therefore involving him more; another one will be the telemetry, because today we have the data, but we do not have it in real time; only having real-time data, we can make a difference." With regard to the partners they have selected for the digital transformation process he affirms that of course they have an internal staff which is responsible for the whole project, but they also resort to external partners. To build the strategic plan they collaborated with an external agency, specialized in digital

strategy, through a series of meetings, and according to the Business Model Canvas, they defined all the needs of the company. Once defined the Digital Business Plan, they integrated it into the company Business Plan and then they did a series of screening with different agencies to better define the online strategy and the new web site. Concerning changes in organizational model he declares the company is in a full phase of change. They are trying to mainly involve Human Resources in the business run. So right now, HR are increasingly involved also in the planning phase and in the definition of the strategy. They are also trying to streamline the entire organization, to try to use new technologies, reaching the operators quickly. Their project is to be able to communicate directly with all the operators. With digitalization, communication is faster, and information is clearer and of quality. They are also conducting training courses, taking into consideration at first soft skills, that are more difficult to exploit, with training related to customer management, know-how management by customers, the sales force, the loading force and external technicians, all people in contact with customers. The company is also offering a specific training on change for the whole workforce, to try to raise awareness on change in act. For middle management, they have instead provided more specific training courses in which, after an assessment made with specialists, they have created grids and mappings with the points of strength and weakness and they have tried to do targeted courses to reinforce the areas of weakness. Concerning potential new jobs created with the advent of industry 4.0 he answers that, regarding the marketing side, there is the need to identify those figures who deal more with digital, social media and communication, that have a great value currently. Another important figure, which already existed before but was different, is what in their company call "operational support", while in other companies is called "jack of all trades". He substitutes the operators when they are absent, but he is also the fulcrum of the 4-5 members of operators' team. In his opinion this figure will become a key person with skills, soft skills to manage the team, an opinion leader in the team and that knows how to interpret the new technologies and innovations. He works more as a trainer on new technologies; if a machine arrives with a new display, which is configured differently from the already known ones, he has the task to teach the team on new technologies.

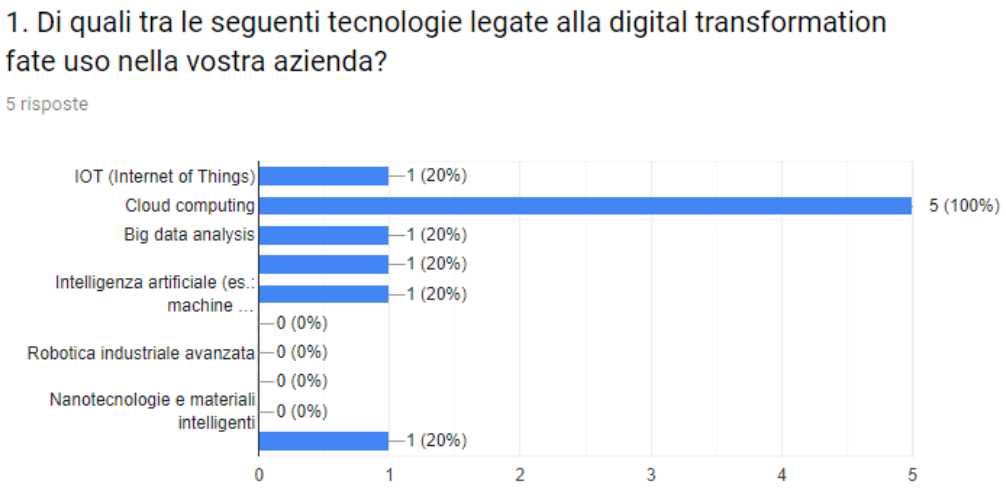
3.3.4 GOOGLE FORMS QUESTIONNAIRE

In addition to the aforementioned interviews, in collaboration with the DT Lab of Padova, also a multiple-choice questionnaire made up of 8 questions was conducted. At first, email addresses were collected from CONFIDA mailing list of vending companies associated. The rate of participation was unfortunately scarce and that is the reason why our sample is

composed by 5 vending companies that are currently facing digital transformation. The majority of the companies that replied to the mail that was sent for the participation in the research, had a business model not ready for digital transformation and they were not in the so called “smart vending” sector, and for this reason not affected by digital transformation impacts. The questionnaire is structured as following:

