

**INNOVATIONS IN AGRICULTURAL ENTERPRISES:
A STUDY OF SMALL SIZE WINERIES LOCATED IN VALLE DEL MELA , SICILY**

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ABSTRACT

There are many obstacles that prevent the development of farm businesses in rural areas, among these is the limited propensity for innovation by entrepreneurs that represents a clear limit to economic sustainability. This research aims to give an idea, albeit partial, of the current propensity to introduce innovations in wineries located in the Sicilian district of Valle del Mela within the metropolitan area of Messina. In addition to assessing the degree of propensity for innovation, this research intends to identify which types of innovations have been introduced by the sample companies involved in the survey in the last 3 years. In this way we can highlight the knowledge of agricultural entrepreneurs regarding the latest innovations available in the sector and how they are possibly willing to invest in order to achieve them. This study also includes information on the level of industrialization 4.0 achieved in the three-year period 2015 - 2018. In order to carry out the research survey, a motivational survey was carried out using a face to face questionnaire in the period 18 September - 20 October 2018.

KEYWORDS

Innovation, viticulture, agriculture, sustainability, research

INTRODUCTION

In recent years the consumer has been increasingly looking for quality in the products he buys and this has led several entrepreneurs to implement strategies and to invest in innovations. In agriculture, the production sector that has invested more in innovation over the last three years has been the wine sector (Schimmenti *et al.*, 2016). In the wine-growing economy, innovation is a fundamental element for competing with producers on an international level. In this work, by means of a *face-to-face* survey, we analyze the level of propensity of the wineries to invest in order to implement new methods of production or new products or to reduce production costs while increasing production and to limit their impact on the environment as much as possible. Among these new methods we consider the new model of the 4.0 industry in agriculture (Galatiet *et al.*, 2015. Lanfranchi *et al.*, 2015a). In fact, in this decade there have been great changes in the global economic ecosystem and this has led to the need for agricultural industries to adapt to the new international systems. In this regard, an important research was carried out by the CREA Research Center for Engineering and Food Processing, which discussed the main technical efforts necessary to optimize the collection of pruning residues. Generally, pruning (branches and sprouts of fruit trees) has been considered more of a problem than an opportunity and residues have often been disposed of incorrectly. This problem could be solved by using pruning residues to produce combustible biomass. In the context of these innovations, Braga (2016) ("Sustainable agri-food leadership, innovation and renewable solar thermal energy: opportunities for sustainable agriculture" published in the "International Journal on FoodSystem" Dynamics ") discussed *SolarWall* technologies and their possible application in the local agro-industrial sector. *SolarWall* captures and makes available for the services a very high percentage of solar radiation (over 90%), diminishing the efficiency of photovoltaic panels (PV). The original technology is extremely sustainable and requires virtually no maintenance, offering long-term production with a life expectancy of several decades. There are possible agro-food applications for *SolarWall* technologies. Now *SolarWall* technologies have been applied to solve the energy needs of Food in Italy, while providing a significant reduction in the carbon footprint. *SolarWall* technologies can be exploited profitably in Sicily by oil and wine producers. Giovanna Medeiros *et al.*, (In their article "Open Innovation in Agrifood Chain: A Systematic Review" (2016), published in the "Journal of Technology Management & Innovation") have carried out a bibliometric analysis on all the studies on innovation in the agri-food chain.

1. INNOVATION AND VITIVINICULTURE: CONTEXT ANALYSIS

Innovation and viticulture are two areas of great interest to the economy in the primary sector. In recent years the approach to innovation has become one of the main leitmotifs of economic debates. Innovation is seen as one of the key tools that influence the competitive success of any business (Dal Vecchio *et al.*, 2018. Chinnici *et al.* 2015. Bernetti *et al.*, 2006). On the contrary, it is possible to affirm that it represents a real necessity to survive, an element which we can no longer do without. In fact, the importance of innovation for competitive performance and for the economic and social growth of companies and world economies is recognized by all currents of economic thought (Pappalardo *et al.*, 2018. Pancino *et al.* 2016. Grayet *et al.*, 2004). The innovative activity of companies differs significantly depending on the sector it belongs to as well as the size and the area of reference (Bentivoglio *et al.*, 2017. Fariasi *et al.*, 2014. Di Vita *et al.*, 2013). These diversities also distinguish the sources from which the company generates innovation. The sources of innovation depend mainly on the choice of the type of research that is to be carried out within the company (Alston, 2018). The sources of innovation are divided into internal and external. Internal sources are represented by research and development, by the creative vein and by the inventive spirit of company personnel (Finco *et al.*, 2018. Boccia & Covino, 2016). External sources are represented by the innovative capacity of external parties with whom the company maintains relationships. In Italy, the 4.0 Agricultural Market invests almost 100 million euros (about 2.5% of the global market) and the 4.0 offers proposed by emerging actors are completely new, while those advanced by already well-

