Sustainability, innovation and biological technology in wine production: an empirical analysis

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Objective and Background *The agri-food industry is strongly connected to environmental issues of sustainability; the very concept of quality agri-food goes hand in hand with the development of crops and production methods that protect the territory, and which increasingly reduce the use of substances harmful to humans and the environment (Casini et al, 2010; Cantino et al., 2018). This type of reasoning can be applied to the wine sector which has traditionally shown great attention to the environmental aspect, recognizing in this element a factor of wine quality (Gilinsky et al., 2015). As pointed out in the First Report on the Sustainability of Wine (http://www.vinosostenibile.org), awareness of the technical and commercial importance of the link between characteristics of the place of production and characteristics and identity of the wine led already in the 19th century to the development of the concept of territory and subsequently, with increasing sensitivity to social and environmental issues, many companies, also with a view to corporate social responsibility, have adopted innovations in corporate processes aimed at greater respect for the environment (Szolnoki, 2013; Siepmann, 2018).*

The wine world has reacted to the challenge of sustainable development through the development of collective initiatives (Castellini et al., 2014) for the implementation of sustainability programs (Roualt et al., 2016) for the analysis and evaluation of the production processes in the companies involved, with a view to continuous improvement, sharing of best practices for internal and external communication of performance achieved in terms of sustainability (Olaru et al., 2014). In Italy, the world of winegrowing has positevely reacted to the challenge of sustainable development.

In the past twenty years, attention to the issue of environmental sustainability has increased more and more, year after year. The reasons are manifold, both environmental, economic and ethical. According to data published by SINAB (National Information System on Organic Agriculture), since 2010 the area for organic agriculture in Italy has increased by almost 800,000 hectares and 27 thousand farms (SINAB, 2019).

The data as at 31 December 2018 therefore confirm the growth of the organic farming sector while maintaining the positive trend, as organic areas increased by 2.6% compared to 2017, reaching almost 2 million hectares. Most of the agricultural sectors have recorded an increase in the biological area. Growth for vines and olives is more contained (with only a plus of 1%) (SINAB, 2019).

As for the regional distribution of biological surfaces, the largest extension was recorded in Sicily with 385,356 hectares, followed by Puglia with 263,653 hectares, Calabria with 200,904 hectares and Emilia-Romagna with 155,331 hectares. Compared to 2017, biological areas in Sicily and Calabria decreased by 10% and 1% respectively, while in Puglia and Emilia-Romagna they increased by 4% and 15% respectively. The biological surface of these four regions holds 51% of the entire national biological surface (SINAB, 2019).

At the end of 2018 in Italy it was recorded that 79,046 businesses were included in the certification system for organic agriculture, recording a 4% increase compared to 2017. It is noted that 58,954 exclusive producers (farms) show a 3% increase over the previous year (SINAB, 2019).

Of the total area cultivated in Italy, organic grows to affect 15.5% only of the national UAA (Utilized Agricultural Area), given that in 2017 it grows by one percentage point compared to 2016. From the processing of the surface data, it is clear that on every 100 hectares of UAA are organic: 5.6 hectares in the North-West, 9.3 hectares in the North-East, 20.1 hectares in the Center and in the South and 19.2 hectares in the Islands. Organic farms in Italy, on the other hand, represent 6.1% of total farms. This figure is uniform in all areas of the country. As regards the average size of the farms that make up the Italian organic sector, the average surface area was 28.2 hectares. Larger company areas have been registered in the Center, South and Islands, while North-East and North-West are smaller (SINAB, 2019).

Nevertheless, even though Italy is one of the main wine producers in the world, organic wine production is almost still and is not addressing the growing request for this kind of product. Therefore, it is interesting from s business

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management perspective to investigate the factors/latent constructs influencing the choice of adoption/non-adoption of innovative organic wine production technologies by Italian wine producers (Zucconi et al., 2019).

