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Explanatory Factors for Innovation in the Organic Agri-Food Sector

A QCA approach

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Introduction

Although it can be argued that organic farming techniques have existed for hundreds, even thousands of years, it is in the last century that the organic agri-food industry sparked a significant debate among stakeholders and other agri-food players.

Indeed, the organic food industry, as we know it today, emerged between the **1930s** and **1940s** as a powerful alternative agricultural method to solve the issues that intensive chemical farming brought to light: soil depletion, declining crop variety, and low-quality products, among others. This farming technique slowly established itself as a "**radical discontinuity with the past**", characterized by the process of unlearning past agricultural practices. With time, the public debate scene saw extreme polarization. On the one hand, some scholars defined organic agricultural methods as archaic, a return to the past, harshly repudiating it, in favor of technological development. On the other hand, some scholars defined it as an eco-innovation, a vital component of a more environmentally, economically, and socially sustainable future.

Today, **the organic agri-food market has seen significant and steady growth—**in 2020, the global retail sales of organic food products accounted for 121 billion Euros, and the total share of organic farmland reached almost 75 million hectares. Moreover, the sector's expansion has proven to be resilient even to big market and economic shocks, as the organic food demand was steady even during the SARS-CoV-2 pandemic. Indeed, the organic food industry found fertile ground in consumers' more demanding attitudes, health concerns, and, more generally, the "healthy food" trend.

Despite these positive data, a question arises: **is the organic agri-food market still innovative**? This thesis further articulates its research problem into two research questions aimed at **identifying the factors that trigger innovation in organic agri-food companies** to understand how to foster innovation in the future.

The empirical analysis of this dissertation relies on two research methods. On the one hand, through the **Gioia Method**, the analysis tackles secondary, qualitative data gathered from interviews with a sample of 30 organic agri-food companies located in Veneto, Italy. In this geographical area, the agricultural landscape plays a significant role in the local economy and is dominated by small- and medium-sized companies. On the other hand, **crisp-set Qualitative Comparative Analysis** (csQCA) allows the research to consider causal complexity and multiple conjunctural causation, assessing whether multiple combinations of triggers lead to the same outcome (innovation). In addition, csQCA allows the researcher to make cross-case comparisons.

This thesis is organized as follows. Chapter 1 outlines the development of the organic food market, starting from a global perspective and slowly narrowing down the geographical focus to the Italian and Veneto region markets. Chapter 2 summarizes the key findings of the relevant literature regarding innovation in the agri-food industry and, more specifically, the organic food industry. Chapter 3 illustrates the research design, introducing the most complex research methodology–Qualitative Comparative Analysis–and the study subjects. Chapter 4 is dedicated to the empirical application of the two research methods, explaining all analysis steps from the formulation of the research questions to the QCA tests for necessity and sufficiency. Finally, Chapter 5 contains the results of the empirical analysis and the discussion of the main findings.

Chapter I: The Organic Agri-Food Market

Over the years, the global food & beverage market evolved twofold. On the one hand, companies worked towards a common and ambitious goal: to supply consumers with more complex products at reasonable prices and within minimum time (Fiorillo, 2015). On the other hand, after numerous food safety incidents and growing awareness of agricultural pollution, consumers became increasingly demanding (Liu and Zheng, 2019). Indeed, **price is not the only driver for food choices** anymore: **consumers' choices are shaped by personal preferences,** including health and safety issues, enhanced by the Covid-19 pandemic (FiBL and IFOAM, 2022), organoleptic characteristics, supply chain transparency, and environmental sustainability (Pei et al., 2020; Alaimo et al., 2020; Toussaint et al., 2021).

In this landscape, **the organic agri-food sector**, which claims to offer healthier and more sustainable products, **boomed in the last decades**, registering a global farmland increase of 3 million hectares (4.1%) in 2020 alone (FiBL and IFOAM, 2022).

The following paragraphs will introduce how the organic agri-food market came to be, as well as its most recent evolutions both on a global and national scale.

1.1 An Introduction to Organic Farming

As stated by the **International Federation of Organic Agriculture Movements** in its general assembly (IFOAM, 2008):

> *"Organic Agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved."*

In other words, **organic agriculture** (also referred to as "biological" or "ecological" farming) **combines traditional farming practices with modern technologies**, paying specific attention to **biodiversity preservation**, **ecosystem protection**, and **soil health** (Reganold and Wachter, 2016).

Although pesticide- and chemical-free agricultural techniques date back decades, even centuries ago, it is fair to say that organic **agriculture as we know it today was consolidated between the 1930s and 1940s**, especially in Europe and the United States (Reganold and Wachter, 2016). Pioneered by **Sir Albert Howard** (Heckman, 2006), the first organic farmers were motivated to reverse those issues caused by mainstream agriculture, i.e. soil erosion and depletion, declining crop variety, low-quality products, and rural poverty (Kuepper, 2010; Lockeretz, 2007). In order to nurture the long-term vitality of soils, laying the foundations for healthier people and thus a healthier society, a **new soil management technique** was created: **humus farming** (Kuepper, 2010). This agricultural technique did not aim solely at preserving soil quality, but its goal was to restore it completely, typically avoiding any chemical or synthetic fertilizers of sorts as much as possible (Kuepper, 2010).

In **1940**, **Lord Northbourne**'s manifesto of organic agriculture *Look to the Land* officially set the term "**organic farming**", paving the way for the modern organic movement (Paull, 2014). With his argument in favor of organic farming, Lord Northbourne opened a clash between organic and chemical farming, which later evolved into a real polarization. Indeed, organic agriculture presented itself as **a radical alternative to mainstream techniques**, while "traditional agriculture" supporters considered organic farming a pariah, a desire to return to an economically unsustainable production model.

In the **1960s and 1970s**, the **back-to-the-land movement** emerged, with a rising interest in setting out organic farms and gardens among younger generations, but the debate was far from ending (Kuepper, 2010). This clash escalated in **1971**, with an emblematic statement from the former US Secretary of Agriculture Earl Butz (Reganold and Wachter, 2016):

> *"Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry".*

As more and more agricultural firms joined in the organic farming philosophy and methods, nurturing the public interest and recognition of this technique, the first organic agriculture standards and legislations were introduced both in Europe and in the United States (Heckman, 2006). Specifically, **the first legal definitions of organic agricultural production** came to be in **1990** in the US (with the *Organic Food Production Acts*) and in **1991** in the European Union via the *EU-Eco-Regulation* (Grunert, 2017).

In the following decades, organic farming kept evolving, gradually leading to an **absolute exclusion of synthetic pesticides and fertilizers** while taking up more market shares and capturing an increasingly more comprehensive plethora of consumers. It is worth noting that, as a consequence, **organic certifiers** increased in number, reaching a **total of 283 bodies worldwide operating in 170 countries** (Reganold and Wachter, 2016).

As certification standards are becoming increasingly strict, a new debate is emerging: certification standards mainly originated in temperate regions, making them more difficult—if not impossible—to implement in other continents, especially in less-developed nations. In addition, if, on the one hand, certifications allow growers to charge premium prices, it is also true that they make organic products less accessible to local people. It is clear how organic agriculture is not immune to two problematic issues that were common within the industrial agriculture model: food security and social equity (International Food Policy Research Institute, 2022).

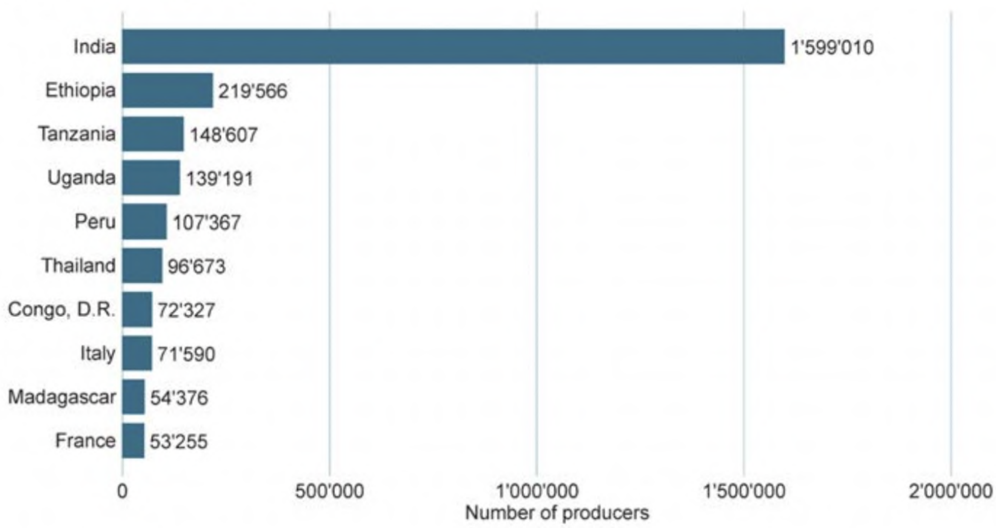
Food security refers to the principle according to which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life. Of course, if locally-produced certified organic food products are charged a premium price, which reflects both production and certification costs, but the local population is living in poverty, they will have less access to organic food, potentially leading to food security issues.

Social equity is the second issue that recently arose within the organic agricultural ecosystem. It might sound counter-intuitive since organic products are often associated with a higher social, environmental, and economic commitment to sustainability (Lamonaca et al., 2022). As highlighted by Lamonaca et al. (2022), even the **Codex Alimentarius**, a set of internationally recognized food criteria, guidelines, and recommendations prepared by an intergovernmental commission to protect consumers' health and fair practices in the food trade, points out that:

> *"Foods should only refer to organic production methods if they come from an organic farm system employing management practices which seek to nurture ecosystems which achieve sustainable productivity, and provide weed, pest and disease control through a diverse mix of mutually dependent life forms, recycling plant and animal residues, crop selection and rotation, water management, tillage and cultivation."*

As mentioned above, organic certifications may be burdensome to less-wealthy communities, charging additional production and consumption costs. This causes not only increased food insecurity, but also social inequity, since the costs of organic certifications have a skewed impact, affecting less wealthy populations. This is particularly significant because eight out of ten countries with the most organic producers in the world are still affected by a high poverty rate (**Figure 1**).

Figure 1: The top ten countries per organic producers (2020)

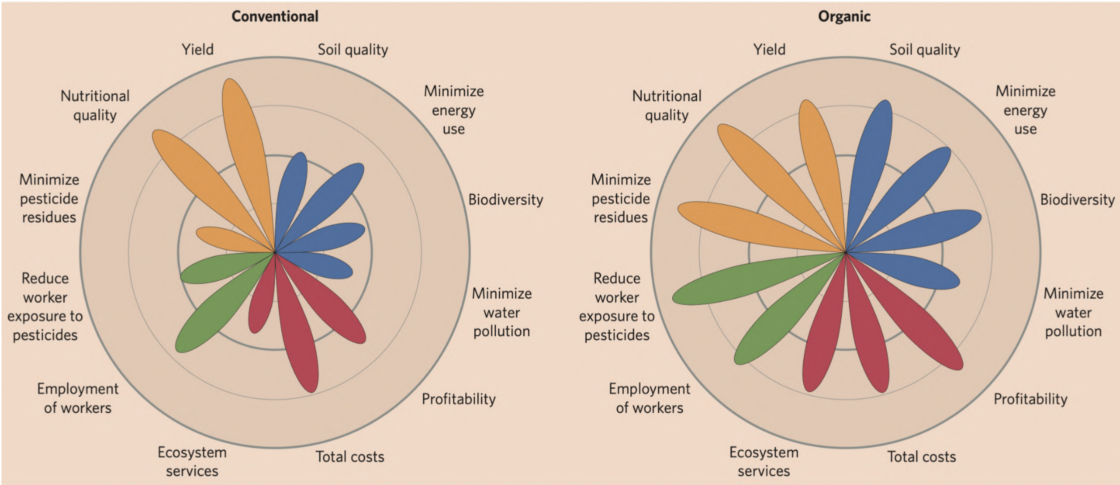


(FiBL and IFOAM, 2022)

It is clear that, **although organic agriculture pioneered sustainability**

principles disconnected from mainstream industrial agriculture (**Figure 2**), **there is still space for improvement in social sustainability**.

Figure 2: Sustainability assessment of conventional and organic agriculture

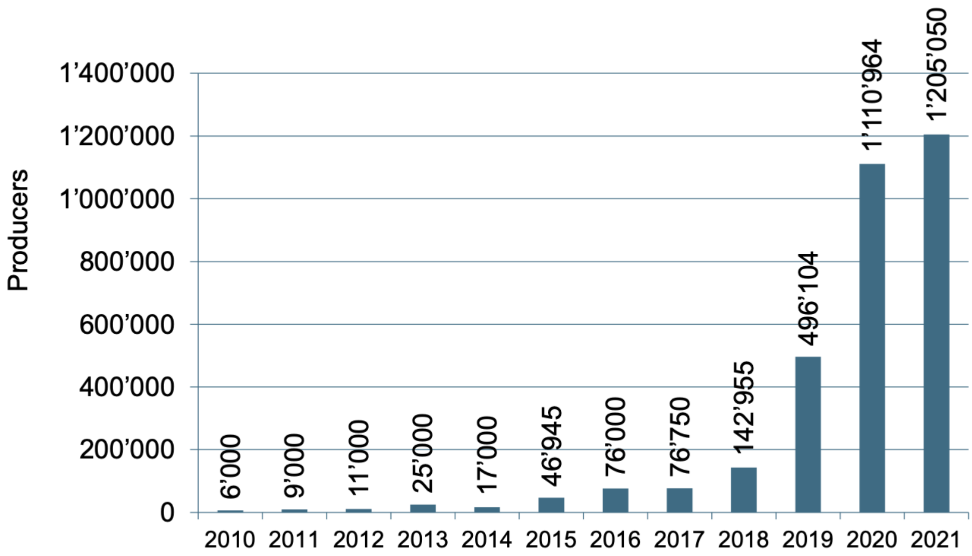


(Reganold and Wachter, 2016)

In response to these issues, **a new verification method** emerged as a complementary tool to third-party certifications: **participatory guarantee systems** (PGS). PGSs have existed for over 40 years, and the International Federation of Organic Agriculture Movements argues they are still a vital tool for ensuring organic food production quality. Since participatory guarantee systems are **low-cost and locally-sourced alternatives**, they are crucial for poorer and marginalized communities. Indeed, these communities are precisely those who would benefit the most from them because they face the highest barriers to entry (specifically bureaucracy and direct costs) into the third-party certified organic food market (IFOAM, 2021).

According to the most recent PGS database (FiBL and IFOAM, 2022), as of 30th November 2019, there are **242 PGS initiatives spread in 78 nations**, involving more than **1.2 million producers** managing almost **1 million hectares** of farmland. This phenomenon is particularly significant for Indian farmers, with 700 hectares of organic PGS-certified farmland, Brazil, Thailand, Uganda, and Peru. On a global scale, the PGS certification trend is growing exponentially (**Figure 3**).

Figure 3: The growth of PGS-certified organic producers on a global scale



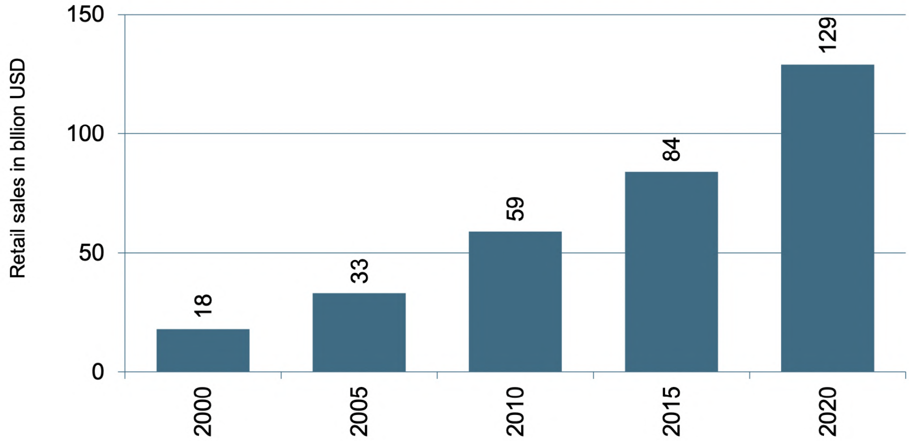
(FiBL and IFOAM, 2022)

This trend can be considered a very encouraging step towards erasing barriers to entry into the organic agri-food market while making the certification system more inclusive and affordable for poorer communities at risk of marginalization.