established actors have been revised. In agriculture 4.0, the cross-analysis of cultural, environmental and climatic elements makes it possible to prevent the spread of disease, to determine the irrigation and nutritional needs of crops and to identify weeds before they multiply, etc (Martino *et al.*, 2017. Lanfranchi *et al.*, 2016). Therefore, today, we are able to intervene in a targeted manner, bringing benefits in terms of saving material and temporal resources and in terms of quality and yield of the finished product (Macmillan & Benton, 2014). The exploitation of such data along the supply chain reveals the full value of agriculture 4.0, tracing and certifying products from the field to industry, creating high quality products, implementing short supply chains, and achieving greater efficiency in the processes of production and exchange of goods and information between the various actors in the value chain (Pannell, 1999). Despite the enormous advantages, the use of such solutions in Italy is still rather limited, in fact only 1% of the cultivated agricultural area used is managed with its own 4.0 Agriculture systems. Viticulture is one of Italy's main agricultural productions. The need to combine innovation and viticulture is fundamental for the Italian economy, especially in an extremely globalized market. In fact, increasing competition should drive all companies to improve competitiveness, the efficient management of resources and the environmental performance of supply chains (Bachev & Terziev, 2018. Kubankova *et al.*, 2016). The 2014-2020 CAP identifies innovation as the pre-requisite for preparing agriculture for global challenges. For this reason, great importance has been given to European research (Horizon 2020), food security, bio-economy and sustainable agriculture. In this sense, innovation policies in the agricultural sector become a combination of research and rural development policies (Blancet *et al.*, 2018. Ogundari & Bolarinwa, 2018. Vagnozzi, 2015). In 2012 the European Commission introduced the implementation of the EIP in terms of "Productivity and sustainability of agriculture" (Communication 2012/79). Their goal is to make visible the actions to promote the productivity and efficiency of the agricultural sector and the sustainability of agriculture. Among the first countries to invest in innovation was Germany with its "Industrie 4.0" program (Sturiale & Scuderi, 2018. Torquati *et al.*, 2016). The development of the fourth industrial revolution in Europe is following a dual path characterized by different strategies (Timpanaro & Foti, 2016. Lanfranchi *et al.*, 2014). While countries such as Germany, Sweden, Austria and Eastern European countries are achieving results in terms of greater market shares and productivity growth, other EU countries are in the process of deindustrialization. This is the case in countries such as France, the United Kingdom and, in general, the countries of Southern Europe which have seen their employment and the level of their added value increasingly reduced. Until a few decades ago, France, the United Kingdom, Italy, Germany, Japan and the US were considered the six most industrialized countries in the world. Italy thanks to the "National Plan Industry 4.0" can return to grow. As mentioned above, the wine sector is one of the most rapidly growing on an international level, especially in the highest quality sectors. The globalization of production and consumption of wine has led to a disproportionate growth in recent years among the countries with the highest wine-growing tradition and the countries that most recently have started to invest in this sector. European countries, such as France, Italy, Spain, Germany and Portugal, while maintaining the primacy in quantitative terms of wine produced and consumed, are now showing a decline in terms of production and consumption of wine (Allegra & Zarbà, 2018. Palma *et al.*, 2018. Zarbà *et al.*, 2014). On the other hand, other non-European countries such as Australia, New Zealand, Argentina, Chile, South Africa and the United States are showing an increase in areas used for vines, production volumes and consumption. In recent years, it has also been noted that the entry into the wine market of other emerging countries, including China, has shown significant growth rates in terms of both production and consumption. According to Ismea data, Italy maintains the international production record and is the world's leading wine producer. There are about Italian 310,000 wineries representing 21% of total agricultural enterprises. Italian wine production, to date, has 526 community awards including 408 PDO and 118 IGP. Moreover, in 2017 vines covered 652 thousand hectares, 1% more than the previous year. From the point of view of foreign trade, however, Italy is the second largest exporter of world wine, behind France in terms of flows in value and Spain in quantities exported. In Sicily the wine sector is growing in quantity and quality (Sgroi *et al.* 2016). Sicily produces more than 10% of Italian wine and is the fourth region for production, after Veneto, Puglia and Emilia Romagna. The PDO and PGI wines have reached 80% of the regional production (24 Dop and 7 Igp). Sicily is the first Italian region for organic vine areas with 38.935 hectares (37.6% of the national surface).

