

Innovative Agribusiness. Which strategy for a dynamic development?

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Abstract

The world of smart agribusiness is still far from being fully and effectively applied by the Italian entrepreneurial fabric. In part, this is due to the fact that its potential and important connections with the technological world of reference are not fully known.

The imperative is therefore: to learn how to manage all the processes that characterize the agricultural chain in a synergistic way, from production to the sale of the product to the final consumer. It is therefore essential to know every minimum aspect of the supply chain considering the current strengths on which to leverage but especially the weaknesses on which to intervene thanks to the use of technology available on the market.

Today, the supply chain is still considered as a set of phases, one consecutive to the other, as if they were detached from each other.

However, in order to operate efficiently, each step should be interconnected: from the farmer's decision to produce an agricultural good to the choice of production factors, from the implementation of harvesting and post-harvest operations to processing, from the selection of goods suitable for sale to the logic of distribution on the target territory.

This work investigates the potential strategy using digital technologies in order to make dynamic the agribusiness supply chain, especially because in Italy the agri-food is one of the most important economic sectors but it is far from the most innovative trends available on the market.

Keywords

Business Administration, Agribusiness, Innovation

1. Important preliminary notes

Agribusiness includes all the operations and processes that start from the supply of the farm inputs up to the sale to the final consumer (KPMG, 2013).

Agricultural marketing has grown enormously in recent decades due to several factors, some of which are the increasing supply of agricultural commodities, increasing urbanization, increasing income levels, increasing exports to foreign markets and public incentives for the agricultural sector. It can be well understood that the potential role of an efficient agribusiness starts from the moment of the decision on what to produce, what variety to produce, how to produce it and again how to prepare the product for marketing.

When it comes to agribusiness strategy, it is therefore necessary to consider the way in which the use of resources is optimised, the management of an increase in agricultural production, the expansion of the markets of the agri-based industries and, above all, the spread of new technologies that can improve the quality of work and the efficiency of processes and operations linked to the production and marketing of agricultural products. Certainly, extending the product market not only within national borders but also outside the country helps to increase business opportunities and, therefore, the demand for products. In addition, it provides economic and financial resources to support new projects for the growth of agri-food companies and, more generally, it encourages the process of economic development. However, these intentions can no longer be supported without a careful analysis of the technologies available on the market or rather of the enabling factors (Mittal et al., 2017) and among them in particular the infrastructure and specialized human resources.

The internal actors (farmers, processing industries, wholesalers, retailers and distributors) as well as the external ones (suppliers of technologies, additives, packaging and logistics) (Zaghi and Bono, 2011) of the agro-food network and all the other intermediation figures

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must be able to be interconnected to support the entire supply chain in an efficient way and still to provide quality goods and services.

The only way to achieve this result is making every actor of the supply chain in possession of the adequate digital tools. As we shall see, another important factor is that this reality must be in tune with the technologies spread in the environment in which the respective companies operate. The use of technological innovation in agribusiness therefore becomes an incentive for the transformation from a “series” supply chain to a real “block” in which all actors are involved and can control the phases from the germ to the sale of the finished product on the market.

The creation of control blocks is not only intended to encourage farmers as they are in close contact with all the actors in the network and, therefore, able to reduce in part the market risk - already magnificently expressed by Richard Cantillon with the example of the tenant (Cantillon, 1755) - but also to speed up the pace of the entire chain and its stages (reducing costs) and to produce goods of superior quality.

2. Innovation: from concept to practice

2.1 The technologies that can support Agribusiness

Before analysing the potential implications for agribusiness, it is necessary to take a critical look at the technologies that can serve this dynamic development. It should be noted that without a full affirmation of the enabling factors that define the 4.0 era, it will never be possible to fully apply an innovative metamorphosis in the agri-food sector, but there will simply be more developed companies than others, and all this translates into a mere relationship of competition due to dimensional criteria. Let's see then which technological resources can be of fundamental help for the development of highly innovative agribusiness networks.

2.2 The SMART innovation context

The evolution of the techniques for the management of the agri-food business proceeds at the same time as the evolution of further socio-economic areas (ENRD, 2016). To be more precise, the agri-food sector can draw very important ideas from the technological system that is evolving in other sectors: first of all that of telecommunications and still the application of the Internet in every phase of daily private and business life. As we will see, these two areas of application are concentrated

in 5G technologies and the Internet of Things, which draws its essence from the former. In order to understand the potential applications in the agri-food sector, it is therefore advisable to identify the trends that define the context.

