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Food Industry 4.0 and The Challenges of Food Safety in Italy in Covid-19 Pandemic Era

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Abstract

The food industry has been hit by the fourth revolution turning it towards digital transformation. Digital technologies are used for production, control and distribution of food with the aim to maintain food industry productive, sustainable and competitive and their implementation are supported by the food legislation. Italy, because of its long tradition in this sector has become one of the international reference points for Food-Tech research and development. However, Italian food industry is facing some obstacles in this digital renewal, among these, the lack of specific skills and specific information. The recent pandemic from Covid-19 has forced the world towards digital technologies giving a strong impulse to this sector. In this context, it is confirmed that digital transformation together with smart technologies are already the greatest challenges for the food industry.

Introduction

In recent years the industrial world, has been hit by another revolution, the fourth, which through a techno-combination of automation, information, connection and programming is changing the paradigm through a digital transformation destined to upset the manufacturing sector. Going back even just a few centuries, we can count the revolutions that marked epochal turning points, from the first of 1798 to the third of the Seventies, which gave birth to information technology and to the application of digital technologies to the production. Over time there has been the fact that, in the industrial sector but not only, we are assisting to a transition from a system based solely on the physical interactions between man and machine, to one in which the interaction between data and machines constitutes a large part of production operations. Today we are experiencing the fourth industrial revolution and the expression "Industry 4.0" that derives from it, was born in 2011, coined on the occasion of a fair in Hanover, although it is in Davos, In the World Economic Forum of 2016 that has consolidated its importance, by becoming a central topic of that edition [1,2].

The Food Industry 4.0

This revolution has inevitably also affected food word which, is globally considered among the most important sectors for world economic development, and which is facing significant problems such as the growing demand for food, the control of food safety, environmental and commercial sustainability, regulatory constraints as well as dialogue with an increasingly demanding consumer. In this sense, in order to be productive, sustainable but at the same time, to maintain competitiveness on the market, it is necessary for the sector, to put in place strategies aiming to addressing and overcoming these challenges, also through the use of digital technologies for production, control and distribution of food, otherwise known as "Food Tech" [3].

Italy, thanks to its vocation and food tradition, as well as to the Research developed in this sector, has become one of the international reference points for Food-Tech and, in the context of the Start-Up and innovative industry panorama, food represents a relevant portion of the contents. In fact, in the agri-food sector, both research and technological innovations have been conducted not only by Research Centres and Universities but also by the Start-Ups themselves, with the aim of obtaining technological improvements and products so far unknown [4].

The term Start-Up indicates precisely the start of a new idea and business and all that entails both from a structural and organizational point of view; in recent years there has been a growing demand from industries or organizations already well placed on the market, to open a comparison with the Start-Up, with the aim of finding in these ideas and innovation. To facilitate this meeting, the exchange opportunities between innovation supply and demand, are becoming more and more numerous, thus allowing the Start-ups to have a certain visibility and potential for growth. As a confirmation of what has been reported, it is the fact that two important international accelerators have been located in Italy: one is Startup BootCamp FoodTech and the other is FoodTech Accelerator by Deloitte (Food Forward), which attract Start-Ups from all over the world and work in close synergy with large companies in the sector. But, while in the past investments were mainly directed towards food delivery or social eating platforms, today There are also investments in the development of technologies for traceability and food safety, new machinery, new products to meet new consumption models and new materials: it is also in Italy that Seed & Chips considered the main international food-tech event, was born [5].

New Technologies for Data Collection and Management

Of particular interest, the use of new technologies for the collection and management of data, aimed at guaranteeing the safety and traceability of food. Blockchain technology, created to manage virtual currency transactions but which is also finding practical applications in other sectors, united by the need for a high degree of

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reliability, including the agri-food sector, is becoming a major force in this area [6].

The blockchain can be considered a sort of digital ledger that keeps track of all the transactions of all the players in the supply chain and distributes them, through the network, to a theoretically unlimited number of computers, called "nodes". The information, boxed and sealed within "blocks", is accessible to all nodes; once the information has become part of the network, it connects to the previous block, thus creating a chain of information that follows a chronological order. The information is then encrypted to guarantee security and distributed among users for maximum transparency, guaranteeing, at the same time, the "unchangeable" and "irrepudiability" of the collected data. In this way it is possible to reach, through selective sharing of data, all types of stakeholders, "from field to fork", including official control, and making specific information available. Unfortunately, security, "unchangeability" and "irrepudiability" of the data do not guarantee its truthfulness; in fact, the blockchain system is based on "self-certification", therefore it cannot be considered an alternative to official controls or certifications carried out by third parties. It should also be remembered that, in the food sector, the problems are more complex than financial transactions and, if the block chain can be considered an important tool for traceability, thus also guaranteeing a better effectiveness of the withdrawal and recall plans in case of non-compliance of food products, however, we cannot consider it exhaustive for the management of food safety. This system cannot replace the implementation of specific plans for risk management or the planning of verification, control and auditing activities [7].

However, even in this case digital technologies come in handy, because these can be used for the development of computerized systems that support the development and management of food safety systems, based this on the HACCP methodology as well as the systems of Quality or Certification, improving data sharing within the company with a view to dematerialisation. Examples related to primary production include Classyfarm®, an integrated digital system that allows you to categorize your farms based on risk. The platform, has been funded by the Ministry of Health and created by the Experimental Zooprophylactic Institute of Lombardy and Emilia Romagna with the collaboration of the University of Parma. It collects and censuses farms in a large computerized system that allows you to collect and aggregate information and to predict potential risks in collaboration with all the players in the supply chain, from a One Health perspective [8].