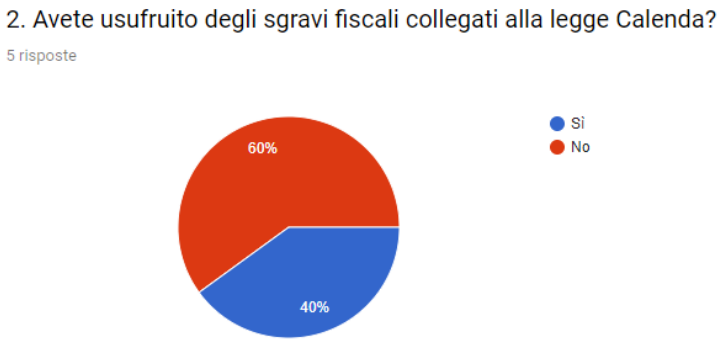
- Question 1: “Which of the following digital transformation technologies do you use in your company?”

The possible answers were: “IoT (Internet of Things)” used only by 20% of respondents; “Cloud computing”, adopted by all companies participating; “Big data analysis”, used only by 20% of respondents; “Augmented Reality/ Virtual Reality (e.g. additive content, video, audio, 3D objects, "digital twin")” adopted only by 20% of companies; “Artificial Intelligence (e.g. machine learning)”, also adopted only by 20%; “3D printing (additive manufacturing)”, “advanced industrial robotics, collaborative production (social manufacturing)”, “nanotechnologies and intelligent materials” instead have not been adopted by none of the companies. A 20% of the companies instead utilizes “other” technologies not mentioned above.



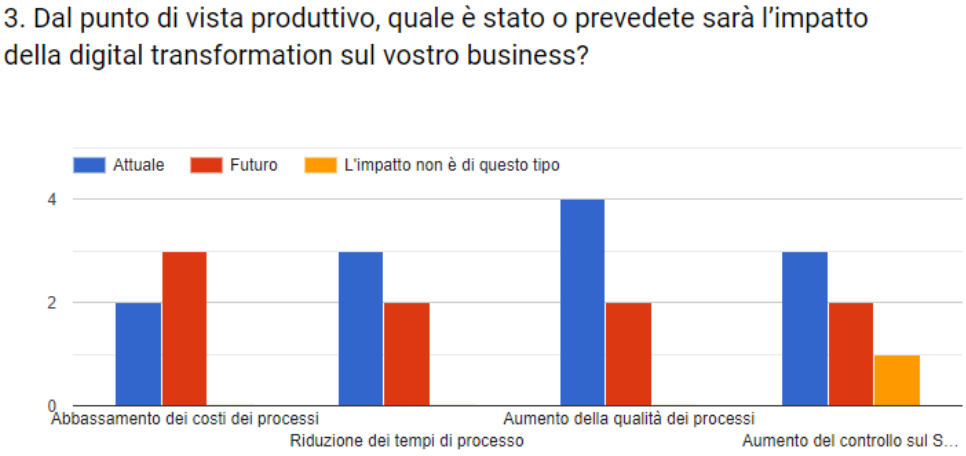
- Question 2: “Have you benefited from the tax reliefs connected to the “Calenda” Law?”

Only the 40% of the respondents have benefited from the tax reliefs for the fostering of industry 4.0, while the other 60% did not.