Today, important key factors can be identified in terms of “smart” innovation. We are referring to the smart city market, the most specific smart road and the smart company. In the past, the “smart city” sector has been approached with projects that are far removed from the real needs of citizens. Too much has been said about technology and too little about the real benefits for citizens. Today, however, business models aim to make smart city projects sustainable, especially for metropolitan realities with a vision that also involves neighboring areas (Smart Land). As far as technology is concerned, we need to talk about infrastructure and platforms to make the city more communicative and interconnected. The “Smart” technology enhances the control systems in the following areas:

- Energy;
- Infrastructure;
- Construction;
- Parking lots;
- Security.

From an energy point of view, the control systems of the aqueducts, the micro-generation and the introduction of smart metering (therefore the reading and management of electricity, gas and water consumption with cutting-edge digital technologies) will be enhanced. This evolution will not only lead to a reduction in consumption but also to a considerable environmental benefit due to the reduced use of thermoelectric systems and common boilers. With regard to the “smart” development plan of infrastructures, the regulations have long provided for the strengthening of the monitoring of the territory and greater stability of infrastructure. In this regard, there are several European regulatory provisions that encourage this transformation as evidenced by Directive 2010/40/EU¹, and Delegated Regulations 962/20152, 886/20133, 305/20134 and 885/20135.

In accordance with these provisions, the smart road project aims to transform the communication and monitoring systems planned on the road networks. In particular, the interventions are aimed at:

- create a seamless communication network;

- use Open data and Big data;
- define a network for connecting “objects” using the IoT;
- constantly interact with travelers through crowdsourcing solutions;
- creation of green islands for energy supply;
- enhancing the technological interaction between vehicles and infrastructure.

These measures will not only lead to an improvement in road traffic conditions, but will also make it possible to exploit in-vehicle technologies.

The benefits will therefore be achieved in terms of reduction of accidents, reduction of CO2 emissions, improvement of routes and travel times (Autostrade Tech Spa, 2018).

From a construction point of view, the smart impact specifically involves the inclusion of home automation for the control and management of structures, as well as the adoption of detectors for a more efficient collection of data on heat consumption. Advanced HVAC solutions, lighting equipment, sensor network and digital water consumption management are included.

Smart Security will instead focus on technologies:

- of biometrics;
- for the prediction of infractions;
- of location-based services;

then on the collection and monitoring of data to ensure continuous monitoring.

Last but not least, the “smart” management of car parks. Aimed at providing solutions to avoid traffic congestion on the road, smart parking focuses on technologies that can provide information to car drivers and motorcyclists to find parking as quickly as possible. Narrow Band-IoT sensors are the essential tools to monitor the occupation of public and private land but are backed up by apps and easy payment technologies to speed up the process. In addition, by greatly simplifying the ability to monitor parking traffic and providing advanced payment technologies, it is possible to obtain an increase in revenues in the municipality where these “smart” systems are installed (see the example of Treviso, one of the first smart cities in Northern Italy that has benefited from an increase in revenues of 14.3%) (Intercomp, 2019). All this considered, it is then necessary to understand what is the relative placement of agribusiness in comparison with the emerged and emerging systems. Or rather, it is more appropriate to understand the prospects of applying smart technologies within the agri-food chain.

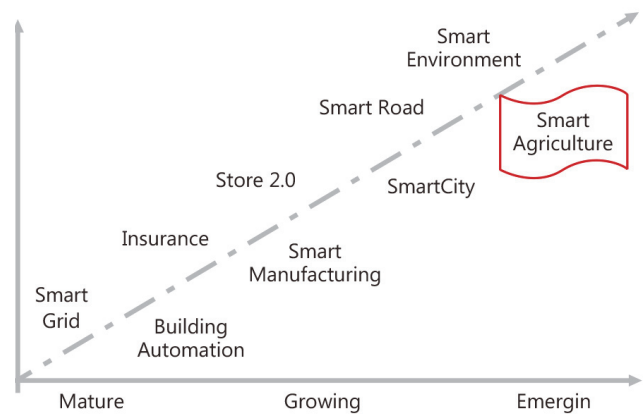


Figure 1. IoT projection for application segments

Source : author's elaboration

Figure 1 aims to underline that to date the potential of advanced technology are many, but the concrete applications in the agribusiness are still far.