Another example, well applicable to post-primary production, is the system developed by a SpinOff of the University of Pisa [9], capable of realizing and managing food safety plans remotely and interactively, reducing the usage of paper and promoting dialogue with official control. This system overcome the problem on the implementation of HACCP methodology implementing the prerequisites' program [10]. Furthermore, the system, based on the ISO 22000 model, through integration with the Internet of Things , is able to continuously monitor, from production to distribution, the maintenance of the cold chain, the compliance status of a company with respect to planned tasks, and to the outcome of those performed [11].

A peculiarity of digital technologies is the possibility of interconnecting with other systems and devices capable of acquiring data, measuring them and reacting in real time [12,13].

Legislative Compliance

Moreover, also from the point of view of Official Control, we can speak of legislation 4.0 with the EU Regulation 625/2017, aimed at harmonizing the official controls of the agri-food chain, in force since 14th of december 2019 [14].

The Regulation makes precise reference to the use of IT systems for collection, management and processing of data deriving from the control, hoping for the creation of new ones and integration with existing ones, both at national and community level, for the purpose of a more targeted programming and a reduction of the environmental impact linked to the progressive abandonment of the card [15].

In Italy, this revolution represents a challenge towards the future for a sector mainly made up of SMEs which, while facing technology and in continuous evolution, likes to define itself as traditional [16].

Italian SMEs and The Digitalization Challenge

A 2017 study carried out by Nomisma in collaboration with the Metes Foundation found that only 57% of a sample of 200 medium-large companies, with a turnover of over 10 million euros, invested in digital transformation while there is a 14% absolutely uninterested in the topic. However, it is precisely the economic impact indices that alarm, among these the one that estimates at 95 billion dollars a year, the loss that food companies suffer worldwide due to poor control of food safety, or a second estimate that sees every dollar invested in food safety generate $ 10 savings to companies [17].

Analysing in detail the type of investment, there is a clear orientation towards cybersecurity (47%) followed by cloud (21%), the Internet of Things (15%), big data (12%) and robotics (10%). The analysis of the benefits linked to the implementation of 4.0 technology is interesting, with priority being the reduction of production costs followed by the improvement of productivity and the increase of information on the production process [18]. While, among the obstacles, there is primarily the absence of specific skills in the company but also the difficulty of finding precise information on these issues [19].

The need for a greater diffusion of information through all the channels that reach the food sector operators is therefore clear, also for the purposes of the dissemination of ministerial and regional incentive plans for the digitalization of companies that, together with the purchase of technologies, support important training on digital skills in the company [20,21].

If up to a few months ago the progression towards 4.0 was a process started but which still presented some perplexities and resistances, never as in this beginning of the decade have we experienced how technological supports have been a precious resource to supply services and customs of our personal, work and social routine [22].

The impact of Covid-19 pandemic has made us understand the close interconnection between human health and the environment and the power of its impact on the global economy. This confirms the need of investments in infrastructure that can provide concrete tools

for the management of emergencies, as it is happening in all sectors, including the food supply chain.

The Covid-19 Pandemic Era

In this global scenario, the problem of security and safety of the food supply chains remains a priority, as it is for the concept of "One Health" that nowadays has become a staple. It is, and will be increasingly necessary to put constant attention to strengthen the resilience of food systems towards critical issues such as this, and as well as other and emerging ones [23].

If, in these recent years, the field of the supply-chain and food safety had gradually started to move towards the computerization and use of technological tools, Hurricane Covid-19 has made clear the need to re-define the organization of food safety and food production systems. As soon as possible systems should be reworked, making them accessible, safe and solid even in facing difficult times such as the one we are going through [24].

In circumstances where companies are forced to work with reduced staff, putting in place extraordinary measures to protect workers and consumers, and without being able to lower the production level neither from a qualitative nor quantitative point of view, is deeply increasing the need of practical benefits coming from the simplification and intuitiveness of digitized and interconnected systems. These are designed to simplify the performance of ordinary food safety tasks and at the same time to guarantee reliability and effectiveness.

Future Challenges

If the "race" has started in last few years, we can affirm that now it is in the acceleration phase, moving fast towards the structural and cultural technological leap, through the virtualization of the HACCP -monitoring and the company traceability systems. Supported by a real digital revolution, these are redesigned towards an operational project aimed at reducing the movements of the controllers and eliminating the paper documentation for the control or for the activities that switch to remote and centralized management [25].

We are currently witnessing a reorganization by all the players in the food supply chain, including official control to provide businesses with reference models to which to anchor a new set of procedures and tools aimed at mitigating the risks of the supply chain and being a guide to those who want to consolidate their existing control practices, making them more robust and appropriate to the context, while optimizing costs and resources.

An increasing dissemination of information is hoped for by the top management and all the elements involved through all the channels that could reach the FBOs, for the broadcasting of international, national and ministerial incentive plans for the digitalization of companies which, together with the purchase of technologies, support training in digital skills. A way to reformulate the way of working today: the ambition to simplify and facilitate the way of working tomorrow in a safe, guaranteeing and increasingly sustainable way. Aware that on the world scene, the increase in demand, changes in consumer tastes combined with an increasingly visceral approach to everything that is digital is also profoundly changing the food sector.

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