1.2 The Global Scenario

As previously mentioned, the market for organic products has been steadily growing. Such a trend was confirmed by the data gathered by FiBL and IFOAM (2022), shown in **Figure 4**. In 2020, the first year of the Covid-19 pandemic, demand for organic products increased by 15% in the US alone, registering the most significant revenue growth (amounting to 129 billion USD).

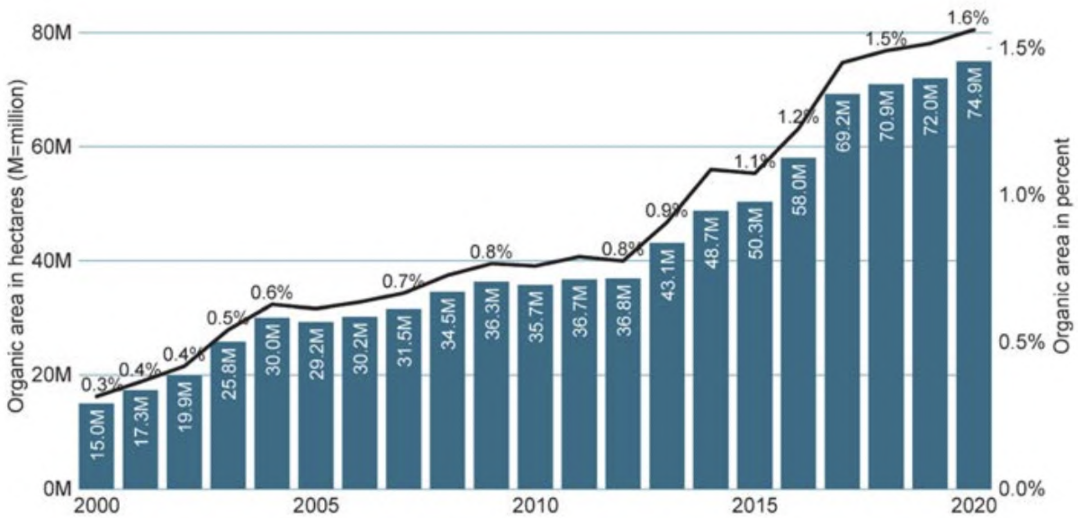
Figure 4: Global organic food & beverage market growth, 2000-2020



(FiBL and IFOAM, 2022)

Of course, as the law of demand and supply states, when demand increases, supply also increases. Therefore, it is natural that the amount of farmland dedicated to organic farming also increased in the last twenty years (**Figure 5**).

Figure 5: Global growth of organic farming 2000-2020



(FiBL and IFOAM, 2022)

The share of global organic farmland reached almost 75 million hectares in 2020, registering a five-fold growth compared to data available in 1999 (FiBL and IFOAM, 2022). This is fundamental data since global organic farmland accounted for only 15 million hectares in 1999, while it registered a growth of 2.97 million hectares (4.1 percentage points) in 2020 alone. **The most significant growth was registered in Latin America** (+19.9%), **Asia** (+7.6%), **and Europe** (+3.7%). The top three countries per organic agricultural land growth were Argentina, Uruguay, and India, with a percentage increase of 21.3, 27.9, and 15.6, respectively. Italy was third to last in the top ten countries, with a growth of 102,155 hectares in 2020.

Finally, the organic food market expanded in terms of revenues as well. **In 2020, total retail sales of organic food products amounted to almost 121 billion Euros**, led by Northern America, Europe, and Asia, which registered sales for 53.7, 52 and 12.5 billion Euros, respectively (FiBL and IFOAM, 2022). The most significant market growth was registered in Canada (+26.1%).

1.3 Covid-19 and the Organic Market

Organic agriculture has been steadily growing globally, and not even disruptive events such as the SARS-CoV-2 pandemic seem to have curbed its development. In fact, Covid-19 seems to have boosted the demand for organic food products (Hesham et al., 2021; Savarese et al., 2021).

The pandemic brought along an unexpected uncertainty around health issues, which had a significant and extensive effect on the global population, leading to different behaviors in a wide range of areas: transportation choices (Bonaccorsi et al., 2020), workplace daily routine, and social life (Birditt et al., 2021). Of course, purchasing behaviors were no exception. Although the effects triggered by Covid-19 on consumers' purchasing behaviors differ according to personal factors such as age and gender (Hesham et al., 2021), the pandemic also had widespread consequences. **Consumers seem increasingly concerned with food safety and wellness** to avoid diseases and build personal immunity (FiBL and IFOAM, 2022).

The **macro trend of "healthy food"**, which set its roots a couple of years ago, seems to have been exacerbated by the increasing uncertainty caused by the pandemic, expanding to food supplements as well (Vuković et al., 2022; Puścion-Jakubik et al., 2021). While consumers are more educated, they also have more information available than ever before. Consequently, they tend to think they can make entirely rational (and correct) decisions about their health. Nevertheless, it is important to underline how **purchasing decisions are affected by both the human brain's cognitive and affective portions** (Vuković et al., 2022). This of course also applies to food choices and changes in consumption patterns in times of exceptionally high anxiety and perceived stress.

During Covid-19, consumers became increasingly worried about their health, which resulted in an increased search for products that would boost their immunity. Indeed, Vuković et al. (2022) highlighted how **food supplement consumption during the Covid-19 pandemic was significantly triggered by emotions, specifically fear**. The growth of the food supplement industry was led mainly by vitamin supplements, which registered a growth of 22.3% in 2020. A striking result after a decade of reasonably flat sales (Vuković et al., 2022).

Circling back to food consumption choices, it is worth noting that two food consumption trends emerged during the Covid-19 lockdowns. On the one hand, **some people reported having trouble maintaining their health in periods of high stress, thus turning to "comfort food"**, with fruit and vegetables being less appealing to them while on lockdown (Scarmozzino and Visioli, 2020; Savarese et al., 2021). On the other hand, **others turned to healthy food, specifically high-value organic food products, considered healthier and safer** (Xie et al., 2020). Such consumer choice was moved by both personal beliefs and health scares and anxiety caused by Covid-19, which increased the desire to boost their immunity and recur to preventive tools such as food supplements (Vuković et al., 2022), as well as organic food (Xie et al., 2020). Unsurprisingly, **food safety is among the primary triggers of organic food consumption**, along with product quality, environmental consciousness, and ethical and social concerns (Xie et al., 2020; Rana and Paul, 2020).

FiBL and IFOAM (2022) estimate that **changes triggered by Covid-19 will not be short-term—**they will rather trigger additional, long-lasting changes in the food & beverage industry:

1. **De-globalization of food supply chains**

   Covid-19 highlighted global supply chains' weakness and lack of preparation when facing global disruptive events. Raw materials supply was blocked as lockdowns and other emergency measures were implemented to contain rising infections. This showed how those organic companies that managed to keep a short (local or, even better, regional) supply chain are the least negatively affected by such crises, possibly inverting the past globalization trend.

2. **Food security**

   Food security measures are surging, as the pandemic made it clear that relying too much on imports can make entire countries more vulnerable to disruptive events. This is why Singapore, a highly-import-dependent country (90% of the total food supply), heavily invests in local production. In particular, Asian and African countries are investing in building an internal market.

3. **Traceability and transparency**

   As the organic agri-food industry expands and more players enter the market, the risk of fraud increases as well. Therefore, it is likely that both private companies and governments adopt tighter control technologies in order to ensure organic food traceability and transparency.

   As shown by FiBL and IFOAM (2022), *Carrefour* is an interesting example. It is the largest supermarket chain in Europe and it has already adopted **blockchain technology** to ensure transparency of its organic private labels (PL). On the other hand, China launched *OrgHive*, an app leveraging blockchain to verify organic certifications.

4. **Consumer behavior changes**

   As previously mentioned, the Coronavirus pandemic profoundly influenced consumer shopping behavior: from initial panic-buying to increased sensitivity to labels, to online shopping. Another shift is towards plant-based products, supplements, and "natural" products, regardless of their organic or non-organic nature. That was the case with organic dairy products, which are suffering from the rising popularity of plant-based alternatives. This reasoning poses a meaningful question: will the same apply to the organic meat industry if it fails to recognize ethical and nutritional values?

5. **Food retailing**

   The pandemic highlighted the vulnerability of the traditional in-store retail model, with online retailers (especially big and well-established ones such as *Amazon* and *Whole Foods Market*) capitalizing on the shift towards online shopping. This trend becomes even more likely as Millennials' and Gen Z's purchasing power increases.

1.4 An Overview of the Italian Organic Agri-Food Market

With its historically solid culinary tradition, extraordinarily diverse territory, and favorable climate and agronomic conditions (FAO, 2001), Italy has been among the top-performing countries related to organic production in the last few years. According to the study *The World of Organic Farming* (based on data from 2019), Italy:

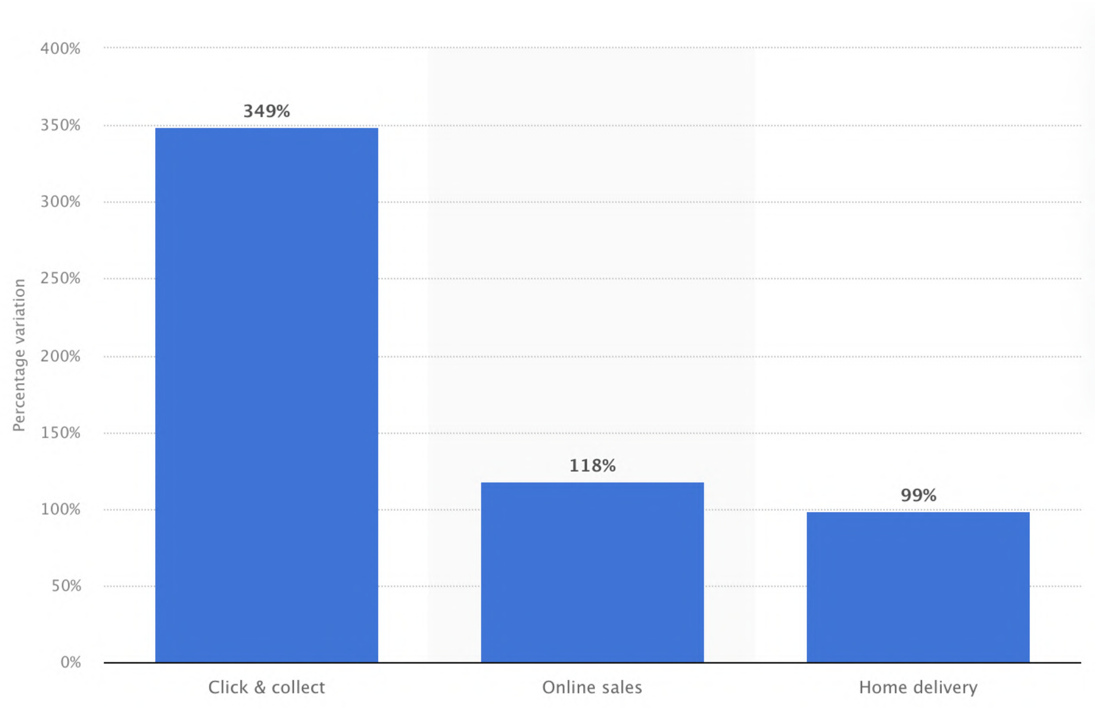
- Has one of the largest organic agricultural areas in Europe (2.1 million hectares),
- Has the third-largest organic food market in Europe (3.9 billion Euros),
- accounts for 17% of the total organic food producers in Europe (71,590), and,
- Has the largest number of organic food processors in the European continent (22,689).

Furthermore, **Italy is the third European country in organic farmland area** after France and Spain (FiBL and IFOAM, 2022).

The evolution of the Italian organic agri-food market confirms global and European trends: organic food sales at the national level registered an increase of 5% in 2021 with respect to the prior year, household consumption registered an increase of 4%, and away-from-home channels registered a 10% boost after Covid-19 restrictive measures were gradually withdrawn (SINAB, 2021).

Although the most significant sales channel is still *Distribuzione Moderna* (comprising 56% of total sales), followed by specialized stores, **online retail is the channel with the highest growth rate** (+67% compared to the previous year, for a total of 75 million Euros), as observable in **Figure 6.**

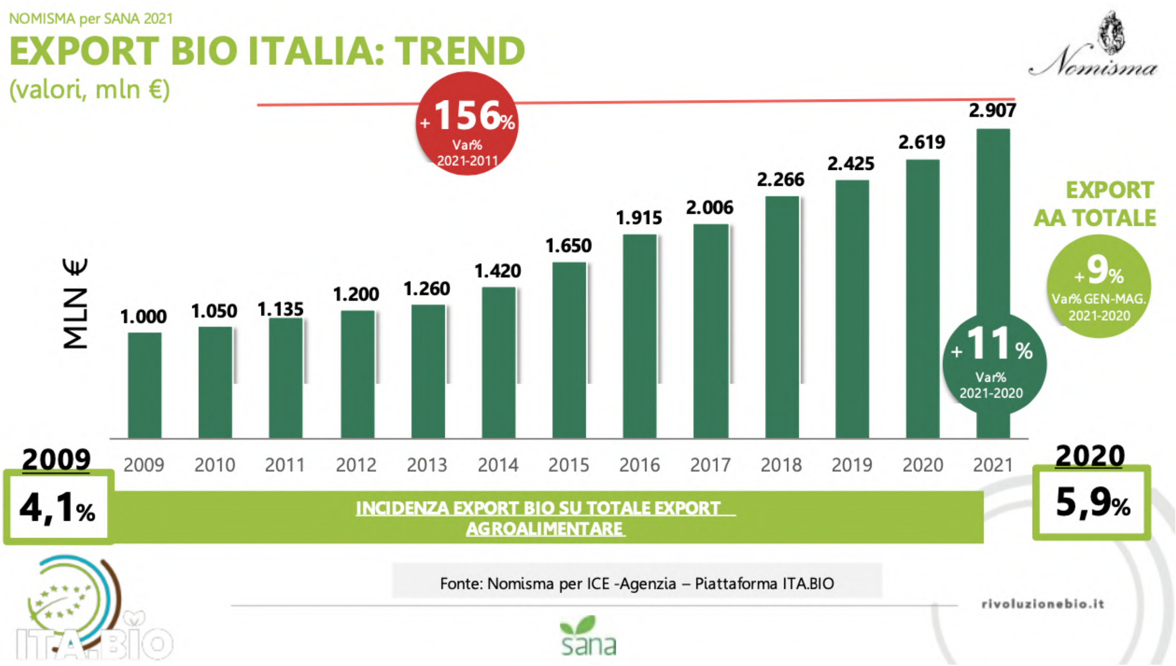
Figure 6: Food e-commerce KPIs during the Covid-19 pandemic in Italy, 2020



(Statista, 2022)

As **Figure 7** shows, export of Italian organic food products also registered particularly positive growth in 2020 (+11% compared to the previous year, reaching 2.9 billion Euros). This makes Italy the second biggest exporter of organic food products right after the United States (SINAB, 2021).