Nevertheless, they should be very useful in the agribusiness world, particularly in order to achieve countless results in terms of saving time, reducing energy costs, reducing human resources effort and producing superior quality products.

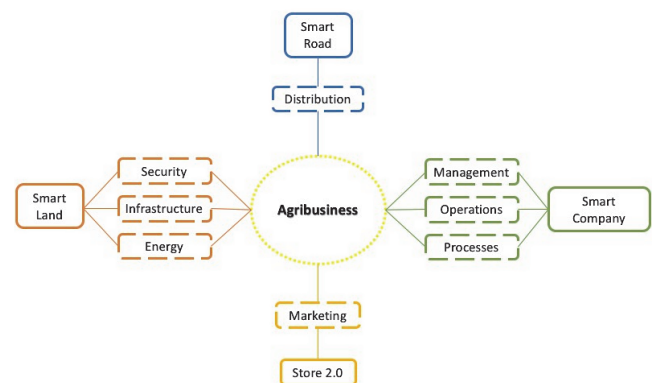


Figure 2. Potential connections between Agribusiness and the “smart” systems

Source: author's elaboration

2.3 The potential effects of the 5G mobile network and the IoT on the agri-food supply chain

The term 5G refers to fifth generation mobile telephony technologies.

5G networks become fundamental for the evolution of the present economy and technology, as they are able to enable technologies such as artificial intelligence, blockchain and the Internet of Things.

The technology road map shows field trials as early as the end of 2019 and the first part of 2020. The deployment of large-volume networks will take place in 2021.

According to data from the Federal Office of Communications of the Swiss Confederation, which is ranked first in the world according to the Global

Innovation Index 2018, the 5G network will enable specific applications in the areas of Enhanced Mobile Broadband, Massive Machine Type Communications and Ultra Reliable and Low Latency Communication (UFCOM, 2019).

The 5G can be a very useful enabling factor to allow the entire food chain to develop efficiently through highly advanced connection systems.

Moreover, through the understanding of the specific applications characterized by the Internet of Things, it is possible to identify more clearly the potential benefits that the 5G communication network can provide to companies in the agri-food supply chain.

Among the three communication solutions, the Internet of Things relies in particular on two communication systems: mMTC, which essentially corresponds to the typical NB-IoT applications, and uRLLC, which can address, for example, applications focused on the use of robots, drones and vehicles (Telecom Italia, 2017).

Table 1. Agribusiness efficiency through 5G and IoT technologies

5G and IoT		
EMBB	MMTC	URLLC
Device connectivity	Environmental monitoring	C2X communication
Fast data transmission	Smart power networks	Drones control for deliveries
Augmented Reality	Smart Farming	Essential Data Monitoring
Virtual Applications	Smart Logistics	Smart Manufacturing
For the purposes of agribusiness = reduction of costs and better concentration of resources:		
Remote control of equipment	Careful selection of agricultural resources	Better use of human resources
Efficient planning of the operations to be carried out	Less environmental invasiveness	Efficiency of the systems of realization and control of the processes
Real-time monitoring of operations	Logistics efficiency	Increased volumes

Source: author's elaboration with data from UFCOM

In order to examine the beneficial effects for the agri-food sector it is worth considering that:

- a. the possibility to remotely control the equipment allows the companies involved in the supply chain to efficiently plan all the operational phases, from the

collection to the final sale. This means maximizing time, concentrating the intervention of human resources (workers, specialists, supervisors) but above all limiting as much as possible the margins of error (waste of raw materials) and environmental invasiveness (through careful traceability of chemicals used).

- b. IoT technology allows machines and physical objects to communicate with each other. As a result, processes become more efficient and various advantages in terms of monitoring can be achieved. The strengthening of control systems allows processors to significantly reduce - and often even eliminate altogether - the risk of machine failures and consequent production interruptions.

- Important results are therefore obtained in terms of:
- increase or otherwise stabilise production volumes;
 - reduction of operating times and costs related to energy users;
 - better and longer preservation of assets.