Methodology. *Over the past 30 years, the field of interdisciplinary study of innovation adoption has developed rapidly. Different theoretical models were developed and applied. The result of these many years of research is the numerous contributions to the field, which, however, remain highly fragmented. Since the 1960s, researchers in various disciplines have published many studies about the adoption of technologies by individuals (Ogrezeanu, 2015). In Table 1, the timeline of the main Research Models under discussion in this research are presented.*

Tab. 1: The main models studying the choices of adoption/non-adoption of innovation

Year	***Research models***	***Core constructs***
1980	*Theory of Reasoned Action (TRA)*	*Attitude, Subjective Norm*
1985 & 1991	*Theory of Planned Behaviour (TPB)*	*Attitude, Subjective Norm, Perceived Behavioural Control*
1986 & 2002	*Matching Person & Technology Model (MPT)*	*Environment, Person, Technology functionality*
1989	*Technology Acceptance Model (TAM)*	*Perceived Usefulness, Perceived Ease of Use, Subjective Norm/external variables*
1992	*Motivational Model (MM)*	*Extrinsic Motivation, Intrinsic Motivation*
1995	*Innovation Diffusion Theory (IDT)*	*Five Perceived Attributes*
	Task-Technology Fit Model (TTF)	*Task Requirement, Tool Functionalities*
	Social Cognitive Theory (SCT)	*Self-efficacy, Affect, Anxiety, Outcome Expectations*
2000	*Technology Acceptance Model (TAM 2)*	*Social Influence, Cognitive Instrumental Processes*
2003	*Unified Theory of Acceptance and Use of Technology (UTAUT)*	*Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Gender, Age, Experience, Voluntariness of Use*
2008	*Technology Acceptance Model (TAM 3)*	*Pre- and Post-implementation Phases*

Table 1 Chronologically lists the main Research Models that investigate the choices of adoption/non-adoption of innovation.

Source: Cobelli N., Innovation in Community-Based Private Practices through eHealth: A Business Management Perspective, New York City, Springer, 2020 (forthcoming).

In 2003, Venkatesh et al. formulated the Unified Theory of Acceptance and Use of Technology (UTAUT), as shown in Fig. 1. They theorised that four components have a significant role in usage behaviour and user acceptance: performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh et al., 2003). Thus, UTAUT can be considered a unified view of previous works. In particular, it is based on an integration of several previous research Models (Lai 2017). Among all the Models described, UTAUT seems to be in literature on of the most sophisticated and with the highest impact in the study of the owners and managers' reasons behind the choices of adoption/non-adoption of new technologies (Im et al., 2011).

Fig. 1 Unified Theory of Acceptance and Use of Technology (UTAUT)

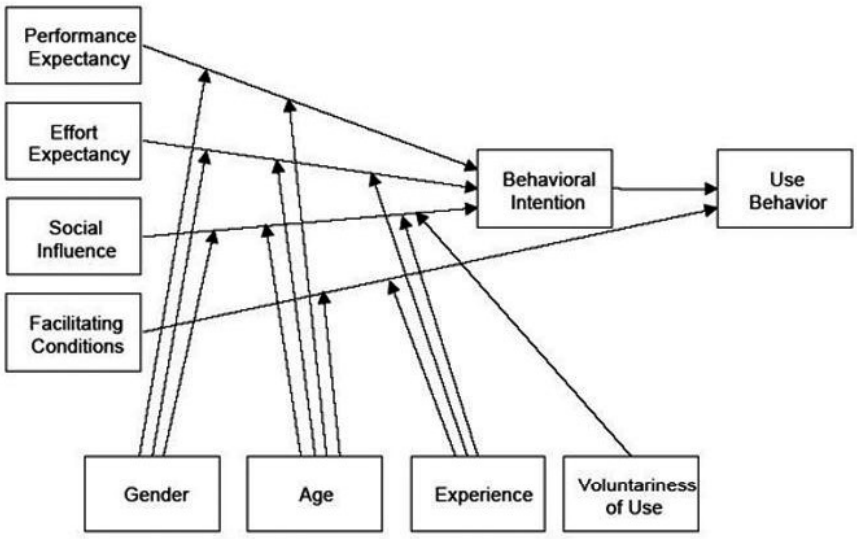

Fig. 1 shows UTAUT, which aims to explain user intentions to use an information system and subsequent usage behaviour.