2. OBJECTIVES AND TOOLS

This study aims to identify the degree of innovation in the wine-producing enterprises falling within the area under investigation. The Valle del Mela falls on the western side of the *Peloritani mountains* of the town of Messina. The companies selected for this research are all in the municipalities of Milazzo, Barcellona Pozzo di Gotto, Merì, Santa Lucia del Mela, San Filippo del Mela, Pace del Mela, Gualtieri Sicaminò, Condò, San Pier Niceto, Monforte San Giorgio. The main purpose of this research was to understand the level of knowledge of winemakers regarding the latest innovations available in the sector and to what extent they are willing to invest in them. A further object of investigation concerns the type of innovation introduced by individual companies during the last three years and the possible obstacles encountered by them. All information was collected at the level of industrialization 4.0 reached in the three-year period 2015 - 2018. In order to carry out the survey a face-to-face questionnaire was used. Preliminarily the members of the research group outlined and developed the research hypothesis, identified the questions of the survey and created the questionnaire to be administered to the selected sample of companies (Giannetto *et al.*, 2016. Lanfranchi *et al.*, 2015b). The questionnaire was submitted to 30 wineries between 18 September and 20 October 2018. The questionnaire consists of five sections. The first section analyzes the size of the company, the second investigates the revenue invested in innovation over the last three years and which departments have been more interested in this process of innovation; the third section analyzes the main problems and the most significant obstacles that winemakers have encountered for the implementation of policies in favour of innovation; the fourth section indicates which types of innovations

have been adopted and finally the fifth section analyzes the level of knowledge on the part of the agricultural entrepreneur in relation to the financial instruments that Italy has granted for the development of the industry 4.0. A similar research was carried out by Di Vita *et al.*, In 2013. In that case the authors investigated the degree of innovation of small winemaking companies producing Malvasiadelle Lipari PDO. The study shows that the market for Sicilian sweet wines needs an adequate support for public communication policies to obtain sufficient visibility on foreign markets and increase their international competitiveness.

3. RESULTS

60% of the wineries involved in the survey have an "individual" corporate legal form, 17% are limited liability companies, the remaining 23% are cooperative companies, limited partnerships, collective partnerships and simple agricultural companies. Furthermore, it was revealed that 67% of companies own 100% of the land, while 24% own part of the land while renting another part. The remaining 9% rent or borrow and in any case do not own the land. Agricultural activities carried out on the land are prevalent in 77% of cases, while 23% also carry out secondary activities, other agricultural activities or agri-tourism activities. 30% of those questioned have between 4 and 9 hectares per single company, the majority have less than 25 hectares. The wine companies in the area of Messina however, have more hectares than elsewhere in Sicily, with an average of about 12 hectares per company. Regarding the number of employees, 83% of those surveyed do not have more than 3 permanent employees, while the remaining 17%, which have the highest revenue, have a maximum of 9 permanent employees. The revenue achieved in 2017 for 50% of the sample is less than € 50,000.