3. Smart Agribusiness: a reality yet to be built

The term smart agribusiness comes from the concept of innovating. Innovating means exploiting the digital technologies available today so that production processes and products are obtained more easily and with superior quality. Translated in the agri-food sector, innovation means that crops are followed more carefully and with selective criteria of the products most suited to the needs of the consumer.

The intervention of automation allows agri-food companies to obtain greater precision not only in the processing phases but also directly in the fields. This concept of precision and independence in the implementation and monitoring phases, together with innovative logistics and distribution systems, contributes to strengthening the agribusiness sector.

To be defined as such, however, the “smart” application must be present throughout the supply chain and not only in a specific segment such as the production of agricultural goods (in this case it would be simply defined as “e-agriculture”).

In order to achieve full benefits, the entire supply chain must therefore be efficient as a whole, otherwise those who will derive the greatest benefits will always be only the already developed companies (e.g. large food processing companies). Let’s proceed with order.

The “smart” initiative must start with the cultivation in the fields. The technologies must enable farms to:

- establish the irrigation and nutrient requirements of

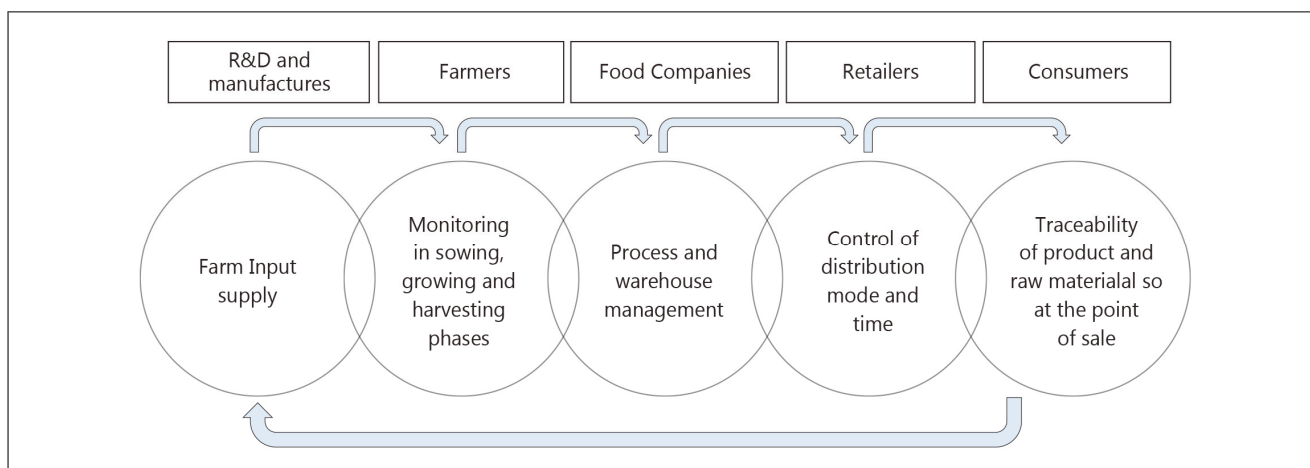


Figure 3. IoT projection for application segments

Source: author's elaboration

the crops;

- prevent crop diseases;
- identify potential pests before they proliferate.

A key example of smart implementation is the use of drones. They can monitor areas. With aerial vision, farmers are able to map fields and identify areas in need of specific pest control well in advance. This provides at least three important benefits:

1. reduction of intervention times and of the number of services provided (- costs);
2. reduction of the chemical components used (- costs; + quality);
3. identification of the best collection times with simultaneous reduction of waste (- costs).

Apart from drones, the benefit of the use of smart technology, becomes both qualitative and quantitative as input reductions can be achieved by obtaining a qualitative increase in products. In particular, this principle becomes a strong point for those agricultural realities that rely on organic and that cannot take advantage of the traditional systems of fertilization of the fields. Today, organic production processes are not only the expression of a responsible contribution of the company towards society (Wiele et al., 2001) but have become a real business.

The *raison d'être* lies above all in the social change underway, which sees a massive transformation of the population's diet from omnivorous to vegetarian and even more so to vegan.