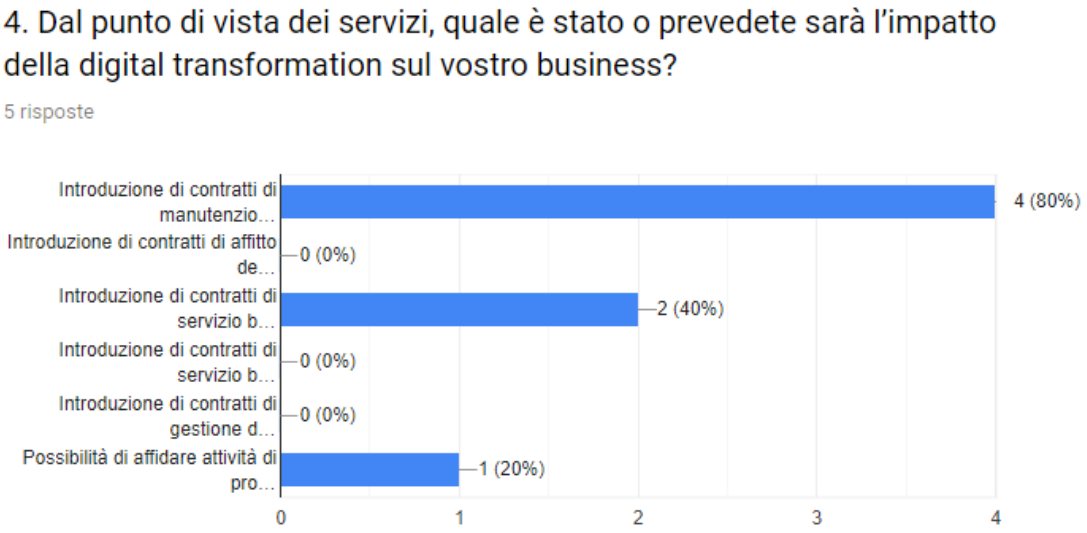
- Question 3: “From a production area point of view, what has been or will be the expected impact of the digital transformation on your business? Specify if the impact is current, future or not of this kind.”

The possible answers were: “lowering of process costs” that is currently happening for 2 out of 5 of the respondents and future for the other 3 companies; “reduction of process times” current for 3 out of 5 of the respondents and future for the other 2 companies; “increasing of the quality of the process” that for 1 company was both current and future, while was only current for 3 out of 5 companies and future for the remaining company; “increasing of the control over Service Level Agreements (guarantees, and assistance standards)” that for 1 company was both current and future, for 2 out of 5 companies was current, while for 1 company was future and for the remaining one the impact was not of that kind.



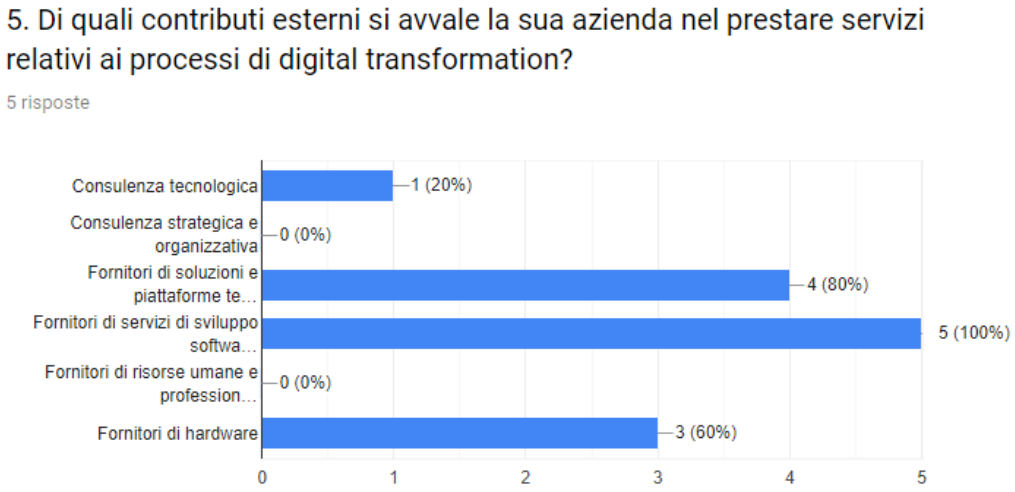
- Question 4: “From the service point of view, what has been, or do you expect to be the impact of the digital transformation on your business?”

With possible answers: “introduction of maintenance contracts (better scheduling of assistance with preventive and / or predictive activities)” that impacts 80% of the companies; “introduction of product rental contracts instead of sales contracts” that does not have any impact in the companies; “introduction of performance-based service contracts” that impacts 40% of the companies; “introduction of service contracts based on actual use (pay-per-use)” and “introduction of contracts for the management of entire processes on behalf of the customer (Business Process Outsourcing)” that do not have any impact in the companies; “possibility of outsourcing production and service activities” that impacts 20% of the companies.