Figure 7: Italian organic food export



(SINAB, 2021)

The main driver of growth within the Italian organic food market is **consumer perception**: after the pandemic, consumers became more sensitive to the **link between personal health and the Planet's health**, which led to a preference for local, organic, plastic-free, and plant-based products (Bio Bank, 2021).

1.5 Focus on the Organic Market in Veneto

Veneto, located in North-Eastern Italy, is the fourth largest Italian region by population (4.8 million residents) and the third per GDP (165 billion Euros) (Statista, 2022, elaborated from dati.istat.it).

Veneto produces **9.2% of the national GDP** (SISTAR, 2021). Agriculture is a significantly important sector for the economy of the Veneto region, which follows the trends of the national agri-food market.

Specifically regarding the organic agri-food sector, in 2019, the workers active in the organic sector in Veneto were 3,808, for a total of 45,999 hectares of farmland, which accounts for 5.9% of the total national organic production (SINAB, 2021).

Between 2017 and 2020, the most significant percentage increase was registered among the organic food importers in the Veneto region (+18.9%), while the highest increase was registered among producers: from 2,516 to 2,757, equal to +9.6% (Agrifood Management & Innovation Lab, 2021). Diving deeper into the organic food production in Veneto, we can notice a predominance of arable land crops, accounting for 59% of the total farmland, of which:

- 22% of cereals,
- 18% of industrial crops, and
- 11% of fodder crops, which registered an increase of +126% compared to 2017.

Perennial crops, i.e. those crops that do not need to be replanted each year, are also important, especially the grapevines (19%). Other important crops are those dedicated to meadows and pastures (13%).

As far as the increase in farmland is concerned, the most significant growth is registered in:

- Root crops (+343%),
- Industrial crops (+153%),
- Fodder crops (+126%),
- Vegetables (+90%),
- Grapevines (+84%).

It is clear that the Veneto region's contribution to the growth of the Italian organic food market is increasing, in line with the national and European trends in this sector. However, in-depth analyses of the organic agri-food companies in the region are still lacking, leaving space for additional research.

The following chapters of this thesis focus on innovation within organic agri-food companies, specifically investigating which configurations of triggers lead to different types of innovation within the organic agri-food companies in the Veneto region of Italy.

Chapter II: Literature Review

Innovation is a complex topic, and although it has been the subject of extensive research, few studies deal with innovation within the agri-food sector. Nevertheless, **studies on innovation within agri-food companies are particularly relevant nowadays** for two reasons. First, the European agricultural sector seems to have a **lower innovation rate** than other industries (OECD, 2018). Indeed, studies seem to agree that the agricultural sector has not reached its full potential yet (Mofakkarul Islam et al., 2013; Spielman and Birner, 2008). Secondly, scholars seem to agree that **this specific industry is more of an innovation adopter than an innovation creator** (Bjerke and Johansson, 2022; Clancy et al., 2020; García Álvarez-Coque et al., 2012).

Bjerke and Johansson (2022) suggest that these considerations might relate to some traditional features that typically characterize agri-food firms. To begin with, especially in the past, agricultural firms used to be **small** and had a **low level of formal education**. In addition, these companies used to be located in **rural areas**, mostly farther from knowledge and innovation hubs. However, the paper suggests this is no longer the case for many companies operating in this sector, which is undergoing significant changes. Agricultural firms have grown in size, implemented technological innovations, diversified their business, and become more market-oriented. Given these **recent industry changes**, it seems even more relevant to investigate if and how these companies have been innovating in the last decades. Are they still mainly innovation adopters, or do they also contribute to the creation of innovation (Alarcón and Sánchez, 2016)?

The relevant literature can be categorized into two main areas of interest. On the one hand, there is a group of studies focussing on **organic companies**, with a specific interest in the adoption of the organic production method as an innovation *per se*. On the other hand, some studies focus on (eco) **innovation in the agri-food sector** but overlook organic food production. This latter group of studies can be further divided into three sub-categories of interest, depending on the focus they adopt:

1. **Micro-level studies** focus on the profile of the innovator, either the entrepreneur or the employees, studying characteristics such as age and other socio-demographic features that might influence the choice to innovate,
2. **Firm-level studies**, analyze features such as the organizational structure and territorial characteristics of a company,
3. **Macro-level studies** focus on innovation within the agri-food industry as a whole.

Table 1: Main references per area of interest

RELEVANT LITERATURE	
Area of interest	*Main references*
Organic agri-food companies	Morgan and Murdoch, 2000. Organic vs. conventional agriculture: knowledge, power and innovation in the food chain. Sabio and Lehoux, 2022. How Does Context Contribute to and Constrain the Emergence of Responsible Innovation in Food Systems? Manta et al., 2022. Determining paths of innovation: The role of culture on the adoption on organic farming management.
Micro-level innovation	Yagüe-Perales et al., 2020. The unexpected profile of agricultural innovators: evidence from an empirical study. Parsons, 2015. The impact of age on innovation. Mutsvangwa-Sammie et al., 2017. Profiles of innovators in a semi-arid smallholder agricultural environment in south west Zimbabwe. Furtan and Sauer, 2008. Determinants of food industry performance: Survey data and regressions for Denmark. Shiri et al., 2015. Bridge and redundant ties in networks: the impact on innovation in food SMEs
Firm-level innovation	Bjerke and Johansson, 2022. Innovation in agriculture: An analysis of Swedish agricultural and non-agricultural firms. García Álvarez-Coque et al., 2012. Territory and innovation behaviour in agri-food firms: does rurality matter? Dangelico et al., 2019. A comparison of family and nonfamily small firms in their approach to green innovation: A study of Italian companies in the agri-food industry.
Macro-level innovation	Pittaway et al., 2004. Networking and innovation: a systematic review of the evidence. McAdam et al., 2014. Development of small and medium-sized enterprise horizontal innovation networks: UK agri-food sector study.

(Compiled by the author)

Little research has been conducted so far to analyze which factors affect innovation within organic agri-food companies. This is precisely the aim of **the present thesis**, which **investigates which types of innovation occur within the study subjects** and, specifically, **the configurations of factors affecting innovation**

from a firm-specific perspective. In other words, this dissertation aims to close the above mentioned gap, broadening the research on innovation in the agri-food sector, specifically focusing on organic SMEs in the Veneto region. This paper addresses two research questions:

> *Q1: What does innovation look like within organic agri-food companies in the Veneto region? What types of innovations were introduced over the years?*
>
> *Q2: What factors, or configurations of factors, have led and are still leading to innovation within the organic agri-food companies in Veneto?*

This chapter offers an extensive review of the relevant literature, highlighting the main findings, research gaps, inconsistencies, and possible areas for further analysis.

2.1 Literature Review

2.1.1 Micro-Level Studies: focus on innovator profiles

Among the most prominent studies on the profile of innovators in the agricultural sector, Rogers (2004) outlines the **diffusion model**, according to which innovation is a linear, sequential process that involves four different actors: innovators, early adopters, late majority, and laggards. On the one hand, "**innovators**" are defined as **keen to take risks**. On the other hand, "early adopters" are usually educated individuals who are positively seen by peers and adopt innovations as a way to move up. At the same time, the "late majority" are more risk-averse and cautious and tend to follow innovators and early adopters. Finally, "laggards" are very risk and change averse, usually socially isolated, and tend not to dispose of considerable financial resources (Rogers, 2004; Van der Veen, 2010; Mutsvangwa-Sammie et al., 2017).

However, Mutsvangwa-Sammie et al. (2017) highlight the limitations of this linear notion of innovation, arguing that it has become obsolete and might not be representative of smaller entities. Specifically, they argue that the **failure to adopt an innovation should not necessarily classify a farmer as a "laggard"**, but might rather signify they willingly chose to adopt a different type of innovation that better suited their environment and resources. This reasoning might better suit the environment of the Mediterranean countries, including Italy and the Veneto region, where SMEs and family-owned agricultural firms predominantly characterize the agricultural industry. Indeed, Mutsvangwa-Sammie et al. (2017) highlight how important it is to **contextualize innovations** and innovator definitions. What might be considered innovative by a particular group of stakeholders or in a specific geographical region might not necessarily apply to a different environment.

Part of the relevant literature has a narrower scope, focussing on the individual protagonists of agricultural innovation, i.e. farmers. These studies aim at **outlining the profile of the "innovative farmer"** including psychological factors, socio-demographic characteristics, and the variables that foster or hinder innovative behavior among them.

Läpple et al. (2015) theorize that farmers' age negatively correlates with innovation performance. This notion is scrutinized in Yagüe-Perales et al. (2020), who also suggest that age is indeed a critical factor that explains innovation adoption in agricultural firms. In particular, **younger farmers** (in their sample, farmers aged below 50) **appeared to be more innovative when they had enough experience** in the sector. The study also underlined how young and experienced farmers tend to have a dynamic approach, implementing many varied innovations. However, older and experienced farmers with a high learning orientation appeared to be very open to innovations as well.

Parsons (2015) investigated the role of employees in innovation, confirming the correlation between age and experience level. More specifically, they highlight that, even though age appears to be negatively correlated with a firm's innovative capacity (Yagüe-Perales, 2020), farmers with more years of experience in leading an agricultural business tend to be more oriented towards innovation. These findings were confirmed by Bjerke and Johansson (2022), who also underline that **innovation adoption seems to be positively correlated with sectoral experience**.

These considerations explain the generally lower level of innovation in agri-food companies in the Mediterranean region, where farmers who own a firm tend to fall in an older population cluster (Parsons, 2015).

Furtan and Sauer (2008) underline how innovative behaviors in the agri-food industry are fostered by various factors, including the type of ownership, value chain, **employee motivation**, competitiveness, and the ability to develop new products, among others. It is interesting to notice that employees are listed among the key factors contributing to innovation. This is in line with Parsons (2015), who underlines that employees hold innovation power in their hands.

In addition, recent studies suggest that **entrepreneurial motivation** plays a significant role in adopting a sustainable entrepreneurial behavior as well (Ben Amara and Chen, 2020).

2.1.2 Firm-Level Studies: focus on agri-food business innovation

Throughout the literature, there is consistent evidence that firm-specific factors impact innovation adoption and creation within the agricultural sector.

Indeed, studies adopting a firm-level perspective consider innovation as a firm-specific phenomenon, based on the reasoning that **inventions are usually not considered innovations until they are implemented or commercialized** in the market (Rosenberg, 1974; Bjerke and Johansson, 2022). Furthermore, innovations tend to stem from a combination of resources, involving at least one, and often several companies (Klerkx et al., 2009; Knickel et al., 2009; Bjerke and Johansson, 2022).

For this reason, this stream of literature tends to concentrate its analysis on firm-specific factors such as firm size, measured according to the number of employees, and human capital, measured by the level of education (Bjerke and Johansson, 2022).

Regarding **firm size**, the relevant literature draws a line between small and large firms, arguing that the former are less innovative because they have fewer resources to foster innovation (Bjerke and Johansson, 2022; Kamien and Schwartz, 1982; Karshenas & Stoneman, 1995). Although literature generally confirms that **firm size positively impacts innovation** (Lindgaard Christensen et al., 2011; Yagüe-Perales et al., 2020), recent studies indicate the issue is more complex.

Yagüe-Perales et al. (2020) state that farm size positively correlates to the entrepreneurial propensity to adopt innovations, but only when farmers are young and have a high market-entrepreneurial orientation, indicating that firm-specific and entrepreneurial characteristics seem to impact innovation when overlapping.

Other studies, in contrast, support the idea that **both small and micro-firms do innovate** as well (Baumann & Kritikos, 2016; Hall et al., 2009). As McDowell et al. (2018) point out, smaller firms tend to be more flexible and thus can adapt more quickly to external challenges and adverse events, such as uncertain market conditions, to innovate. This is particularly relevant in the scenario investigated in this thesis, which focuses on small and medium-sized agri-food enterprises in the Veneto region.

As far as **human capital** is concerned, the concept is related to **absorptive capacity**, i.e. "*a firm's ability to acquire and assimilate new knowledge and technology*" (Bjerke and Johansson, 2022). As previously mentioned, human capital tends to be measured via **education level** (Caloghirou et al., 2004; Cohen and Levinthal, 1990; Moura et al., 2019). Micheels and Nolan (2016) suggest that agricultural firms' absorptive capacity has a more substantial impact on firms' capacity to adopt innovations than firm size.

García Álvarez-Coque et al. (2012) suggest that innovation in agri-food companies relies on characteristics such as the organizational structure and the geographical region where they are located. This paper brings forth the idea that innovation is a **"territorially-implanted process"** that heavily relies on local resources, such as the labor force, traditions for cooperation, and entrepreneurial culture, among others. Based on these considerations, the study suggests three key theoretical frameworks to identify the **localized variables affecting innovation**: learning economies, Porter's competitive advantage, and regional systems, i.e. the local labor system and industrial districts. The paper surveyed agri-food businesses in both rural and urban areas, concluding that **rurality does not hinder innovation** *per se*. However, a series of territorial variables do positively affect innovation in agri-food companies, regardless of where they are located: education level, access to knowledge centers, and presence of companies in industrial districts specialized in the food industry.

Darnhofer et al. (2009) found that in the 21st century, **the agricultural sector is affected by a wide range of uncertainties**, such as erratic commodity markets, more demanding customers, and climate change. As the scenario changed significantly, the notion of a top-down innovation approach led by researchers became obsolete. Instead, it became necessary to include other factors, such as farmers' personal values and attitudes, the diversity of the farming system, and socio-technical issues. This study supports adopting the so-called "**farming system approach**" (**FSA**), which is a farm-scale approach to analyze innovation. In particular, the study encourages integrating farm-level methods with a **horizontal dimension**, which focuses on territorial aspects, and a **vertical dimension**, which takes into account the market. It can be argued that Darnhofer et al.'s FSA merges all three levels analyzed in this study: the micro-level characterized by studies of the farmer, the firm-level approach, and the macro-level studies focussing on a broader industry dimension.

Dangelico et al. (2019) study whether the **organizational structure** of agricultural companies has an impact on their approach to innovation, researching whether there exist substantial differences between family- and non-family-owned small companies. This paper focuses specifically on green innovation as defined by the OECD, European Commission, and Nordic Innovation (2012): any innovations that *"allow for new ways of addressing current and future environmental problems and decreasing energy and resource consumption, while promoting sustainable economic activity."*

Although its scope is narrower than that of this thesis, which aims at investigating innovation in general, it is still significant when assuming that any innovation within the organic agri-food industry can be classified, to a certain extent, as a green (or sustainable) innovation. In addition, Dangelico et al. (2019) investigated 14 Italian small family firms operating in the agri-food sector, which reflects the study subjects of this thesis, thus representing an interesting sample to mention. This paper warns that there appear to be substantial differences between **family-owned** and non-family-owned **companies** and that the former **tend to be more likely to turn their environmental firm policies into innovation** strategies (Craig and Dibrell, 2006). In addition, Dangelico et al. (2019) developed a framework that clearly identifies the main drivers of eco-innovation in small family-owned firms, dividing them into three categories: family firms' inherent characteristics, pressures from internal and external stakeholders, other motivations (such as owners' values and economic opportunities). It is imperative to highlight that **firms' characteristics, including organizational culture, flexibility, communication, and non-economic objectives, seem positively related to adopting eco-innovations**. The study concludes that there are relevant differences between family-owned and non-family-owned companies in their approach to innovation. The former, indeed, tend to be prevalently driven by internal pressures (such as family values) and long-term economic goals. They also tend to give greater importance to cultural drivers and future generations since the business will likely be passed on to them. Non-family-owned businesses, on the other hand, are driven by internal and external pressures (including market demands), cultural values, and medium- to short-term economic goals. Consequently, family-owned firms tend to see green innovation as an **opportunity**. In contrast, non-family-owned firms tend to consider it a necessary step to **retain market share** and **satisfy customer needs**, at least at the initial stages of business life.