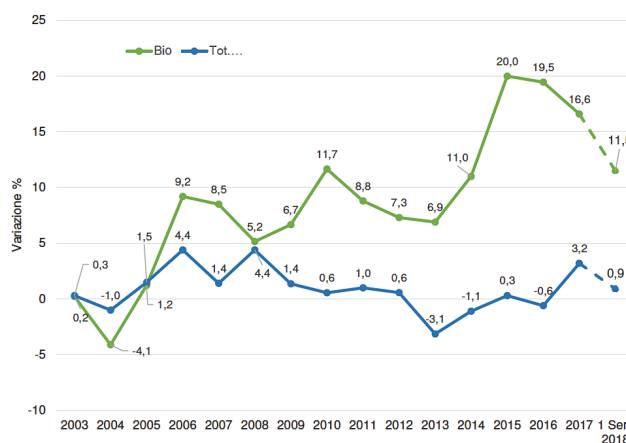


Figure 4. Annual consumption dynamics in value of fixed weight organic products in large-scale distribution and comparison with the total agri-food trend in Italy - % changes

Source: Ismea-Nielsen e Panel Ismea-GFK Eurisko

Once the benefits of the first stage have been considered, another important factor to be mentioned is the possibility of tracing the good and certifying the products obtained up to the processing industry. This important contribution of the technique is essential to enhance the value chain and to ensure a quality product to the final consumer. The benefits for the food processing company have already been mentioned earlier in the description of 5G communication technologies and the Internet of Things. But they're not limited to those.

Large companies, including those in the agri-food sector, are transforming their modus operandi into a "smart" key. That means that:

- production processes, sensors and actuators as well as control processes will increasingly be entrusted to systems assisted by artificial intelligence that can make automated systems more independent;
- the management of operations aims at planning by means of “lean” systems. In particular, through the use of big data, it is possible to carry out detailed process mining analyses for the modeling, implementation and improvement of subsequent processes; it is possible to define in an optimal key the stocks, the optimal lots of purchase and even the tracking of resources;
- also the company management will be more and more smart, taking advantage of the big data that in this specific area allow to identify more accurately the market risks, monitor the reputation of the brand, better identify the human resources to be hired, detect the tastes of the consumer and assist in offering products more suited to the profile of the customer.

The transport and distribution phase can also benefit greatly from the use of new digital innovation technologies.

For example, solutions for:

- optimize the cold chain with temperature sensors on the vehicles;
- control routes and quality of service with data collection;
- integrate the planning of the best route with respect to deliveries;
- organize the positioning of the goods in order to optimize space and delivery times;
- provide all actors involved in the supply chain with data to monitor the position and status of the goods.

Last segment but certainly not for importance is that of consumption.

Technology also plays an essential role at this stage, as the end customer must be able to be informed about the food he consumes in restaurants or buys at the point of sale.

The possibility of tracing the raw material with a more specific indication of the production systems can no longer be neglected especially in an economic system where the origin of the food can be in countries where food control is not sophisticated and accurate. In the digital age, these conditions are no longer tolerable.

Thanks to the simple use of the qr code, the product becomes digital and the consumer is able to read information about the place of production of the good, the transformation processes, the time of storage of the food and the path of transport (Canadi et al., 2010). Therefore, with the spread of a population more educated on food systems and agri-food processes, from the point of view of economic competition it certainly becomes a strong point for the most discerning companies to be able to provide customers with more information on the entire supply chain.

In this sense, those companies that will permeate the entire supply chain with the most suitable technologies to obtain quality products through a saving of resources and production costs will benefit and then will be able to offer a detailed information service on the product to the final consumer.

4. Analysis of strategies for a dynamic development

The problem is therefore how to reach this revolution defined as 4.0.

A swot analysis was carried out in order to quickly identify the internal and external strengths and weaknesses that need to be addressed to achieve new objectives for dynamic and, above all, sustainable development.