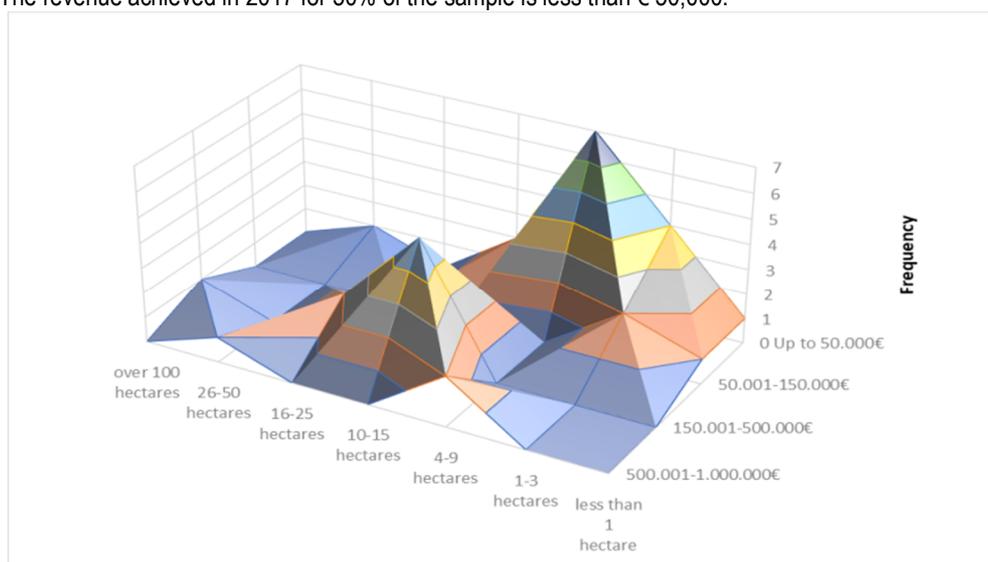


Figure 1 Relation between revenue and size of the land

As shown in Figure 1, we have compared the revenue with the size of the land in hectares, revealing a greater benefit for companies with from 10 to 15 hectares. They have an average revenue of between €150.001 and €500.000, which represents 26.67% of the revenue of the companies interviewed. Of those with 4 and 9 hectares, represented by half of those surveyed, 78% show a revenue of below € 50,000. It is very interesting to note that the companies with the highest number of investments over the past 3 years in innovation projects are those with the highest revenue, i.e. companies with an area of 10 to 15 hectares. These make up 26% of the whole sample. Among these companies, 62.5% allocate more than 16% of their revenue to innovation projects (figure 2).

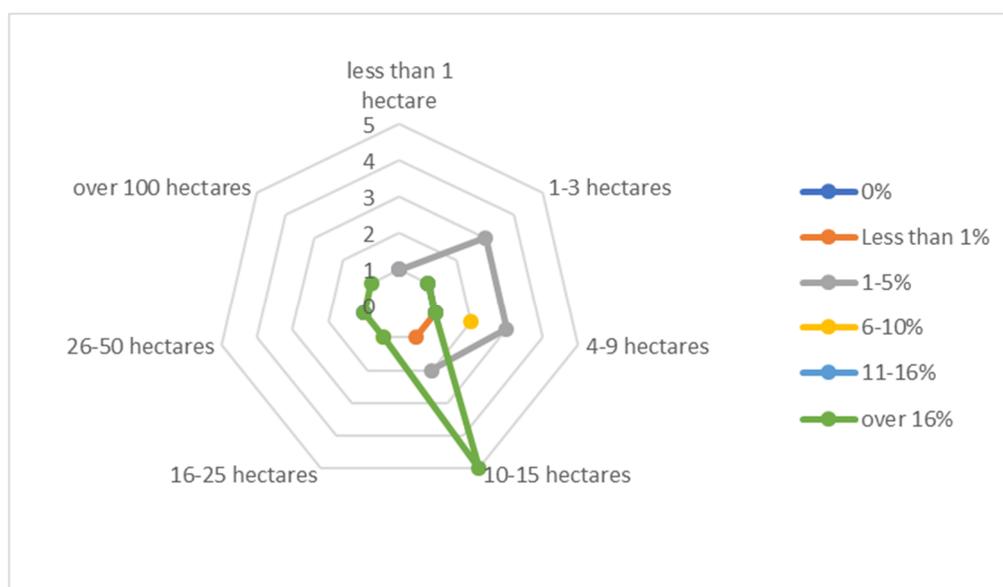


Figure 2 Percentage of revenue invested for innovation and land size

In general, 33% of companies invested more than 16% of revenue in innovation projects.