Bjerke and Johansson (2022) investigated whether the traditional notion of agri-food companies being innovation adopters rather than innovation creators is true in the current ecosystem or rather lacks foundation. As seen above, innovations within this industry were traditionally considered a result of knowledge and technology transfers from other sectors (Clancy et al., 2020; García Álvarez-Coque et al., 2012) rather than innovations introduced for the first time by the companies in this industry themselves.

2.1.3 Macro-Level Studies: focus on sectoral innovation

Macro-level studies focus on innovation in the agri-food industry as a whole. Those included in this literature review tackle one central issue: the role of networks and collaborative behaviors across companies operating in the agri-food sector.

In the last decades, the locus of innovation seems to have gradually shifted from the individual to the firm level, eventually landing at an even broader level: the network in which companies are embedded (Pittaway et al., 2004). Evidence of this can be found in Klerkx et al. (2012), who also highlight how **innovation in the agri-food industry is a "process of interactions among different actors"**.

It is important to note that some studies present contrasting results regarding the role of collaborative behaviors and networks in agri-food small- and medium-sized enterprise innovation.

For instance, Lindgaard Christensen et al. (2011) and Lambrecht et al. (2015) find that **numerous innovative companies in this industry** do not engage in collaborative behaviors but rather **prefer to rely solely on internal skills and resources**. Similar results were found by Hanna and Walsh (2002). This study argues that fear of losing control over the innovation process (due to a possible shift of the locus of critical skills from within to between firms) is the reason behind the resistance to participating in networks (Bjerke et al., 2022). Other vital factors hindering collaboration among SMEs are lack of trust and coordination difficulties (McAdam et al., 2014).

However, more recent studies suggest that agri-food small- and medium-sized enterprises (SMEs) are becoming more likely to adopt **collaborative behaviors to increase their innovation capability** (McAdam et al., 2014).

Indeed, literature agrees that, since most firms in the agricultural sector are SMEs, they cannot easily access vast resources to foster innovation (Cantwell and Zhang, 2012). Therefore, the key to introducing innovation in this field might rely on an external component, i.e. the adoption of **collaborative approaches and networks** between firms (Bjerke and Johansson, 2022; De Martino and Magnotti, 2017; Klerkx et al., 2009).

After an in-depth analysis of a variety of case studies belonging to a multitude of industries, Pittaway et al. (2004) found that, on a general level, networking has multiple benefits, such as risk sharing, skill- and knowledge-sharing, and safeguarding property rights. In addition, the study underlines that **not engaging in cooperative behaviors might cause a long-term limitation of a company's knowledge base**. Another key finding in this study is that **informal networking** is vital in fostering innovation, specifically by tacitly transferring knowledge and promoting learning.

Bjerke and Johansson (2022) suggest that external resources such as **networks are an important way to overcome such structural barriers** because they allow a better exchange of information, skills, and knowledge. Other studies highlight that collaborations and partnerships may be indeed key factors measuring a firm's innovation strategy (Fitjar and Rodríguez-Pose 2016) and that **collaborative behaviors** play a fundamental role in overcoming the lack of internal resources (Bathelt et al. 2004; De Martino and Magnotti, 2017).

The **open innovation model** supports this reasoning as well, indicating that network collaboration is a key external factor that allows overcoming internal resource limitations typical of SMEs in the innovation process. Indeed, this model describes innovation as an "organizational-wide process", which is based on external as well as internal knowledge (McAdam et al., 2014).

Another critical aspect of the theory of open innovation is that it claims that a network and its constituent components use internal and external resources in an idiosyncratic way, thus making their activities difficult to replicate. For this reason, **networks might offer SMEs a unique competitive advantage** (McAdam et al., 2014).

In light of the main findings and theory around both formal and informal networks, their potential for small and medium enterprises in the agri-food sector is clear. Therefore, they were included in the analysis among the other triggers of innovation investigated.

2.1.4 Organic Agri-Food Firms Studies

Since this thesis aims at investigating the triggers of innovation within the companies embedded in the organic agri-food sector, an analysis of the literature with an in-depth focus on this specific industry was conducted.

An interesting trend emerged during the literature review research: on the one hand, before 2010, roughly, studies on organic farming and innovation almost uniquely revolved around the **adoption of organic farming as an innovative method** of production. Nevertheless, on the other hand, subsequent research narrowed its scope to investigate a specific type of innovation within the industry, i.e. **eco-innovations**. Therefore, most of this literature falls either in the micro-level or the firm-level study domains analyzed in the previous paragraphs.

Having said this, very few studies investigated innovation drivers (or triggers) within the organic agri-food industry from a broader, macro-level perspective. This thesis, therefore, presents itself as an opportunity to dig deeper into the topic of innovation within the organic food industry in the Veneto region, taking into consideration all **three dimensions of innovation drivers** investigated in the literature so far: micro-level variables (personal values), firm-level variables (technical triggers) and macro-level variables (market pull, adverse events, and networks). In this way, **this thesis aims at bridging this gap in the research** traditionally focused on either individuals, firms, or the industry as a whole, given that the business environment is a very complex one in which **all three dimensions co-exist and co-operate**.

Innovation in the organic agri-food sector has not been given as much attention as the topics previously discussed by international research. However, the adoption of organic farming has constantly been growing in the last decades, as discussed in Chapter 1. For this reason, and given that this thesis' scope regards precisely the organic sector, it seemed necessary and relevant to include the most prominent pieces of literature analyzing innovation in the organic agri-food industry.

An interesting remark to make at the outset is that the adoption of organic farming methodologies is a unique kind of innovation. As Morgan and Murdoch (2000) stated, **organic farming constitutes a "radical discontinuity with the past"**, which, unlike most other innovations in history that require learning and applying something new, required a process of **unlearning** the techniques and assumptions of intensive production techniques first.

As Johnson (1992) argued, recalling the Schumpeterian definition of creative destruction:

> *"the role of forgetting in the development of new knowledge has been underestimated. The enormous power of habits [...] constitutes a permanent risk for blocking potentially fertile learning processes. It may be argued that some kind of "creative destruction of knowledge" is necessary before radical innovations can diffuse throughout the economy. Old habits of thought, routines and patterns of cooperation [...] have to be changed before technical change can begin to move ahead."*

Morgan and Murdoch (2000) underline that, in the organic agri-food sector, **the process of unlearning** is not enough *per se*. Instead, it **must be paired with the acquisition of new, external knowledge**, which at the beginning of the organic farming revolution was particularly difficult because the agri-food sector was dominated by the intensive, agri-chemical model of production. Another knowledge-acquisition issue was due to the organic farming method not being created by the scientific establishment to fit the standard system of dissemination of knowledge. In fact, it was created by environmentally committed individuals and only later on analyzed by the scientific community. This caused the formal knowledge system to lag behind the practice of organic farming at the beginning. This **knowledge deficit** was one of the farmers' main barriers to entry into the organic agri-food sector. However, it is essential to note that this barrier was not merely inherent to the organic industry and method of production themselves. It was also partly attributable to a **systemic bias** against organic farming, which came from both formal institutions and informal peer pressure (Morgan and Murdoch, 2000).

With time, as more agri-food businesses converted to organic farming, some trends typical of the "standard" agricultural industry also expanded to the organic one. Indeed, the organic conversion process brought to light a new type of relationship between farmers and organic producers. More experienced farmers became more likely to share their **tacit knowledge** with their peers during face-to-face interactions, farm visits, or study groups (Morgan and Murdoch, 2000). This is a key finding in the literature that once again proves the power of formal and informal **networks** regarding the adoption of innovations both in the mainstream and the organic agri-food industry.

Another key finding from Morgan and Murdoch (2000) is that if, on the one hand, organic farming relied on local, context-dependent internal knowledge, there was nevertheless the need to integrate it with **external sources of knowledge**. In addition, the process typical of organic farming ecosystems of combining tacit (and often local) knowledge with standardized knowledge was found to empower farmers, allowing them to manage resources more innovatively.

Sabio and Lehoux (2022) focus on responsibly-oriented practices in the agri-food industry. Nevertheless, this study was included in the literature review for two main reasons. First, it lists organic farms and networks among the responsible organizations and practices, which makes it a good fit for this thesis' literature review. Second, this paper has a unique approach—indeed, the authors address the **interaction among contextual factors that shape the emergence of responsibility practices** in this industry, defined as:

> *"practices that integrate characteristics of responsible innovation both in terms of process and outcomes"*.

In this instance, responsible innovation is defined as innovation that is *"sustainable, ethically acceptable, and socially desirable"*.

The study highlights how **agri-food systems are part of a systemic process** that cannot rely on innovation alone but rather needs the support and involvement of many social and institutional actors. For this reason, it is argued that the adoption of **innovative practices in this industry must be contextualized**, where context is defined as:

> *"a set of characteristics and circumstances that consist of active and unique factors that together may interact, influence, modify, facilitate, or constrain*

the emergence of responsibility in food systems" (Sabio and Lehoux, 2022; Pfadenhauer et al., 2016).

This line of thought also appears throughout this thesis, where various contextual factors, and their interactions, are studied in order to understand which combinations lead to innovation within the organic agri-food industry. Therefore, Sabio and Lehoux' (2022) findings are particularly relevant for the scope of this thesis.

Specifically, the study analyzed eight contextual dimensions: biophysical and environmental dimension, technology, infrastructure and knowledge, economic and market, political and institutional dimension, sociocultural and demographic dimension, consumer behavior, food supply chain, and interpersonal relationships. The study shows how **all eight dimensions of context have both a positive and a negative impact on adopting innovative, responsible practices** in the agri-food system. What is even a more striking result is that **interpersonal relationships seem to have a mediating role** over six dimensions, confirming the theory set forth by Morgan and Murdoch (2000).

Manta et al. (2022) analyzed **culture's role in organic agri-food companies' innovation process** of organic agri-food companies, aiming to understand whether six national culture components are correlated with technical innovation and sustainability issues of organic agricultural companies. They argue that culture, together with economy, is the primary driver of human behavior (Throsby, 2001) and that since innovation is a continuous process, society constantly needs to make adaptations for what is new, hence the need for a "cultural change aware of evolution". One of these changes is the shift in developed nations from a utilitarian, profit-oriented way of thinking to a society that is more and more concerned with **shared value** (Elkington, 1997; Porter and Kramer, 2006, 2019), shedding light on the triple bottom line theory.

As MacRae et al. (1990) defined it, **agricultural sustainability can be seen** not only as a system of farming but also **as an out-and-out philosophy**. This urge to act in a more environmentally, socially, and economically sustainable way that sets its roots in the triple-bottom-line theory, increased significantly in the last years, spreading to all sectors, including the agri-food industry (Manta et al., 2022).

Specifically, the study stresses how the relevant literature considers organic farming methods a responsive, sustainable reaction to pressing environmental issues (Canaj et al., 2021; Eyhorn et al., 2019; Halberg, 2012; Rigby and Cáceres, 2001). Consumers' favorable view of organic food products indicates that they are a valuable study subject to analyze whether social elements have an impact on innovation in this sector.

Manta et al. (2022) specifically analyzed **six dimensions of national culture**, i.e. distance power, individualism, masculinity, indulgence, long-term orientation, and uncertainty avoidance. The results of their analysis were particularly interesting as they highlighted that there is indeed a relationship between culture and innovation. Specifically, **certain values affect the management approach** within firms, **which directly impacts the firm's innovation** level and performance. Diving deeper, Manta et al. (2022) highlighted that masculine values negatively impact efficiency growth, and personal values such as competition and success might have a negative impact as well. On the other hand, indulgent cultures are related to higher efficiency.

Ambition and **personal motivation** seem to be critical factors that aid the innovation process. At the same time, **intangible remuneration** appears to be more important than economic remuneration. In addition, **long-term orientation** is a key driver of good performance. All these factors converge into and shape business culture, which can, by itself, be a driving force to foster innovation.

Manta et al. (2022) showed how both national culture and personal values play an essential role in fostering (or hindering, depending on the case) innovation in the organic agri-food industry. These findings are crucial for this thesis, which includes personal values among the possible drivers of innovation among the study subjects.

To summarize what has been discussed in this chapter, the relevant literature highlights both key findings for this thesis' scope and significant gaps in the research about the organic agri-food field.

Specifically, the literature review was divided into three main dimensions of innovation (the micro-level, the firm-level, and the macro-level perspectives) and the stream of studies focussing on innovation in the organic agri-food sector. However, throughout most of these pieces of literature, consensus emerges over the importance of **contextualizing innovation** by analyzing the different factors (or triggers) that lead to innovative behavior in the organic food industry.

Digging deeper into the three streams of literature mentioned above, micro-level studies agree that two main variables have a key impact on innovation: **age** and **experience** level. On the one hand, age seems to negatively impact innovation as older farmers tend to experience more resistance to change, while experience is positively related to innovation. On the other hand, however, when the two factors are taken into consideration together, they have a positive impact on innovation. Another key finding is that both employee and entrepreneurial **motivation** play a positive role in aiding innovation in the agri-food industry.

Studies focussing on the firm-level dimension of innovation show consensus on the role of **firm size** on innovation only to a certain extent. Indeed, while certain studies consider firm size alone able to foster innovation, others believe that firm size matters only when combined with age, arguing that bigger companies show more propensity to innovate only when younger farmers are involved. In addition, **family-owned small businesses** seem to show a higher propensity to turn environmentally-conscious practices into innovation strategies. Finally, **human capital** was identified as another crucial firm-level factor that fosters innovation. It is important to note that firm-level studies show that this dimension is deeply intertwined with the micro-level dimension by including human capital in the key variables investigated, as well as by relating firm size to farmers' age. This confirms that further research might be needed to investigate how variables belonging to more than one dimension of innovation are related and if they indeed have a combined effect on innovation practices. In conclusion, this thesis' scope is relevant to deepening the knowledge of innovation in the organic agri-food industry.

Macro-level research agrees that **collaborative behaviors** and **networks** are two key factors that foster innovation (specifically an open innovation model). This seems especially true in the organic agricultural sector, where farmers seem more prone to sharing knowledge both in formal and informal networks and relationships. In addition, networks are crucial for small and medium-sized enterprises, which could gain a significant competitive advantage from them.

The literature concerning the organic agri-food sector, in turn, defines the organic farming and conversion process as a peculiar type of **eco-innovation** that begins with a process of unlearning past behaviors and practices and which, later on, must be combined with the absorption of external knowledge. These studies highlight that organic agriculture is part of a systematic process of innovative practices that must be contextualized. Organic farming can be considered not only a methodology but also a philosophy. For this reason, it is argued that culture and personal values (such as ambition and personal motivation) do have an important role in how organic practices evolve and innovate. This is an interesting theory that has not been thoroughly studied yet. Once again, the inputs on organic farming are so vast that there have not been studies that agglomerated them all.

All the above considerations shall explain that the present thesis proposes a twofold action to bridge gaps and deepen knowledge in the field of organic agri-food systems and innovation. On the one hand, there is the goal of broadening the present literature by creating research that considers all three dimensions of innovation (the micro-level, firm-level, and macro-level) by studying if and how values belonging to all three of them combine to create innovation. On the other hand, there is the goal of narrowing down the research by contextualizing it into a specific branch of the agri-food sector, i.e. organic farming.

Chapter III: Research Design

As previously discussed, the days when organic farming presented itself as a disruptive innovation are long gone. Nevertheless, the market for organic food has constantly been evolving ever since (FiBL and IFOAM, 2022). As more companies are converting to this agricultural method partially or entirely, reaching at least 3.4 million organic producers worldwide in 2020 (FiBL and IFOAM, 2022), and new players are entering the market, competition is quickly rising. Perhaps now more than ever, understanding the factors sustaining this growth has become of key importance. This understanding will allow organic agri-food companies to build sound and resilient business models while maintaining competitive advantage and appeal to consumers.