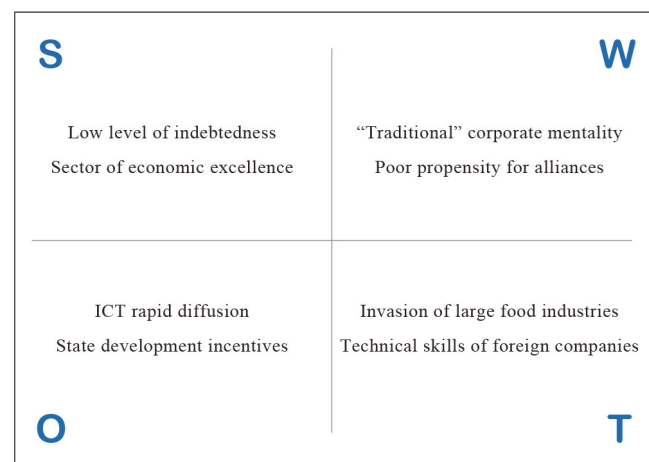


Figure 5. Swot analysis of current agribusiness system

Source: author's elaboration

At the moment, Italy is a world leader in the quality of agricultural products and foodstuffs. Made in Italy in the food sector is at the top of the economic sectors. According to ISTAT estimates revised by the Observatory Tuttofood, in 2018 the agri-food sector recorded a growth rate more than double the national GDP (+2. 2% compared to +0. 9%), exceeding for the first time the threshold

of 140 billion euros (La Repubblica, 2019). Global exports of agri-food products in 2018 consisted of € 56.3 billion or 12.2% of all Italian exports (Coldiretti, 2019).

These values are far from insignificant and must make us reflect on how urgent it is to keep our attention on this leading sector of the Italian economy.

Another important factor for change is the cost of investing in technology:

Table 2. Main costs related to an investment in technology

Starting Step	Consulting costs for feasibility plans, design and identification of the most suitable technological solutions to achieve the expected cash flow
Central Step	Costs for the purchase of technologies
Final Step	Costs of monthly fees for digital platforms Costs for ancillary work or expenses

Source: author's elaboration

These costs, which in a first approximation can frighten the entrepreneurs of the sector because they vary in terms of numbers, are not so substantial from the point of view of economic and financial return.

Case studies have shown that ROI is potential compared to relatively low investment costs but above all is achievable together with greater peace of mind management (KPMG, 2019).

It should also be stressed that today even “traditional” companies cannot overlook the most innovative techniques for forecasting the economic and financial return of an investment.

With them it is possible to evaluate the three alternatives more carefully:

- “Do nothing”, i.e. the non-intervention option;”
- “Do minimum”, i.e. the option of minimum intervention;”
- “Do something”, based on the interest in carrying out a largely technological project.

These evaluations are certainly sufficient to determine whether the investments in technology are actually able to achieve a positive rate of return on investment, given that on average the costs are estimated at a few hundred thousand euros for a complete project of a small business to which, as seen above, must then be added the costs of monthly fees for using digital platforms and also the costs for technical advice in the initial phase.

As far as the negative aspects are concerned, some extremely important considerations should be made.

The potential benefits that companies can reap from an investment in technological innovation today clash with a social reality far from fully understanding the possibilities available on the market.

The spread of these technologies is still far from international standards (Aleke et al., 2011).

The internal obstacles to diffusion lie primarily in the fact that there is no accurate training of human resources to be employed in the design of hi-tech operations in the e-agriculture sector or in subsequent employment during the production processes.

However, this problem is the direct result of a misconception of the company, since the number of technical specialisations is directly related to the number of jobs offered in that sector by the companies.

It should be added that, in cases where the owner of the company cannot understand the potential of an investment in technological innovation, it will also be difficult for him to understand the advantage achievable by the company through the hiring of highly specialized human resources.

The cultural barrier to innovation is the most frightening problem that has to be faced in order to overcome the so-called “traditional” business system.

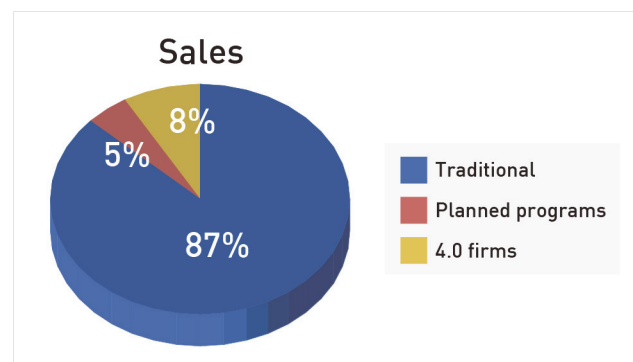


Figure 6. Percentage of “traditional firms” in comparison with “innovative firms” in Italy

Source: adapted from MET, 2018

Today in Italy, the number of companies that have planned or started business reengineering processes in an innovative way is infinitely lower than that of traditional companies. This conception not only does not allow companies to make new investments in technological innovation, but it also makes the very small companies more and more distant from the market reality that is rapidly changing today.