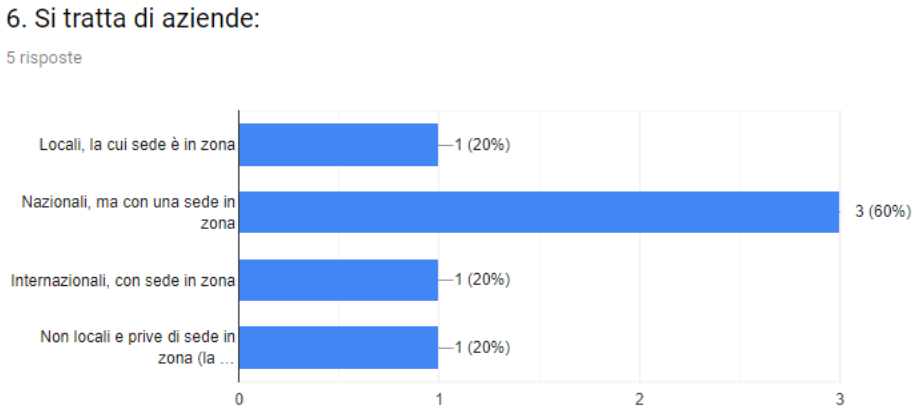
- Question 5: “What external contributions does your company use in providing services related to digital transformation processes?”

The answers available were: “technology consultancy” used only by 20% of the companies; “strategic and organizational consultancy” that is not used by any company; “technology solution and platform providers” used by 80% of the companies; “software development service providers” used by the totality of the companies; “human and professional resources providers” not used at all; “hardware suppliers” used by 60% of the respondents.



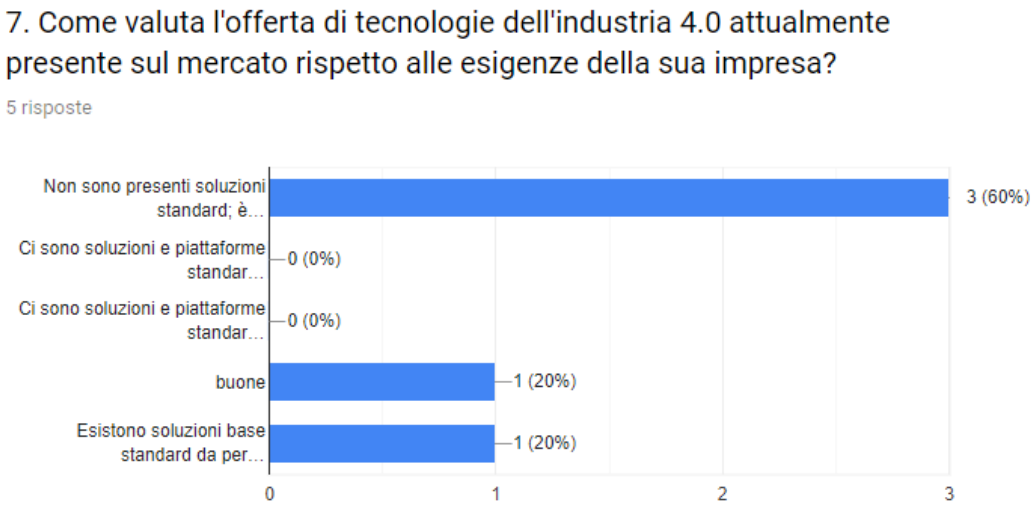
- Question 6: “What type are the aforementioned companies?”

The possible answers were: “local, with headquarters in the local area” that was true for 20% of the respondents; “national, but with an office in the local area”, answer given by 60% of the companies; “international, based in the local area” that was true for 20% of respondents; “non-local and without headquarters in the local area (proximity does not count)”, answer given by 20% of respondents.



- Question 7: “How do you consider the supply of technologies in industry 4.0 currently on the market with respect to the needs of your company?”

The possible answers were: “there are no standard solutions, it is all to customize”, answer given by 60% of the companies; “there are standard solutions and platforms, but they do not fit our specific needs” and “there are standard solutions and platforms, but they are too expensive”, answers not given by any company. One company out of 5 answered that the current supply of technologies is suitable, while the remaining company replied that standard solutions exist to be customized.