In this dynamic and fastly growing scenario, a question arises: **what are the conditions that characterized innovation in organic enterprises** in the past, and what will be the triggers for additional innovations in the future? **Is the path towards an innovative business model linear, or is it instead given by a combination of factors leading to a common outcome?**

The scope of this thesis consists precisely in investigating the different configurations of conditions (*triggers*) that lead to a specific outcome, i.e. innovations within organic agri-food companies in the Veneto region. Pursuing such a complex aim, comparing the nuances of qualitative information available without over-simplifying them by reducing them to a linear model required a complex research method, which was found in QCA.

This chapter introduces both QCA as a research method and the study subjects around which the whole study revolves.

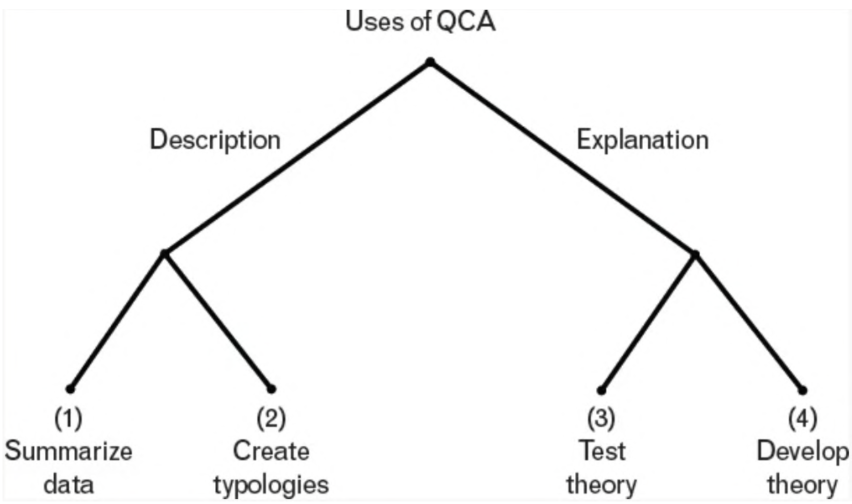
3.1 An Introduction to QCA

Qualitative Comparative Analysis is a research method popularized by the current Chancellor's Professor of Sociology at the University of California and worldwide-known sociologist Charles Ragin starting in 1987.

Nowadays, QCA accounts for one of the most influential and innovative research techniques used not only in social sciences but also in political sciences, economics, business and management, education, and health policy research, among other disciplines (Thiem and Dușa, 2013). More specifically, **QCA is a set-theoretic, case-based, comparative research method** that analyses cases as combinations of different conditions. QCA then compares cases to underline both the necessary and sufficient conditions for a particular outcome (Mello, 2021). Qualitative Comparative Analysis can be used for a wide range of purposes **(Figure 8)**, such as:

- **Descriptive purposes** (mainly to summarize data or create typologies),
- **Explanatory purposes** (to test an existing theory or develop a new one).

Figure 8: The uses of QCA



(Mello, 2021)

QCA lays its foundations in **Boolean Algebra**, which relies on **dummy variables**, i.e. variables that take only two values: true (present, often denoted with 1) and false (absent, often indicated with 0). Boolean Algebra is essential in QCA because it allows for **set-theoretic operations**, truth tables, and their minimization to derive solutions, all of which appear among the main steps of Qualitative Comparative Analysis. The notions of necessity and sufficiency are also based on set theory. Specifically, **necessary conditions** are always present when the outcome observed occurs, while **sufficient conditions** indicate that every time the condition is present, so is the outcome (Mello, 2021).

It is worth noting that dummy variables might present a limit to QCA since they allow researchers to work only with crisp sets, in which 1 underlines the presence of a certain condition and 0 its absence. In order to overcome this shortcoming, in 2000, fuzzy sets were introduced as well, allowing to grade set membership (now scoring any value between 0 and 1). For this reason, the most popular types of QCA used in modern research are:

- **CsQCA** (crisp-set QCA), and
- **FsQCA** (fuzzy-set QCA).

These characteristics make QCA the ideal research method to tackle the issue of **causal complexity**, which is based on three different principles:

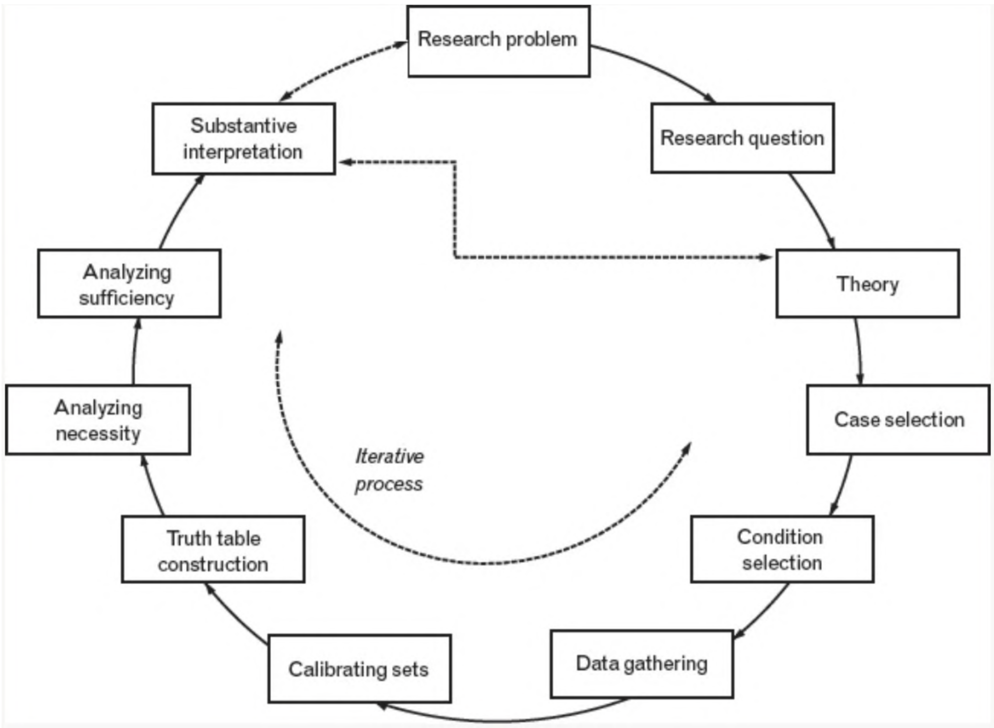
- **Multiple conjunctural causation**, which tackles how different conditions work with one another (in configurations) to cause an outcome,
- **Equifinality**, which means that different combinations of conditions might lead to the same outcome,
- **Causal asymmetry**, which entails that an outcome and its absence, the non-outcome, do not necessarily have the same explanation.

It is important to underline how, through its analytical procedure based on set theory and software-based algorithms, QCA creates models that can comprise both the in-depth information characterizing qualitative analysis and the rigorous techniques typical of quantitative approaches.

3.2 The Steps of QCA

Mello (2021) explains that the QCA approach follows a cyclical and iterative process (**Figure 9**).

Figure 9: The cycle of QCA



(Mello, 2021)

Typically, **the first step** consists of **formulating a research problem**, detailed into a more specific **research question**, which allows the researcher to narrow down the issue observed when analyzing the relevant literature. Specifically, QCA research questions might be classified according to their focus and level (Mello, 2021). On the one hand, *focus* differentiates research questions into:

- **Case-specific**, indicating they investigate the environment leading to one or more outcomes. These questions usually derive from empirical findings,
- **General**, i.e. questions deriving from theoretical considerations and focused on the relationship between concepts.

On the other hand, *level* divides research questions into:

- **Condition-centered**, i.e. those questions trying to identify the effect of a single condition or the combination of more than one condition,
- **Outcome-centered**, focused on identifying the cause or causes for an outcome.

After selecting the research questions, the **set-theoretic part of QCA** begins, as the researcher proceeds with:

- **Case selection**, i.e. the selection of the units of analysis of the research. For the scope of this thesis, the cases selected are the 28 out of the 30 organic agri-food companies selected by the Agrifood Management & Innovation Lab (2021),
- **Condition selection**. The number of conditions should be kept as small as possible without over-simplifying them. Indeed, **QCA works best with a small range of conditions** (commonly three to five). It is a best practice for researchers to provide a justification that explains why certain conditions were included while others were excluded from the research. In addition, researchers shall consider the ratio between cases and conditions because the latter determines the size of the truth table. This means that the more conditions are taken into account, the more cases shall be added to the research (**Table 2**).

Table 2: The relation between cases, conditions and truth table size

Number of Conditions	Truth Table Rows	Suggested Minimum Number of Cases	Ratio of Cases per Condition
2	4	8	4
3	8	12	4
4	16	16	4
5	32	25	5
6	64	36	6
7	128	42	6
8	256	56	7

(Mello, 2021)

After selecting cases and conditions, it is time for researchers to proceed with **data gathering** and **set calibration**, the key steps that lay the foundations for Qualitative Comparative Analysis. While the concept of data gathering is well-known and self-explanatory, set calibration is slightly more complex and unique to QCA (Mello, 2021; Ragin, 2000; Schneider and Wagemann, 2012). Calibration translates raw data (or base variables) into a precise set membership:

condition or outcome (Thiem and Dușa, 2013). In other words, calibration transforms raw data into set data ranging from 0 (full exclusion) to 1 (full inclusion) into a set. Therefore, this is the exact step that **allows comparability** between cases (Baghiu, 2020).

The following step, the true core of this methodology and necessary for the calibration process, is the creation of **truth tables** (Baghiu, 2020) and the analysis of the **necessary and sufficient conditions** for the outcome observed. The final step of QCA consists of the researcher's **interpretation** of the results (Mello, 2021).

It is worth mentioning that the set-theoretic portion of QCA is an **iterative process**, not a linear one as most statistical methods relying on linear algebra are. This means that the researcher will likely go back and forth between the different steps of this portion of QCA.

3.3 An Introduction to Research Design

The research design for this thesis started with the analysis of **secondary data** previously collected by a research group of the *Agrifood Management & Innovation Lab* in collaboration with the Veneto region, summarized in the paper "*Atlante, Modelli di Business delle Imprese del Biologico 2021 - un'analisi del Veneto*" (Agrifood Management & Innovation Lab, 2021).

Such data, which lays the foundation for this thesis, stemmed from a **qualitative-comparative study** and was collected through two different research methods (Agrifood Management & Innovation Lab, 2021):

- **Desk analysis**, i.e. the process of collecting publicly available data about the firms investigated in the research. This technique was used to gather economic-financial information and data regarding companies' communication strategies through online channels (mainly corporate websites and social media). Additional sources for the desk analysis were press releases.
- **Interviews**, necessary to gather empirical evidence. A variety of people

were interviewed, ranging from business owners to CEOs, from marketing managers to employees of organic companies in the Veneto region. Interviews followed a semi-structured survey protocol which allowed researchers to gather homogeneous information for all firms involved in the study.

It is worth noticing that **combining desk analysis and interviews had a twofold advantage**. On the one hand, researchers could access background information about the companies involved in the study (such as a timeline of their development and communication strategies) before the interviews. On the other hand, interviews made it possible to grasp a more in-depth analysis of the companies' history, as well as ongoing business strategies. Most of all, **interviews highlighted the main reasons behind innovations within these companies**.

The main goal of the research group was to answer three main research questions. First, researchers tried to identify the business models of organic companies in the Veneto region. Secondly, the research focused on identifying the configurations of value propositions, supply chain relationships, and regimes of value appropriation of the organic companies in this region. Finally, the focus moved to the drivers of development within organic companies in the Veneto region, as well as the issues that arose concerning the industries' capacity to generate revenues.

Such questions required a **qualitative analysis** that was able to grasp as many displays of an outcome as possible without the risk of oversimplification that might stem from linear statistical models. Hence, the use of **interviews**.

It is important to notice that **there are downsides when using secondary data** for this thesis. Indeed, since it had been previously collected and analyzed by other researchers for a project outside the scope of the current dissertation, some portions of this data might not be relevant to the current research questions. However, this downside was offset by adopting a dynamic approach in the research design of this thesis, going back and forth to verify that available data was in line with research questions and, where needed, to integrate the available information with additional relevant data.

The use of secondary data also had a **significant advantage**: it shortened the preliminary research period in favor of a more in-depth analysis through advanced qualitative methods such as the Gioia Method and QCA.

3.4 Study Subjects

The interviews conducted by *Agrifood Management & Innovation Lab* (2021) involved 30 organic agri-food companies in the Veneto region (**Table 3**). They were carried out between October 2020 and September 2021, in the middle of the Covid-19 pandemic outburst.

Table 3: Firms' specific data (2020)

FIRM	INDUSTRY	DISTRICT	YEAR OF ESTABLISHMENT	2020 REVENUE	2020 EMPLOYEE N.
Agricola Grains Spa	cereal-transformation	Padua	1991	€ 70.399.805,00	70
Albio Srl	cereal-transformation	Treviso	1978	€ 1.186.949,00	10
Azienda Agricola Le Carline di Daniele Piccinin	wine-making	Venice	1988	n.a.	n.a.
Azienda Agricola Quirina di Salvan Carlo	fruit and vegetable	Rovigo	2016	< € 100.000,00	<10
Bortolin Remo, Giovanni e Mario S.S. di Bortolin Alessandro, Giovanni e Mario Soc. Agr.	animal husbandry	Rovigo	1975	€ 2.500.000,00	10
Brio Organic (Brio Spa)	fruit and vegetable	Verona	1993	€ 64.000.000,00	40
Cereal Docks Group	cereal-transformation	Vicenza	1983	€ 1.026.000.000,00 total revenue - € 22.000.000,00 Cereal Docks Organic revenue	256 total employees
Chiesura Corona Valentina - Le Terre del Fiume	fruit and vegetable	Padua	2015	n.a.	n.a.
Consorzio delle Cooperative Pescatori del Prodotti ittici	fish products	Rovigo	1978	€ 50.354.392,00	42
El Tamiso Società Cooperativa Agricola	fruit and vegetable	Padua	1984	€ 10.570.961,00	39
Fattoria alle Origini dei F.lli Zaggia Ales- sandro e Vinicio S. S	animal husbandry	Padua	1999	€ 5.000.000,00	15
Francesco Barduca Srl	fruit and vegetable	Padua	1977	€ 4.209.790,00	12
Frantoio di Valnogaredo	Olive-oil	Padua	1960	€ 450.000,00	<10
Juvenilia Società Agricola S.S.	animal husbandry	Vicenza	1990s	€ 400.000,00	4
Kiwiny Srl	fruit and vegetable	Treviso	2013	€ 2.600.000,00 fresh department revenue - € 105.977,00 beverage department revenue	5 - fresh department
L'insalata dell'orto	fruit and vegetable	Venice	2000	€ 35.897.946,00	16
Lattebusche Latteria della Vallata Feltrina S.C.A.	milk-dairy	Belluno	1954	€ 110.100.000,00	305

Latteria Soligo Società Agricola Cooperativa	milk-dairy	Treviso	1883	€ 80.000.000,00	180
Lorusso Andrea - Apicoltura Nonna Giovannina	beekeeping	Belluno	2010	n.a.	n.a.
Luovo dalle Dolomiti	animal husbandry	Belluno	2014	€ 2.000.000,00	5
Ortoromi	fruit and vegetable	Padua	1996	€ 98.421.166,00	626
Paolo Casarotti	fruit and vegetable	Verona	1929	€ 300.000,00	<10
Perlage Srl	wine-making	treviso	1985	€ 6.535.000,00	20
Roberta Martin (Az. Agricola Martin Gazzani)	cereal	Verona	2000	€ 70.000,00	0
Sgambaro Spa	cereal-transformation	Treviso	1947	€ 20.489.187,00	47
Soc. Agric. La Decima Srl	animal husbandry wine-making cereal	Vicenza	2016	€ 2.200.000,00	24
Società agricola Bepi Bordignon S.S.	fruit and vegetable	Treviso	1993	€ 100.000,00	0

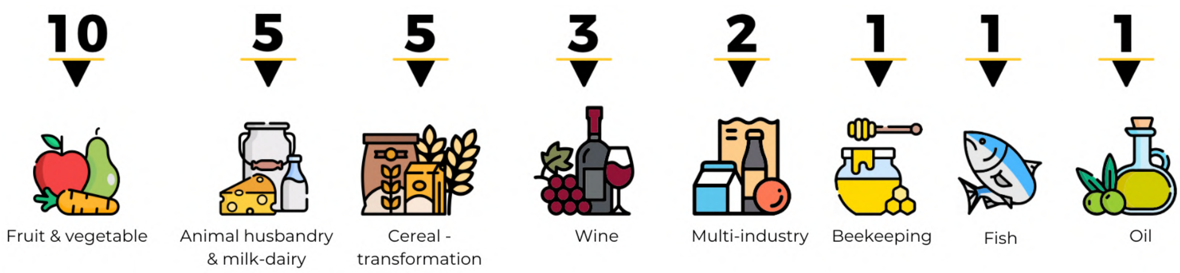
(Agrifood Management & Innovation Lab, 2021)

The companies involved in the study represented a vast array of activities within the organic agri-food industry, ranging from **production** to **transformation** and **distribution**.