Source: Venkatesh et al., 2003.

The literature provides many guidelines with respect to sample size, including having (a) a minimum sample size of 100 or 200 (Boomsma, 1985), (b) five or 10 observations per estimated parameter (Bentler and Chou 1987) or (c) 10 cases per variable (Nunnally and Bernstein 1967; Cobelli, 2020).

For the collection of data to be analysed, a quantitative analysis was carried out using questionnaires based on UTAUT research model. The questionnaire administered to each company consisted of 4 sections with a total of 34 questions. The first part consisted mostly of general questions (14 questions), such as the year the company was founded, the owner's registry, number of employees, etc.

The second part, consisting of 17 questions, focused on marketing and communication strategies and, in particular, on the motivations that pushed producers to pursue a specific production/management path.

The third part aimed to know what the perceptions towards organic wines were and finally on the hypothetical weaknesses and strengths of the production choice undertaken. The fourth and final part, however, included a series of questions directed to the owners' personal data, such as gender, age, role etc..

The sample, taken into consideration for this study, included 891 companies; a response rate of 21% was recorded, or 181 companies (n. 181), operating throughout the national Italian territory.

Expected Findings. *Data analysis is not completed. We are still working on them through the use of R software (R Core Team, 2020). For these reasons, now we can present some expected outcomes and findings, rather than certainly proven findings.*

It is a matter of fact that, according to the responses, sustainability in viticulture is defined by two important international organizations: International Organization of Vine and Wine (OIV) and International Federation of Wine and Spirits (FIVS). Both have drawn up sustainability programs called respectively: Guidelines for Sustainable Viti-viniculture (production, processing, and packaging of products) and The Global Wine Sector Sustainability Principles Project.

The OIV defines the sustainable production of wine as follows: "Global approach commensurate with the systems of production and transformation of the grapes, simultaneously associating the economic longevity of the structures and territories, the obtaining of quality products, taking into consideration the needs precision viticulture, risks related to the environment, product safety health and consumers and the enhancement of historical, ecological, cultural and aesthetic heritage"(OIV, 2019, http://www.oiv.int).

In the guidelines, the OIV refers to numerous aspects: the choice of the site, biodiversity, varietal selection, varietal management, soil management, energy use, water and waste management, use of chemicals and finally human resource management. The FIVS, in addition to what is considered by the OIV, also focuses on carbon management, pollution caused by transport and finally the consumption of fossil fuels (Mariani, Vastola, 2015).

As previously stated, the management of human resources must be considered within the concept of sustainability. This makes it clear that the meaning of the word sustainable is not limited only to respect for the environment but is an approach that embraces multiple fields; one of them is human resource management. FairTrade3, Fair Trade is involved in this field. The mark of this international body, placed on food labels, provides the consumer with a guarantee of sustainability in all its forms (Mariani, Vastola, 2015). Globally, according to the 2018 FairTrade Annual Report, in 2018 sales of fair-trade wine increased by 5% in volume, equivalent to 26 million kilograms of wine grapes.

According to Santini et al. (2013), sustainability is a behavior that can be adopted or not by companies based on the perception of stimuli, both external and internal. This leads to the identification of three important elements: the external stimuli, the organizational characteristics of the company that can lend themselves positively to the sustainable choice and finally the motivations of the company.

The most important external stimuli are institutional, therefore linked to incentives promoted by governments, associations, consumer demand and competitors. As for internal stimuli, these are difficult to determine, as they depend exclusively on the entrepreneur, that is, on his skills, curiosity, creativity, flexibility, the degree of risk appetite: it is very clear that a change of strategy, whatever it is, it is not an easy choice to take.