Table 1. Main fields of innovation

Revenue invested	Training	Software development	Brand and reputation	Web design	Research and development	Product design and services	Organisation and production	Machinery, licences
0%	36,67%	30,00%	23,33%	20,00%	30,00%	26,67%	36,67%	13,33%
Less than 1%	6,67%	20,00%	6,67%	23,33%	26,67%	10,00%	6,67%	3,33%
1-5%	36,67%	20,00%	43,33%	33,33%	23,33%	33,33%	20,00%	20,00%
6-10%	10,00%	20,00%	6,67%	6,67%	3,33%	16,67%	13,33%	26,67%
11-16%	0,00%	3,33%	6,67%	10,00%	6,67%	10,00%	3,33%	10,00%
Oltre 16%	10,00%	6,67%	13,33%	6,67%	10,00%	3,33%	20,00%	26,67%

(Source: Our elaboration)

Table 1 shows the percentage of revenue that the companies under investigation, have invested in relation to the different areas in innovation. It is therefore possible to highlight in which sectors the various sections are more connected, and consequently where the main positive results are detected. The analysis carried out shows an almost uniform distribution of positive results in all sectors with regard to investments in innovation of the organization and of production. There is a positive correlation between the increase in sales and the growth of the market share of 89%. It is evident that companies tend to invest mainly in "machinery, licences" and "brand and reputation" and far less in "training", "Softwaredevelopment" and "research and development" (Fig. 3).



Figure 3 Types of innovations

It has also been noted that, in the last 3 years, about 70% of those involved in our survey have improved the structure of the company, especially in the redesign of packaging, promotions and prices, therefore with a greater concentration on marketing, but also on services, production processes and distribution, organisation and in the product itself. As far as the product and the distribution and processes of production are concerned, 25% had not only made improvements, but had undergone a complete renewal. Over the last 3 years, as far as software is concerned, it has been found that 50% have implemented almost no improvement or innovation. Only a few wineries are moving towards greater computerization of processes and control of the same through updated software, and there is no significant correlation to size or revenue. From the elaboration of the information and from the analysis of the data collected, different percentages of positive results emerged from the innovative function in different company fields such as: "expansion of market segments", "punctual identification of the target" "customer satisfaction", "increase in sales" and "growth in market share". The variability between the averages of the percentages of each sector is low. There is a higher percentage of positive results with regard to "customer satisfaction", with 74%, while the remaining sectors are around 60% (Table 2).

Table 2. Correlation between the characteristics of the wineries and the level of investment in innovation

Related Elements	Expansion of market segments	Punctual identification of target	Customer satisfaction	Increase in sales	Growth in market share
Number of hectares	-19%	-18%	-22%	-32%	-13%
Revenue 2017	53%	32%	11%	31%	43%
Revenue invested in innovation in the last 3 years	11%	-8%	-2%	-10%	-4%
Revenue invested in training	2%	18%	4%	6%	0%
Revenue invested in software development	36%	30%	10%	15%	25%
Revenue invested in brand and reputation	45%	54%	-3%	13%	16%
Revenue invested in web design	49%	37%	-2%	25%	29%
Revenue invested in research and development	22%	35%	11%	9%	18%
Revenue invested in product design and services	35%	51%	-9%	20%	13%
Revenue invested in organisation and production	33%	14%	36%	36%	31%
Revenue invested in machinery and licences	25%	2%	30%	24%	30%

(Source: Our elaboration)

The various percentages, when positive, determine an increase in the positive results deriving from the investment in the corresponding sectors, this because they are directly proportional, while, if negative, they determine an inversely proportional trend. A percentage with a positive or negative sign which is around 30% determines a weak dependence, if it exceeds 30% it can be considered medium-strong. From the data collected it is possible to highlight that increasing the extension in hectares diminishes the positive results deriving from the innovation. As far as revenue is concerned, the exact opposite occurs (tab.2). From Figure 4, which shows the average percentage of dependence, it is possible to note that apart from training, which seems to have little influence on the positive results revealed, all the other sections seem to contribute much more evidently, especially for those who have invested a greater percentage in innovation in "organization and production".