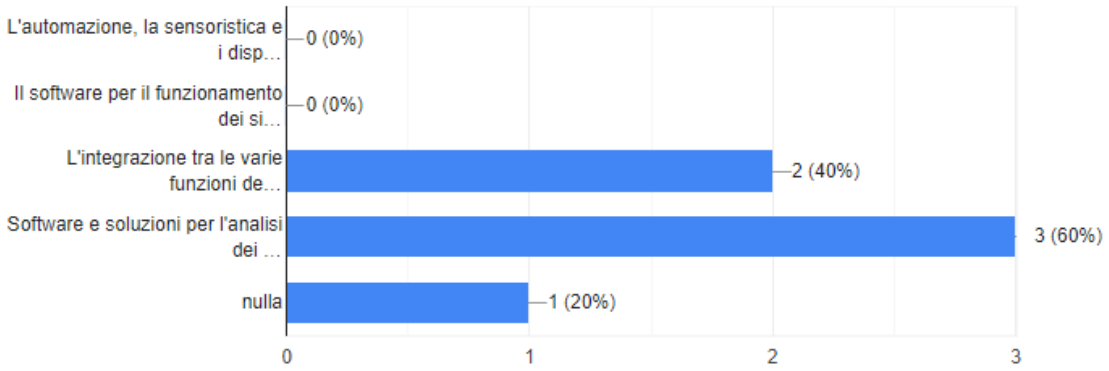


- Question 8: “In your opinion, what does shortcomings and gaps in the current offer mainly concern?”

The possible answers were: “automation, sensors and basic devices” and “software for operating systems” that were not true for any company; “the integration between the various functions of the systems”, answer given by 40% of respondents; “software and solutions for data analysis”, that was true for 60% of the companies; one company out of 5 answered that there are no shortcomings or gaps in the current offer.

8. Ritiene che eventuali mancanze e lacune dell'offerta attuale riguardino principalmente:

5 risposte



CONCLUSIONS

In the previous chapter it was presented an overview of the vending sector, from its origins until today, analyzing the main technologies and innovation that have disrupted the sector, making vending industry deal with the process of digital transformation, including obstacles and barriers that they had to face and still will encounter and the consequent enrichment of their offerings through new services available. Among the three companies interviewed to have an empirical evidence about digital transformation impact in vending, we can certainly affirm that all of them have a strong awareness of the importance of new technologies and of the impact that they will have on their business. The issues to which is paid more attention include mainly human resources inside the firm and the end consumer. The means through which companies try to overcome the widespread resistance to change include majorly training courses organized inside the company itself, with the aim of both having a change effect in the employee's mind, helping him to better accept the technological disruption in act and the consequent changes, and getting the employees ready to face current and future innovation and the new ways of doing business to which company should adapt. In fact, for the implementation of the new or modified business model, potential organizational adjustments and changes in corporate culture should be addressed and communicated. "Controlling and monitoring processes follow the implementation of the business model. If any inconsistencies occur during the phase of review, iteration loops have to be carried out which optionally require an adaption of the strategy" (Paulus-Rohmera et al, 2016). All the companies highly evaluate the potentiality of Big Data, a technology that evolves with a fast pace and offers every day new instruments to better run the business and manage the relative smart vending machines, with a consequent more effective and efficient service for the end consumer. The firms interviewed consider innovation fundamental to be competitive in a market in constant evolution; this is the main reason why at first, they resort to third-party companies for the softest skills not yet developed inside the company, to not lag behind other companies in the sector. In a subsequent moment there are company that strive to develop these skills internally, while others are afraid about investing in something that tomorrow could change. "Moving from a transactional engagement to a more services-led engagement requires moving around resources, extensive retraining of existing resources and also acquiring talent externally". (Oseguera, 2018) Therefore, if the firm is aware of the revolution in place, it can adapt its strategy after having analyzed its position in the market. The strategy is implemented by a consistent business model, that will cause the active

change of the organization's role in the ecosystem and the digitization offers opportunities for implementation. (Paulus-Rohmera et al, 2016). As we can clearly read from Company Y interview, organizations today have created completely new business models, shifting from a product-centric to a service-oriented approach, implemented by digitalization. To conclude, it is fundamental to clarify that results of this small sample research cannot be extended to the whole sector, but they can be of course a valuable starting point to further develop the analysis about how digital transformation impacts the vending sector.

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