In the 1990s, a new term, Ecopreneurship, was introduced to define the branch that studies the critical aspects brought to light by entrepreneurs on issues of ecology and the environment, where Gabzdylova et al. (2009), sought to establish what were the main motivations that guide wineries to take the path of sustainability; in particular the role played by the stakeholders in the decision-making process of the companies and the environmental practices adopted relating to the consumption of water, chemical agents and their management. The study has shown that the most important stimuli that lead to the adoption of sustainable practices by wineries concern personal value, preferences and staff satisfaction; followed, in order of importance, by product quality and consumer demand. This means that consumer demand is not always the only motivation capable of influencing a winery's business choices. Our study should give a more insightful view on the constructs behind the decision making of adoption of the innovative technology.

Research limits. *As with any research, this work has its limitations. First, convenience sampling was used to maximise the survey response rate; thus, it may be argued that only respondents with an interest in the study made contact with the researchers, creating the possibility of selection bias. Second, the criteria for identifying participants were wide, which may have affected the results emerging from the investigated sample. Finally, the only Italian context has been investigated. However, Italy is one of the main wine producers (Cusmano et al., 2010), there might be factors our study did not take into account and that are present in countries different to Italy.*

Practical implications. *An initial examination of the data collected shows that the meaning of the concept of "sustainability" is not yet known in its entirety, as this term is used only in opposition to air pollution and in general to the protection of the environment. Indeed, sustainability encompasses three key points within itself, that is, the environment, as already mentioned, the economy and society. The term environment refers to all practices that are capable of combating polluting sources and climate change (Costanza and Patten, 1995).*

Preserving the environment for future generations while ensuring economic and social development at the same time. Indeed, sustainable practices adopted by companies must not only protect the environment, but also protect the health of the consumer and those who work. The company must also ensure that workers' rights, such as safety at work, enhancement and training, are respected and safeguarded; finally, it must produce an income for the people who work there trying to control production costs in the best way. Furthermore, a company can be considered sustainable not only if it metabolizes some sustainable procedures within its production chain but is also capable of being self-sufficient. Finally, to the social and ethical concept of sustainability provides that the company must integrate in the best possible way within the territory that surrounds it, try to create and protect relationships with people who live and work in that same territory (Costanza and Patten, 1995).

The first analysis of the data collected through the questionnaire, however, shows that, although the definition of sustainability is partially known to those who work in this field, the opinion persists that most producers use sustainable methods for a strategic and market end and is therefore not a choice determined by ethical, social and/or environmental reasons. Precisely on this aspect, some respondents wanted to give their own vision of what "organic wine" is. If on one hand some considered it important to point out that organic production is a true lifestyle that bases its foundations on nature, on the other hand, the respondents confirmed that they are looking for a way to increase their revenues.

On the basis of these two polarized positions, it is clear that associations and public decision makers should provide producers with a more precise and complete knowledge of organic productions, taking into consideration revenues and also the relevance of this innovation to preserve the exploitation of natural resources at the expense of future generations, with a view to maximizing profits and differentiating the offer on the market.

Wine production is sustainable, if such sustainability, in relation to organic wine, also concerns other aspects, such as the working conditions of people and the good health of the territory. After all, wine is one of the products of the earth which is strongly linked to the traditions of the territory in which it is grown and the impact of the cultivation itself has important effects in terms of landscape, hospitality and catering. In this, the production of organic wine can bring producers and consumers back to a deeper ethical approach to this product, which, as mentioned, has important connections with all stakeholders.

Originality of the study. *At the best of our knowledge, although other studies have been conducted on the sustainability and use of techniques that lead to the production of biodynamic wine, the real and great originality of this study consists in focusing on the psychological factors of entrepreneurs to fully understand, through techniques, including psychometric techniques, the variables on which it is possible to act to fully understand the reasons behind the choices of adoption and non-adoption. This allows to go beyond the mere evaluation of the turnover and the ecological potential made available by organic wine. Organic requires a real change of mentality and approach, which must be independent of merely economic factors.*

Key words: *innovation, choices of adoption, organic wine, UTAUT*

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