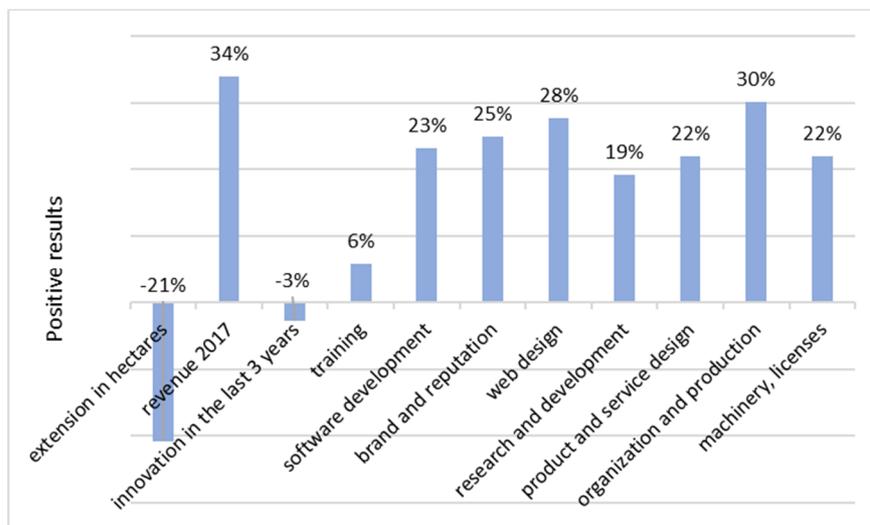


Figure 4 Percentage of investments in innovation

The data showed a low level of knowledge on the part of the agricultural entrepreneur regarding not only financial opportunities related to innovation strategies. This has been attributed to rather ineffective communication and information strategies by private and public institutions. In fact, 30% of those involved consider information regarding the means to encourage innovation to be non-existent, while 46% believe they are inadequate. The level of knowledge of agricultural entrepreneurs regarding the latest innovations in their sector is quite high, only 17% think they have little or no knowledge of the latest innovations introduced, the remaining 83% believe they know them. The research also investigates the use of the means made available by the government to support companies who want to invest in innovative tools. Many companies are unable to obtain financing because they are not aware of the ways available to obtain them. The data show us that, in reality, only 50% of those surveyed used the means granted by the state. 7 companies out of 15 used "research and development tax credit", which was the most widely adopted method. 30% of those surveyed stated that they are aware of these tools but did not use them. 13% did not meet the requirements, while to 17% they seemed useless. The remaining 20%, on the other hand, were either unaware or not informed. The main obstacle to innovation is thus the lack of human and financial resources, particularly with regard to the product / service. A further obstacle is represented by the rules and regulations, especially in the phase of production. The main reasons for the success of innovation projects, according to our survey, derives from the active role of the entrepreneur, especially where product / service innovation is concerned.

CONCLUSIONS

Through the collection and analysis of data and interviews with entrepreneurs, it has been possible to see that innovative projects in the field of agri-foodstuffs is no longer an exception. The analysis of the survey has shown that the search for innovative strategies is encouraged as it represents an antidote to competition among the many companies in the wine sector. Agricultural entrepreneurs are aware that investing in innovation can give a competitive advantage. Agri-food companies that pursue sustainability goals develop innovations that maximize efficiency in the use of resources, make structural and organizational changes in the supply chain, use natural and / or renewable processes and materials, protect the supply chain upstream and downstream and create value from waste in a circular economy. Finally, the analysis has shown that the main obstacles to the spread of innovation are represented by: a cultural barrier and attitudes that show them to be *followers* rather than innovators; a lack of awareness and a limited understanding of the benefits connected to the use of the tools of agriculture 4.0; from a small average business size compared to that of other countries that negatively affects the propensity to invest and the appreciation of the potential benefits of the 4.0 technologies; from a clear immaturity on the part of the actors regarding what is on offer. According to the latest ISTAT forecasts, innovation can guarantee an increase in revenue of 15 billion euros to agri-food companies. The paradigms on which it is necessary to intervene in innovative terms to produce growth and value are: attention to the consumer that can lead to a 22% -25% increase in revenue; synergy among operators that could allow a growth of more than 36% of revenue; availability of quality products that would imply an increase of over 40% in revenue.

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