Two firms were excluded from this thesis sample. On the one hand, **NaturaSì** was excluded because it merely sells organic products, while this dissertation aims to analyze innovation within companies that produce organic food and beverage. On the other hand, **Malocco Vittorio & Figli Spa**, more widely known by the brand name Ducale, was excluded because it no longer produces organic food and, therefore, the firm falls outside the scope of this thesis.

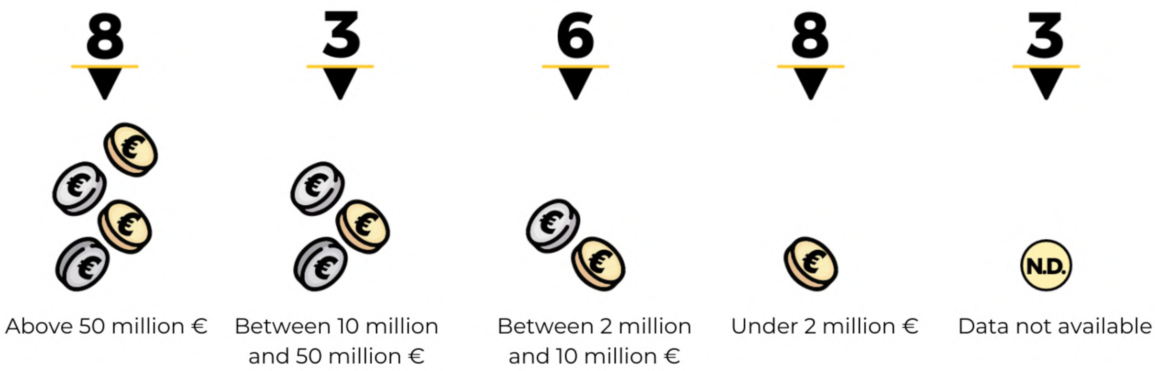
The **28 companies** that were analyzed belonged to different branches of the organic agri-food industry: cereal, fruit and vegetable, milk and dairy, animal husbandry, and viticulture, among others (**Figure 10**), and had different sizes in terms of annual revenue (**Figure 11**).

Figure 10: Number of firms per industry



(Agrifood Management & Innovation Lab, 2021)

Figure 11: Number of firms per revenue class



(Agrifood Management & Innovation Lab, 2021)

This diversity made the group of 28 firms an excellent sample, representative of the organic agri-food scenario in the Veneto region.

Since the research design of this thesis heavily relies on secondary data and qualitative research, a systematic qualitative analysis needed to be conducted with the same reasoning. Therefore, coding through the **Gioia Method** and **Qualitative Comparative Analysis (QCA) were chosen to conduct this thesis research**. The following chapter explains in more detail the steps of the empirical analysis.

Chapter IV - Empirical Analysis

Now that the study subjects of this thesis and the principles of how QCA works have been explained, it should be somehow clear why QCA was adopted as the main research method.

As explained in **Chapter 3.2**, QCA is a complex process that follows a series of iterative steps: formulation of the research problem and question, case selection, condition selection, data gathering, calibration, and tests for necessity and sufficiency (Mello, 2021). The scope of this chapter is precisely that of contextualizing the different steps of QCA relative to this thesis, highlighting the empirical portion of the analysis.

A remark should be made: although in Mello (2021), data gathering comes after both the formulation of the research question and the selection of cases and conditions, these steps followed a different order in this thesis. Indeed, the secondary data analyzed were pre-existing to its writing. Therefore, a different structure was implemented while conducting the research: to avoid possible biases and downsides caused by secondary data, an iterative process was adopted for all the steps of this QCA analysis, not only for the set-theoretic portion. This means that the researcher went back and forth various times to verify that the research questions and cases selected were coherent with the information gathered by Agrifood Management & Innovation Lab (2021), which was integrated with new data where necessary.

4.1 Research Questions

As previously explained, the **data gathering** step of this QCA study was carried out by a different research group before this thesis was written. Therefore, the first step within this research scope consisted of an in-depth analysis of all the qualitative, secondary information gathered by Agrifood Management & Innovation Lab (2021). At first, the analysis only included the transcriptions and recordings of the interviews to prevent possible cognitive biases while potentially identifying areas of interest that had not been delved into by the Agrifood Management &

Innovation Lab research group. Later, an analysis of the report written by the research group and of the relevant literature was carried out as well, which allowed adopting a comprehensive view of the organic agri-food market on a global, national (Italian), and regional (pertaining to the Veneto region) scale.

The analysis of the case studies included in Agrifood Management & Innovation Lab (2021) and the relevant literature, paved the way to one main finding: **many of the companies included in the study were real pioneers in the organic agri-food sector**. They were founded in the 1970s and 1980s before any official legislation regulating organic production was implemented in Europe and Italy. This was the case for *Francesco Barduca Srl*, *El Tamiso Società Cooperativa Agricola*, and *Sgambaro Spa*, among others.

Such companies identified an opening in the market, being among the first to establish a business that could answer an (at the time) unsatisfied need. In time, they were also able to innovate (broadening their offerings, introducing new services and products, and implementing new production processes) while maintaining market share and competitive advantage. Of course, the level and type of innovation differed widely among the various companies. If it is true that some pioneered their industry with a clear strategy, the majority of them did not have a well-structured business model but rather followed personal ethics and values. Nevertheless, as the organic agri-food market broadened and new players entered the scene, these companies were able to keep up with ongoing innovation and growth.

At the same time, new companies leveraged the introduction of a wide array of new products and production technologies, presenting themselves as young and innovative enterprises (*Kiwiny*).

With such considerations, the two main **research questions** of this thesis naturally emerged:

> *Q1: What does innovation look like within organic agri-food companies in the Veneto region? What types of innovations were introduced over the years?*
>
> *Q2: What factors, or configurations of factors, have led and are still leading to*

innovation within the organic agri-food companies in Veneto?

Both the research questions used in this thesis are outcome-centered and case-specific. In addition, their aim is twofold:

- Distinguishing and **defining the different types of innovation** introduced within the sample of reference over the years,
- **Identifying the *triggers*** of such innovations, highlighting the strengths and weaknesses of the subjects of this research while highlighting future improvements to their strategic choices.

Once the research questions were formulated, the issue of how they could be tackled and answered most efficiently emerged. The following paragraph will illustrate the subsequent and crucial step of this research: the choice of the research methods.

4.2 Research Methods

This thesis relies on **two essential analysis methods**: **coding** (as defined by the Gioia Method) and **Qualitative Comparative Analysis** (as defined by Charles Ragin). This choice made it possible to analyze secondary qualitative data, fully recognizing the importance of informants' voices and representing them when reporting the main findings. It also made it possible to dive deeper into specific aspects of the research rigorously, merging the benefits of qualitative research and quantitative software analysis.

4.2.1 The Gioia Method

As previously mentioned, this thesis research started with the analysis of secondary qualitative data in the form of interviews to answer a relatively broad research problem: *Is the organic agri-food market still innovative?*

The Gioia Method was adopted to answer such a complex and broad question because it allows the researcher to appreciate the complexity of qualitative analysis, digging deeper into all shades of the information shared by interviewees before narrowing it down to codified data. The **Gioia Method** (Gioia et al., 2012) is an inductive qualitative research methodology that relies on three main assumptions.

First, it assumes that **the organizational world is socially constructed** (Gioia et al., 2012). Second, actors within the organization are assumed to be "**knowledgeable agents**" aware of (and able to explain) what they do. Finally, this method relies on the assumption that researchers are also knowledgeable, able to identify patterns that informants might unconsciously overlook, and formulate relevant concepts (Gioia et al., 2012).

The choice of this method for the preliminary analysis provided a series of advantages and added value to this thesis. To begin with, it added an important layer of **consistency** to this work. Since the Gioia Method relies on multiple data sources and semi-structured interview processes to reach retrospective and real-time accounts by the interviewees (Gioia et al., 2012), it was used by the research group that first gathered the data analyzed in this thesis. In addition, this method allowed keeping a certain degree of interpretative flexibility, allowing interviewees to follow their stream of consciousness during the interview, thus gathering very comprehensive information. This is clear in the interview recordings and transcriptions. Finally, relying on this type of qualitative data brought another advantage to the table because it allowed the researcher to **unveil new concepts** more easily. Therefore, keeping the same method to bring the data analysis even further seemed a coherent and natural choice for this thesis.

Furthermore, **the Gioia Method helped bring more rigor and specificity to qualitative research**, as it relies on well-specified, general research questions.

This analysis method was applied with some degree of freedom, adapting it to the research. However, in the eyes of the researcher, this is considered an advantage. Indeed, in Gioia et al. (2012), the authors clearly stated that they consider their approach more as a "methodology" than a "method" or a "cookbook", indicating that the Gioia Method is actually meant to be *"a flexible orientation toward qualitative, inductive research that is open to innovation"*.

Circling back to the empirical use of the Gioia Method in this thesis, it was applied in several steps. First, **analyzing the interview transcriptions and recordings**, the researcher kept note of all types of potentially relevant information shared by the interviewees in **informant-centric terminology**, organizing it into **categories** of interest. This step was crucial because it allowed the researcher to get lost in the multitude of information, adopting a comprehensive overview of the topic of interest. Following Gioia's words, "*You gotta get lost before you can get found*" (Gioia et al., 2012). This advantage of the Gioia Method was enhanced by the fact that this thesis analyzes secondary data that a different research group had gathered. If, on the one hand, this brought forth an additional layer of complexity to the analysis, on the other hand, it allowed a more impartial and objective interpretation.

While this first analytical phase usually highlights a very high number of categories, information is narrowed down in the subsequent step. Indeed, informant-centric data is then elaborated into **researcher-centric codified information**, highlighting the most prominent areas of interest. This second step allowed the researcher to formulate more specific research questions.

Both these steps preceded the literature review, allowing the researcher to keep a certain degree of **semi-ignorance**. This is extremely valuable in qualitative research because it allows the researcher to avoid prior hypothesis bias (specifically, the confirmation bias). In addition, categorizing data into 1st- and 2nd-order categories increases the qualitative rigor of the research.

The coding process through the Gioia Method consists of gradually reducing the categories of interest into a more manageable number by seeking similarities and differences. Labeling the initial categories made it possible to identify the research issue and the research questions. By doing so, the Gioia Method allowed the researcher to assess if there was a deeper structure underneath the array of information stemming from the qualitative analysis. For example, trying to answer the general question "What is going on here?" circling back and forth between data, concepts, and themes, led to formulating other, more specific questions (this thesis research questions).

Finally, the Gioia Method provided another crucial advantage for this thesis: it allowed the researcher to not only take into consideration all major concepts that emerged from qualitative research but also the relationships between concepts. Not only did the Gioia Method allow the researcher to formulate the research issue and questions. It also paved the way to the deeper layer of analysis of this thesis, i.e. Qualitative Comparative Analysis.

4.2.2. Qualitative Comparative Analysis

The formulation of the research problem and its articulation into the two research questions made it clear that the issue tackled in this thesis was very complex. While the preliminary analysis through the Gioia Method allowed gathering information to answer Q1, Q2 needed a different approach to be solved. This paragraph illustrates the reasoning behind the adoption of Qualitative Comparative Analysis to tackle research question number two.

As previously mentioned, QCA is a set-theoretic approach. This is a particularly important factor that differentiates this research technique from pure statistical analysis (**Table 4**).

On the one hand, **statistical analysis aims at identifying linear relationships**, such as correlation, between dependent and independent variables. In addition, **it is variable-oriented** and aims at making comparisons *across* different cases using linear algebra (Meuer and Rupietta, 2016).

On the other hand, **QCA allows researchers to make comparisons *between* cases**, thus being called a *case-oriented* approach (Meuer and Rupietta, 2016), thanks to the use of Boolean algebra and set theory. This means that QCA allows for the retention of a **higher quantity of qualitative information**, making it the ideal approach for tackling causal-complexity issues (Mello, 2021). Not only does it allow researchers to highlight which conditions are sufficient or necessary for a specific outcome, but it also allows for **cross-comparisons** to identify the configurations of conditions leading to the outcome observed.

Table 4: Differences between set-theoretic and statistical approaches

Differences by Approach	Set-Theoretic Approach	Statistical Approach
Phenomenon to be explained (explanandum)	Outcome	Dependent variable
Phenomena to explain (explanans)	Conditions	Independent variables
Numerical conversion of concepts / raw data	Calibration	Measurement
Relationships to be explored	Causal complexity	Linear relationships
Analytical device	Truth table	Correlation matrix
Results	Necessary and sufficient conditions	Net effects of individual variables

(Mello, 2021)

The choice of QCA as the ideal method to conduct the study for this thesis, especially answering Q2, relied on this reasoning, as well as three additional factors.

To begin with, **the data used in this thesis belongs to a qualitative comparative study** based on information extracted from extensive interviews, as well as desk analysis. Therefore, adopting a methodology that allowed recognizing the complexity of such data while avoiding over-simplifications was a key priority. Secondly, **the number of cases observed** (the 28 companies involved in the research) might not be sufficient to constitute a statistically significant sample for linear statistical analysis, while it is perfectly acceptable for Qualitative Comparative Analysis. Finally, **the scope of this thesis**, entailed in the research questions, **aligns with the goals of QCA**, i.e. identifying the conditions (*triggers*) and combinations of such that lead to a specific outcome (*innovation within organic agri-food companies in the Veneto region*).

Since innovation is often cumulative in nature, meaning that it stems from the sum of various smaller, incremental innovations, it is reasonable to argue that the different triggers of each innovation interact with one another. This made the use of Qualitative Comparative Analysis even more important and fit for such a research project.

The following step of the research consisted in selecting the **outcomes and conditions of the analysis**, which are commonly referred to as *variables* in statistics and are illustrated in the next two paragraphs.

4.3 Outcome Selection

As previously illustrated, QCA aims to identify the conditions or combinations of such leading to a specific outcome. This definition of Qualitative Comparative Analysis is deeply rooted in the two research questions of this thesis.

Specifically, Q1 underlines the **outcome**, i.e. innovation within organic agri-food companies in the Veneto region:

> *Q1: What does innovation look like within organic agri-food companies in the Veneto region? What types of innovations were introduced over the years?*

In order to answer Q1, interviews were analyzed in depth to highlight all types of innovations identified by the interviewees.