The distance from the “smart” technological conception and mentality, therefore, not only makes traditional business realities uncompetitive, but also irremediably defines their economic defeat in the medium to long term as technology evolves exponentially (Hilbert and López, 2011; Kurzweil, 2005) and it will be increasingly difficult to understand and adapt to new standards.

The obvious consequence will be that the large industries of the food sector will be the only ones to invest in cutting-edge technologies and to exploit highly qualified and specialized human resources in the hi-tech agri-food sector, thus deciding more and more the fate of the very small farms that work upstream and which will have to offer products in abundant numbers but at very low prices to survive.

Achieving a revolution in a smart key means first of all acting on the knowledge of our companies so that they can understand the strengths of a development 4.0. Moreover, it means understanding the potential of human resources with specific technical skills that can manage the new 4.0 technology without having to resort to external consulting, thus burdening the company with additional costs.

In order to achieve this objective, it is essential that the following goals are achieved:

- ad hoc training courses for specialised technicians;
- university courses to educate the new generations;
- the incentive to develop spin-offs;
- the interaction between companies and university research centres in a logic of open innovation;
- the use of innovation managers (temporary managers, innovation coaches) to stimulate companies’

investments and to allow companies in the “start-up” phase to become “scale ups” thanks to new business models;

- an opening up of the concept of doing business towards a “shared company logic” (Rangone, 2019; Rangone, 2018).

In fact, the current outlooks (EUBlockchain, 2019; Zwart, 2018) clearly suggests that the supply chain will be increasingly permeated by new technologies such as the blockchain, which is currently only a mirage for most economic actors and belongs to extremely large business realities.

However, it is essential that even small businesses enter into the perspective of emerging technologies, exploiting those already on the market and looking to the future for those still in their infancy.

Delaying in this decision would be fatal for companies, especially the micro companies that today make up the entire Italian entrepreneurial fabric.

However, new technologies are based on “data sharing”. The blockchain is specifically based on transparency and the ability of each actor involved in the chain to share and intervene on data relating to production, processing and distribution (Toulon, 2018).

This means that the supply chain must have an extremely high degree of cohesion between the actors.

In the absence of this change, the large food processing companies that already control large portions of the food supply chain will increasingly monopolise the agri-food system, defining supply criteria and imposing their own economic terms.