Innovation is a very broad concept, which can be declined into many different domains intertwined with one another (Avermaete et al., 2003). It often refers to small, incremental changes rather than big, disruptive changes (Avermaete et al., 2003; Lundvall, 1992). Indeed, Lundvall (1992) described innovation as:

> *"An ongoing process of leaving, searching, and exploring which results in: new products; new techniques; new forms of organisation; and new markets."*

For the scope of this thesis, unless differently specified, the term *innovation* refers to the broader concept of **business model innovation**, i.e.

> *"the art of enhancing advantage and value creation by making simultaneous and mutually supportive changes both to an organization's value proposition [...] and to its underlying operating model"*

as defined by the Boston Consulting Group (BCG, 2022).

The choice to initially focus on the wider concept of business model innovation lies in the broad range of information on which this research is based. Narrowing down the first steps of the analysis to only one specific type of innovation could have led to cognitive biases, and therefore a more comprehensive approach was adopted.

Business model innovation can be declined into two levels (BGC, 2022):

- **Value proposition level**, which includes those innovations, changes, and improvements regarding segmentation, product or service offering, and revenue model,
- **Operating model level**, focussed on the value proposition to increase or sustain competitive advantage, profitability, and the creation of value. This includes value chain positioning, cost models, and organizational structure.

As business model innovation includes a variety of innovation types, the data gathered to analyze **the cases included in this thesis presented two key domains of innovation**: product and process innovation. Data regarding both was structured into an Excel spreadsheet (**Appendix A**) to provide a comprehensive overview of how innovation had spread among the subjects of this study.

Diving deeper into the specifics of these two types of innovation, it can be argued that **product innovation** comprises "*any good, service or idea that is perceived as new*" (Kotler, 1991; Avermaete et al., 2003). This type of innovation usually stems from two different factors (Avermaete et al., 2003):

- Organizational changes within a company, such as improved quality control within agri-food companies,
- New market segments, such as organic, nutritional, and ready-to-make food.

Process innovation, on the other hand, consists of either new or improved production methods. Process innovation also includes new (or improved) delivery methods, improved techniques, equipment, and software, depending on the company (OECD/Eurostat, 2005).

Within the scope of Qualitative Comparative Analysis, product and process innovation are the *outcomes* (Y1 and Y2, respectively) of the study. The *conditions*, on the other hand, are to be found in the triggers of such innovations, i.e. those factors that might have contributed to innovations within the companies included in this research. The next chapter analyzes condition selection in depth.

4.4 Condition Selection

While Q1 focuses on the outcomes of this study, i.e. product and process innovation, Q2 refers to the factors that lead to innovation itself as the **conditions** studied:

> *Q2: What factors, or configurations of factors, have led and are still leading to innovation within the organic agri-food companies in Veneto?*

In this thesis, the factors leading to innovation are referred to as *triggers*.

The use of QCA to understand how each trigger, as well as the combinations of such triggering factors, affect innovation is key not only in this thesis but also in the business research field. Indeed, **current studies have the tendency to focus on individual factors** rather than on the combination of factors, which brings forth a risk of oversimplifying complex phenomena such as innovation processes (Montalvo, 2006). In addition, if it is true that there is an implicit recognition that triggers do interact with and influence each other, **there is a lack of models built to facilitate a quantitative empirical study on such relationships** (Montalvo, 2006). Thanks to Qualitative Comparative Analysis run through the software fsQCA, this thesis highlights the importance of integrating those studies that have a narrower focus with models that are able to have a wider, as well as more comprehensive perspective. After all, innovation is not linear and cannot be limited to a one-way process (Kline, 1985).

Answering Q2 required two key steps. First, the interview codification process through the Gioia Method allowed the researcher to identify an initial set of eight macro-categories that, according to the interviewees, fostered innovation in the organic agri-food sector. Specifically, they are technical issues, market pull, adverse events, Covid-19, networking, traveling, personal values, and "other factors". These variables are considered macro-categories to be kept into consideration but are not the conditions selected for QCA. While they provide important information about the innovation process in the study subjects, the risk of cognitive biases was deemed too high, and therefore the researcher proceeded with the identification of a more specific set of conditions for the Qualitative Comparative Analysis. A more in-depth discussion of the eight macro-categories can be found in Chapter 5, Paragraph 1.

In order to reach an adequate level of relevance and objectivity, the next step implemented to answer Q2 was that of **identifying a series of more specific triggers** associated with the three areas of innovation examined in Chapter 2, i.e. the micro level, the firm-specific level, and the macro level.

For this purpose, **seven conditions** (*triggers*) were identified:

- **Firm size** (SIZE), measured according to the number of employees and revenue, per guidelines provided by the European Commission (EU recommendation 2003/361). Since, according to the literature review, firm size tends to be positively correlated with innovation adoption, this condition was included in the QCA research. Although the literature review highlighted how firm size might be relevant when combined with young-aged farmers who have a high market-entrepreneurial orientation, these last two factors were not included in the present QCA study because of a lack of data. However, the author recognizes that future research might investigate further the relationship between firm size, farmer age, and market-entrepreneurial orientation.
- **Longevity** (LONGEVITY). This condition classifies companies as "recent firms" (founded from 2000 onwards) and "mature firms" (founded before 2000). This factor was considered of interest as it might relate to entrepreneurial expertise in the field, which is positively related to innovation, according to the literature review.
- **Distribution channel** (B2C). Companies were divided into B2C and B2B, according to the distribution channel of choice. This trigger did not have to do with any specific statement from interviewees or information gathered

during the literature review. However, since this thesis aims at keeping into account firm-level factors, and the information was available when the research was carried out, this trigger was included in the research.

- **GDO** (GDO). This condition registers whether companies are involved in the GDO (*Grande Distribuzione Organizzata*, i.e. large-scale distribution). This indicator was considered related to networking activities, which were identified by the interviewees as impactful in the innovation process. Indeed, selling through the GDO channel requires companies to maintain a series of relationships (hence, networking) with third parties.
- **Internationalization** (INT). This trigger indicates whether companies are active only in the Italian market or not, which, once again, has to do with the networking relationships that need to be maintained.
- **Online presence** (ONLINE) Interviewees seemed to perceive innovation as related to the digital sphere. Although they saw the digital presence more as a result than a trigger of innovation, the author deemed it interesting to assess, via QCA, if the reverse is true. Does an online presence somehow contribute to innovation? During the calibration process, having a website was given for granted, and companies were classified as "online mature" if they were active on at least one social media platform, where active means they published at least one post in the last 30 days.
- Presence of **own brand** (BRAND). Initially, this indicator was also included in the data matrix. However, given the very homogeneous results (only four out of twenty-eight companies do not have their own brand), it was not included in the empirical qualitative comparative analysis.

While firm size and longevity were expected to be positively correlated with innovation adoption thanks to the evidence gathered during the literature review, there were no expectations regarding the other triggers. This was reflected in QCA during the test for sufficient conditions, which is further discussed in Chapter 5.

4.5 The Calibration Process

At this point, the information gathered for the operational part of QCA was still qualitative. On the contrary, to run operations through **fsQCA 3.0**, it was necessary to translate such information into quantitative data that could be processed via software. This process is called **calibration**, and it is one of the crucial steps of Qualitative Comparative Analysis.

After identifying the different conditions (*triggers*) that might lead to product or process innovation in organic agri-food companies of the Veneto region, triggers were calibrated into crisp sets. In other words, they were assigned value 1 where present, and value 0 where absent (**Table 5**).

Table 5: Explanation of the calibration process

TRIGGER	1 = PRESENT	0 = ABSENT
INTERNATIONALIZATION (INT)	the company is active in foreign markets	the company is only active in the national (Italian) market
GDO	the company directly sells to the GDO channel (large-scale retail)	the company does not sell to the GDO channel (large-scale retail), or it deals with GDO through intermediaries
ONLINE MATURITY (ONLINE)	the company owns a website and has been active on at least one social media platform in the last 30 days	the company does not own a website, or it owns a website and has not been active on at least one social media platform in the last 30 days
B2C	the company is a B2C	the company sells B2B
SIZE	other companies (small, medium and big)	micro company (employee number < 10, annual revenues =< 2 million Euros)
LONGEVITY	the company was founded before 2000	company founded after 2000
OWN BRAND	the company has its own brand	the company does not have its own brand

(Compiled by the author)

This also applied to the outcomes, i.e. product and process innovation, which were assigned values 1 or 0 where present or absent, respectively. Specifically, companies were considered to be "product innovative" and "process innovative" where the interviewees identified at least one product innovation and process innovation, respectively.

There exist three different techniques for calibration (Mello, 2021):

- The **manual approach**, which assigns scores by hand to each case involved in the study. This method requires a previous definition of the target set, external criteria, and consistent coding rules to avoid biases (Mello, 2021),
- The **direct method**, which uses software to translate raw numerical data either into crisp or fuzzy sets,
- The **indirect method**, in which the researcher must assign preliminary scores to each case observed and then uses of a statistical estimation technique.

Delving deeper into the calibration process, the first step consists in choosing whether to use crisp sets or fuzzy sets. If researchers choose **fsQCA (fuzzy set QCA)**, they need to establish the 0.5 crossover point, i.e. the level of highest ambiguity, at which you cannot determine whether a case belongs to the target set or does not (Mello, 2021). On the other hand, **csQCA (crisp set QCA)** requires the researcher to clearly define the criterion according to which a condition falls within or outside the target set.

At this point, it is necessary to recall that this study aims to analyze which conditions (*triggers*) and configurations of conditions are sufficient or necessary to display product or process innovation (*outcomes*) in an agri-food company from the Veneto region (*cases*).

As far as the scope of this thesis is concerned, **the concept of innovation** is **binary**. This means that the cases observed can either be innovative or not, or in QCA terms, they either fall in the target set or outside of it. For this reason, **csQCA was selected as the method to conduct the analysis**.

For this thesis, the manual calibration approach was used, meaning that each case was assigned scores 1 and 0 manually. This was justified by the choice of crisp sets rather than fuzzy sets, and the limited number of cases analyzed.

As suggested by Mello (2021), to avoid any ambiguity the main rules for calibration were respected in this thesis, i.e.:

- The conditions (*triggers*) included in the analysis were explicitly stated (Chapter 4.4) and explained (Table 5),
- Data sources were as transparent as possible, including quantitative data. Qualitative data was not made fully available in this thesis to protect the study subjects' privacy. However, upon request, access to a data repository will be granted,
- The method of calibration (manual method) was clearly stated, while calibration thresholds were explained,
- Set labels were chosen so they could be as unambiguous and clear as possible.

The results of the calibration process were **two data matrices** (Appendices B and C), which were later imported into the software fsQCA and used to test for necessary and sufficient conditions. The following paragraph contains an in-depth explanation of both tests.

4.6 Testing for Necessity and Sufficiency

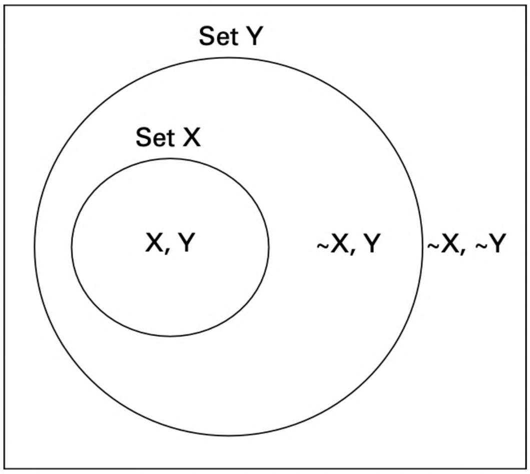
The empirical QCA analysis can be divided into two main steps: testing for necessity and testing for sufficiency, and both rely on two main parameters of fit: consistency and coverage.

Recalling Schneider and Wagenmann (2012), condition X is sufficient for a given outcome Y if, whenever the condition occurs, the outcome also occurs.

Graphically: $X \rightarrow Y$, which is read as "if X, then Y" or "X implies Y".

For instance, assuming that internationalization is a sufficient condition for process innovation means that, whenever process innovation is present in a company, so is internationalization. In set theory, this is expressed visually through Venn diagrams and, specifically, the notion of subsets.

Figure 12: Sufficiency explained with Venn diagrams



(Schneider and Wagenmann, 2012)

As displayed in **Figure 12**, if X is a sufficient condition for outcome Y, set X is fully within set Y, thus being a perfect subset. As discussed above, the combination (X, ~Y) will be empty because sufficiency implies that whenever X is present, Y will also be present. Therefore, no case will fall in that area.

In the software FsQCA, sufficiency analysis starts with the creation of a truth table. The **truth table** is a matrix that displays all the possible combinations (*configurations*) of conditions and whether the outcome is present or absent for each configuration. Truth tables display 2^k configurations, where k is the number of conditions. In this thesis, since six conditions are tested, truth tables display 64 configurations of conditions. The truth table is a crucial tool for the **identification of subset relations** between the conditions and the outcome which, in turn, identify **sufficiency**.

The first version of a truth table obtained via software does not display the value of the outcome (1=present, 0=absent). In order to get that result, the researcher needs to establish two thresholds: frequency and consistency.

In this thesis, since the sample size is small, the **frequency threshold is set at 1**. This means that, in order to be considered sufficient, configurations of triggers must display at least one case. Configurations that do not occur in any case, called **logical remainders**, were initially excluded.

Secondly comes the consistency threshold. Consistency is the primary measure of fit to measure sufficiency in QCA. Specifically, **consistency measures subset relations, indicating the proportion of cases in a specific set X that are also in set Y**. In other words, consistency measures the degree to which solution terms (all conditions that make up a configuration) and the solution as a whole are subsets of the outcome studied. **Raw consistency** (the consistency of a truth table row) measures the proportion of cases in a truth table row that display the outcome. Ragin (2017) recommends that, in order to consider a csQCA configuration sufficient, **consistency must be 0.75 or higher**.

By setting both thresholds, the FsQCA software allocates a value to the outcome column as well. Specifically, the outcome will be 1 for sufficient configurations (those that meet both the frequency and consistency thresholds) and 0 for all other rows. This truth table does not display logical remainders.

At this point, sufficient configurations are already available to the researcher in the new truth table. However, a further step is necessary to get the solution terms (also known as prime implicants). This step is called logical minimization.

Logical minimization is the systematic comparison between the truth table rows that display sufficient configurations of conditions to find the simplest notation possible. Logical minimization relies on the principle that, if two logical expressions differ in only one condition that is present in one expression and absent in the other, this condition is logically redundant and therefore does not contribute to the outcome. For this reason, such redundant conditions can be striked off and the result will be a simpler logical expression. The software runs logical minimization until it displays the final **solution terms**, or **prime implicants.**

It is important to note that, in some cases, the software might display more prime implicants than are needed to cover all the primitive expressions (i.e. the initial configurations before logical minimization). These prime implicants are called "logically tied" and, to proceed with the sufficiency analysis, the researcher needs to manually choose which prime implicants to keep from the prime implicant chart (Ragin, 2017).

The test for sufficiency displays three solutions: the complex, the parsimonious, and the intermediate solution.

The **complex solution** ignores logical remainders (the configurations of conditions that are theoretically possible but empirically did not occur in any of the cases investigated). The advantage of using the complex solution is that it sticks with the empirically observed facts. However, it might be difficult to interpret given its complexity.

On the contrary, the **parsimonious solution** uses all logical remainders. While it tends to be shorter and simpler than the complex solution, it is very difficult to interpret as it makes use of difficult counterfactuals (theoretically highly implausible assumptions about the relationship between conditions and outcome).