This means that companies must learn to open up to

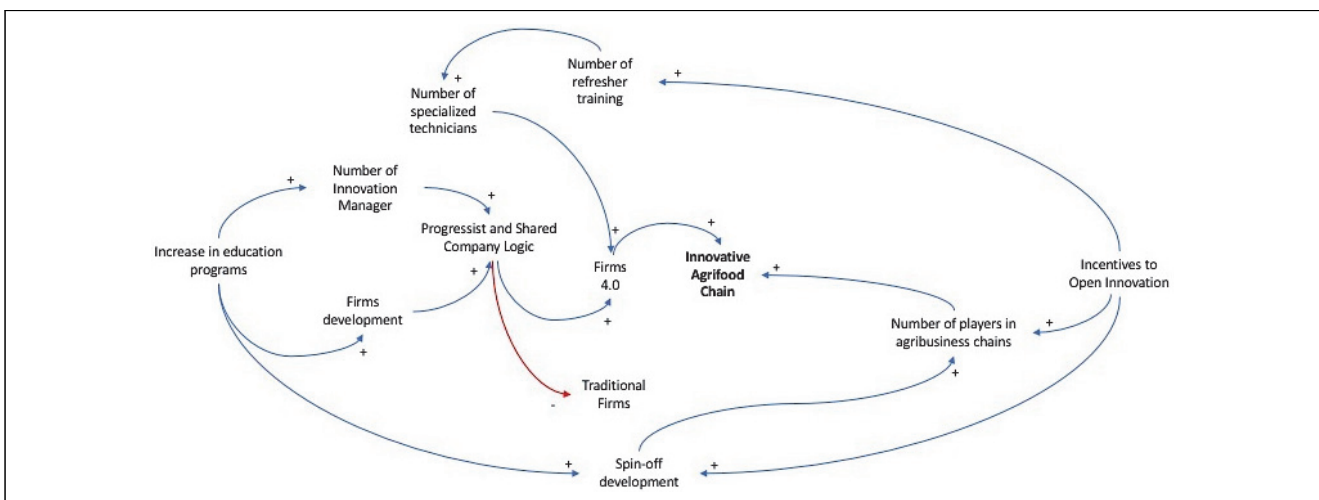


Figure 7. Essential causality diagram for the innovative agribusiness development

Source: author's elaboration

new forms of collaboration so as not to be excluded from new technological solutions and the potential they express.

The “company logic” (Rangone, 2018) must be rediscovered according to a principle of “sharing” that can provide the tools for new corporate governance solutions or push companies in the agri-food sector to seek new strategic partnerships (Rangone, 2019).

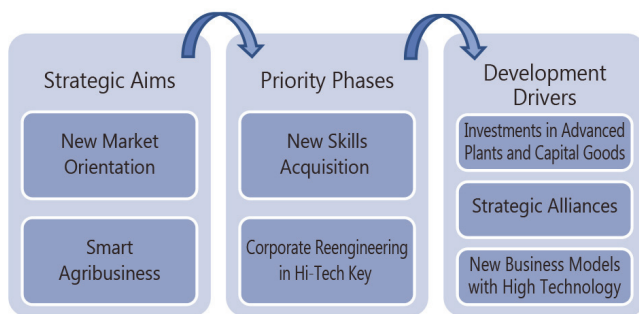


Figure 8. Key points for a dynamic development

Source: author's elaboration

Therefore, wanting to draw conclusions from this analysis, which certainly expresses a prelude to subsequent studies, it is considered useful to underline how much it has become imperative for companies in the agri-food sector to define new important strategic objectives for technological development.

In our opinion, this new orientation requires substantial processes of corporate reengineering of the entire food chain so that it can be carried out efficiently and effectively for the companies involved but especially for the end consumer.

It is therefore imperative to give priority to the contribution that technology on the market today can make to the companies involved in terms of reducing costs and the time needed to carry out processes and obtain goods. Today, despite the fact that the food sector is extremely important for the Italian economy, it has not yet been permeated by a strong diffusion of ICT technology, unlike other economic sectors or public infrastructures.

This revolution must therefore proceed at the same time as the smart revolution in the environmental sector that is emerging on the horizon.

In order to achieve this evolution, companies can leverage on some important drivers that consist both in investing in plants as well as in technologically advanced capital goods and in strategic alliances that allow to optimize the connections provided by the digital reality.

These drivers will provide the most appropriate tools

to develop new business models that will make the companies themselves more competitive in the market.

5. In economics who dares wins

“Audentes fortuna iuvat” is the title of the conclusions to this work.

This motto, which was already very important for the Latins, has been deliberately emphasized from an economic point of view, since all too often companies rely exclusively on cold analyses of financial performance, without however considering that in the business world those who dare generally win.

To be clearer, in the business wins who is able to understand the changes or the entrepreneur who has a “vision” of the society in which he lives and future prospects considering that, regardless of the values more or less high ROI, there will always be a margin of risk in any form of investment and at every stage of its implementation.

So, entrepreneurs have to be daring and often have to be guided by their instincts.

Today it is imperative to understand new technologies but above all to understand that if large companies in every sector are investing in them, it is not possible to refrain from carefully evaluating every potential benefit. The alternative is decline.

There are still many open questions that can be considered on the subject of agribusiness in an innovative way and will certainly be developed through concrete cases in subsequent publications.

However, we would like to underline that at the base of the great changes in the economic field there are always “visions” and strategies that often refer to intuitions. This is therefore a warning to the categories of entrepreneurs who often abandon themselves to the terror that business risk generally spreads and who hinder the development of their company for fear of taking new steps towards what they do not know.

But history teaches us that intuitions guide us towards great discoveries and winning initiatives.

These are the insights of the great men who, not by chance, later become great entrepreneurs and guide the trends of our future.

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