Finally, the **intermediate solution** only uses easy counterfactuals, i.e. only theoretically plausible assumptions. Therefore, this is the most frequently used solution to interpret sufficient solution terms.

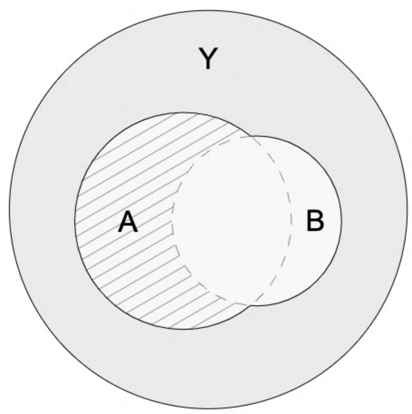
Although all three types of solutions were investigated for this thesis, the complex and parsimonious solutions are shown in **Appendices D and E** for transparency purposes, but the interpretative focus is centered on the intermediate solution for the aforementioned reasons.

At this point, **coverage** (the second parameter of fit) allows the researcher to evaluate the importance of each solution term. Indeed, coverage indicates how much of the outcome is explained by each solution term and by the whole solution. As regards sufficiency analysis, there is no minimum coverage threshold required, as it merely shows the empirical importance of a given solution. More specifically, there are three types of coverage:

- **Solution coverage** indicates the coverage of the solution as a whole,
- **Raw coverage** shows the coverage of a single solution term,
- **Unique coverage** explains the extent to which the outcome is explained only by a specific solution term and not by another one.

To clarify, raw coverage measures the coverage, i.e. the empirical importance of a specific solution term (configuration). As Ragin (2006) put it, raw coverage measures "*the relative importance of several combinations of causally relevant conditions*" (Poveda and Martínez, 2011). However, such a configuration might overlap with another one, forming an intersection with another solution term, speaking in set theory language (**Figure 13**).

Figure 13: Raw coverage and unique coverage



(Dușa, 2018)

This aspect is clarified by looking at the unique coverage, which is a weighted coverage that measures how much of the outcome is covered *uniquely* by a solution term. As Poveda and Martínez (2011) explain, "*unique coverage is calculated by the coverage of a configuration of interest from the set of configurations minus the raw coverage of configurations without the particular configuration of interest*". When QCA is run via software, the program will do the computation for the researcher.

Testing for necessity is a separate process that does not require a truth table. A condition X is necessary if, every time a certain outcome Y is present, so is the condition (or configuration thereof). The notion of necessity relies on the concept of **supersets**. If, whenever Y happens, so does X, it means that X is a superset of Y. Graphically, necessity is stated as follows:

X ← Y, which is read as "if Y, then X" or "Y implies X".

Again, the main measure of fit for necessity is consistency, which indicates if the condition is a superset of the outcome. In this case, the test is run for single conditions and not for configurations of conditions. Indeed, if a configuration is deemed necessary, this means that every single condition belonging to said configuration must be necessary too (Mello, 2021).

Since necessity tests for single conditions, the **minimum consistency threshold is 0.90**, higher than the threshold for the sufficiency test (Mello, 2021). In addition, coverage plays a crucial role in testing for necessity because it allows assessing whether a condition is necessary only theoretically or also empirically. In other words, coverage allows the researcher to distinguish between *trivial* and *relevant* necessary conditions (Mello, 2021). The **coverage threshold** should be as close as possible to 1 and, in this thesis, it was set at **0.80** to indicate that a condition is a relevant necessary condition.

Chapter V: Results and Discussion

Before diving deeper into the empirical part of the analysis, it is important to summarize the main steps that made it possible to conduct the qualitative comparative analysis of the study subjects.

To begin with, an in-depth analysis of secondary data and its codification through the Gioia Method allowed the researcher to obtain an understanding of the development of the organic agri-food industry over the past decades, as well as an overview of the dynamics of innovation in this sector. This made it possible to carefully analyze and pick the **study subjects** suitable for this thesis and formulate a specific yet broad research issue. The following step consisted of the **literature review**, followed by the formulation of two **research questions**:

> *Q1: What does innovation look like within organic agri-food companies in the Veneto region? What types of innovations were introduced over the years?*
>
> *Q2: What factors, or configurations of factors, have led and are still leading to innovation within the organic agri-food companies in Veneto?*

While the codification process allowed answering Q1, Q2 required further analysis. Therefore, QCA was identified as the **research methodology** that best suited the second research question. The subsequent steps are the key elements of qualitative comparative analysis: first, the **selection of the outcome** (product and process innovation), then, the **selection of the conditions** (innovation triggers), **calibration**, and the tests for **sufficiency** and **necessity**.

After calibrating data into binary variables, the research could proceed with the empirical part via the **software fsQCA 3.0**. However, an important remark needs to be made before diving into this part of the analysis.

As the main aim of this thesis consists in identifying the relevant combination of triggers that lead to innovation within the organic agri-food industry in Veneto through csQCA, complex qualitative data needed to be calibrated into binary conditions. In addition, in order to follow the ratio of cases per conditions suggested by Mello (2021), some triggers were excluded from the empirical analysis because they were present only in a few cases. Finally, although calibration allows performing a systematic software analysis, it might consider irrelevant triggers that occur in only a few cases. All these steps, although necessary, entail a simplification of the information available after the empirical part of QCA is conducted. Therefore, **in order not to lose track of the peculiarities registered during the qualitative coding analysis** of the interviews, **the next paragraph will show the main qualitative findings** of this research phase.

5.1 Coding Results

As mentioned above, the analysis of the qualitative information derived from the interview process allowed understanding which types of innovation emerged in the companies involved in this study.

First of all, the analysis of the interviews led to the identification of a series of **critical areas linked to innovation within the organic agri-food businesses** interviewed. Specifically, interviewees attributed innovation to eight main areas of interest:

1. **Technical reasons**, which include factors stemming from strategic business decisions, industry needs, or production process needs. For example, *Società Agricola Bepi Bordignon S.S.* introduced ancient cereals because of a technical reason: crop rotation. This, in turn, triggered the production of flours made with ancient cereals, resulting in product innovation.
2. **Market pull**, also referred to as "demand pull" or "need pull". The term indicates a type of innovation that is triggered by unsatisfied customer needs resulting in a company attempting to solve this issue (Brem and Voigt, 2009; Schön, 1967). Market pull-led innovation is a very interesting phenomenon because, in this context, it is consumers that educate producers, which in turn try to fulfill a market-defined niche based on their perception of what is needed (Dixon, 2001). The most common market pull trigger observed was indeed the *demand for organic products* from consumers.

3. **Adverse events**, i.e. those events such as wars, economic crises, biological or natural disasters, which often result in economic loss, decreased economic growth and productivity (Dieppe et al., 2020).

   Being founded in the 1970s and 1980s, many of the companies included in this thesis had to face disruptive events during their lifetime, such as the financial crises of the early 2000s, 2008, and 2011 and the crisis of the textile sector. However, only a few adverse events emerged as triggers of innovation during the interviews. Specifically, *Roberta Martin - Az. Agricola Martin Gazzani* explained having introduced a new type of rice to their agricultural practice in order to fight the diffusion of a fungus.

   This result is in line with the findings of Dieppe et al. (2020), according to which global adverse events seem to have a negative impact on productivity, while hindering innovation. Of course, different types of adverse events hit different areas of firms' productivity. For instance, wars and natural disasters (which include the current Covid-19 pandemic) might damage infrastructures, supply chains and value chains (Dieppe et al., 2020; Acevedo et al., 2020; Cerra and Saxena, 2008), while financial crises lower the availability of financial resources and corporate earnings, decreasing the likelihood of new investments (Dieppe et al., 2020).

4. **Covid-19**. The current pandemic was kept separate from the previous category, adverse events, because of its relevance to this date. Indeed, global biological disasters have the power to disrupt companies' productivity from two sides, affecting demand and supply at the same time. On the one hand, supply chains, in particular, are a key measure for innovation diffusion. On the other hand, a decrease in aggregate demand can significantly reduce the effort to introduce new products, directly affecting product innovation (Dieppe et al., 2020; Baker et al., 2020; Ludvigson et al., 2020; Ma et al., 2020).

   Nevertheless, many of the companies included in this study mentioned Covid-19 as a trigger of change within the company. Indeed, many worked in close contact with the Horeca (hotellerie-restaurant-café) industry, which is extremely exposed to shocks in the economy, such as those brought by the pandemic, and the restrictions on mobility, openness and capacity that were implemented to contain Covid-19 (García-Madurga et al., 2021). Even though, as seen above, pandemics can hinder and even put a stop to innovation, some companies identified Covid-19 as a trigger to innovation, specifically related to technological advances and the introduction of e-commerce as a way to compensate for the movement restrictions implemented by the government. That was the case for *Agricola Grains Spa*, *Spumanti Valdo,* and *Frantoio di Valnogaredo*.

5. **Networking**. Innovation has traditionally been implicitly considered a linear process stemming from research and development. This typically Schumpeterian view of innovation implies that bigger companies, who usually have more financial resources for R&D, might be better innovators than smaller companies (Love and Roper, 1999). However, research shows that small firms are often more innovation-intensive than larger ones (Love and Roper, 1999; Acs and Audretsch, 1988). Among the various elements affecting and encouraging innovation, evolutionary innovation models highlight the importance of inter-firm networks, i.e. "*institutional structures involving a market, or quasi-market relationship between firms*" (Love and Roper, 1999; Freeman, 1991). Pittaway et al. (2004) suggest that networking, whether formal or informal, provides many benefits that contribute to a company's ability to innovate. Among others, networking helps in sharing risk, getting access to new markets and technologies, and obtaining access to external knowledge and skills (Pittaway et al., 2004).

   Therefore, a question naturally arises: does implicit networking also trigger innovation? How does this trigger interact with the others identified in this study? The interviewees suggest that there is indeed a positive relationship between informal networking occasions and product innovation. That, for instance, was the experience mentioned by *Sgambaro Spa* and *Kiwiny Srl*.

6. **Trips**. As seen above, networking seems to boost innovation significantly. In the interviews conducted by the Agrifood Management and Innovation Lab (2021), the tendency of networking to happen during business or personal

travels emerged. It was the case for *Ortoromi*, who considered the participation to a sectorial exhibition as a key factor contributing to the idea of introducing a new product (fruit smoothies). A similar experience was reported by *Francesco Barduca Srl*, *Sgambaro Spa*, and *Kiwiny Srl*.

7. **Personal values**. Research shows that a variety of behavioral factors, including personal values, deeply affect the allocation of resources within a company as far as innovation activities are concerned (Dabic et al., 2016; Chesbrough 2009; Tidd and Bessant 2009; Mullins 2010). It is worth noticing that the relevant literature does not offer extensive evidence regarding the link between personal values and innovation implementation within companies yet (Dabic et al., 2016; Ralston et al. 2014; Camelo-Odraz et al. 2011). At the same time, the information gathered in the interviews conducted by the Agrifood Management and Innovation Lab (2021) seems to suggest there is a positive relationship between the two.
8. **Other**. Other triggers include a variety of factors ranging from the entrance of the new generations into a firm to European Union legislations regulating organic food and beverage production.

The codification process was a crucial step that allowed this thesis to take into account the study subjects' *perception* of what triggers innovation within the organic agri-food industry. However, although these categories do fit within the research scope of this thesis, such qualitative data stems from the interviewees' personal experiences and opinions and, therefore, might reflect personal biases and lack objectivity.

As far as **product innovation** (*outcome Y1*) is concerned, technical issues were identified by eight companies. Technical issues included necessities specific to organic agriculture (such as crop rotation, the need to keep organic products separated from non-organic ones, and the competition caused by GDO private labels). Market pull was identified as a key factor by five companies, which all mentioned either consumers' or clients' requests as important determinants for the introduction of product innovations, specifically brand extensions. In turn, adverse events were identified as a significant factor only by one company (*Azienda Agricola Martin Gazzani*), and the Covid-19 pandemic was not mentioned at all.

Networking and trips were, in turn, mentioned multiple times, specifically by four companies, suggesting that interviewees perceived networking occasions (such as industry exhibitions) and traveling as key inspirational factors leading to product innovation. Four companies attributed a high degree of importance to personal values, specifically the desire to avoid any waste during the production process and to be as sustainable and coherent as possible in all choices concerning the business.

The perception of influential factors for **process innovation** (*outcome Y2*) shows similar results for some factors but also discrepancies. For instance, technical issues were considered important for process innovation as well since six companies mentioned them, mainly referring to financial necessities and business expansion. In turn, market pull was not considered significant for the adoption of process innovation, while Covid-19 was perceived as a key contributor to a specific innovation related to digitalization: the adoption of e-commerce. Networking and trips were again identified as important by four companies, while personal values related to sustainability were mentioned only by two interviewees. Finally, three companies indicated the participation of the new generation as an important contributor to process innovation.

The evidence gathered during **the coding activity** is significant for two reasons. First, it **answers research question number one**, highlighting the two types of innovation that occurred in the study subjects and how many companies involved in the study introduced either product or process innovations over the years. Second, in doing so, it **allows keeping track of the complexity of qualitative information** without reducing it to mere numerical values by registering informants' viewpoints and perceptions of the environment they work in, which is sometimes difficult to report in qualitative, statistical analysis.

5.2 Empirical Qualitative Comparative Analysis

As mentioned in Chapter 4, elaborating on the insights provided by the coding activity, six more specific triggers were selected to narrow the scope of this thesis and specifically answer research question number two. These triggers are: firm size, longevity, B2C distribution channel, GDO, internationalization, and mature online presence. The choice of these triggers relied on their objectivity. While the critical areas discussed in the previous paragraph were subject of interviewees' perceptions and opinions, the triggers used in the csQCA are objective information regarding each company involved in the study. This adds specificity to this thesis and allows for a systematic qualitative comparative analysis.

Via Qualitative Comparative Analysis, it was possible to investigate which triggers (*conditions* in QCA language) and combinations of triggers (*configurations*) lead to innovation (the *outcome*), thus answering the second research question.

Thanks to the calibration process discussed in Chapter 4.5, two **data matrices** emerged (**Appendices B and C**), displaying all the *cases* included in the research in the rows and the degrees of membership to each trigger (*condition*) in the columns (Kent, 2008). Each data matrix was then uploaded to the **software FsQCA 3.0**, which uses the Quine-McCluskey Algorithm for **Boolean minimization** to carry out crisp-set Qualitative Comparative Analysis. The use of FsQCA was essential because it allowed proceeding with two crucial steps of the analysis: testing for necessary and sufficient conditions (or configurations thereof).

Before diving deeper into these steps, however, an important remark is needed. As previously mentioned, QCA deals with complex causality (see Chapter 3.1) and, specifically, asymmetric causation (or causal asymmetry). **Asymmetric causation** entails that a condition A causing an outcome Y does not explain whether the absence of A causes the absence of Y. In other words, the explanation of the non-occurrence of Y cannot be derived from the explanation of the occurrence of Y.

Graphically: $A \rightarrow Y \neq \sim A \rightarrow \sim Y$

The most immediate consequence of asymmetric causation is that QCA must be run twice for each outcome: once to test for necessary and sufficient conditions when the outcome is positive (i.e. occurs) and once to test conditions when the outcome is negative (i.e. does not occur). Since this thesis investigates two outcomes (product innovation and process innovation), four tests were run through the software fsQCA. However, the discussion and interpretation of QCA solutions focus on the tests for sufficiency and necessity with positive outcomes Y1 and Y2. This is indeed the scope of research question number two, and the researcher deemed it of key importance not to digress from the main scope of this thesis. However, for the sake of completeness and transparency, the tests run for negative outcomes are available for consultation in **Appendices F and G**. The interpretation of such results might be an interesting area of future research.

5.3 Test for Positive Outcome Y1

5.3.1 Test for Necessary Conditions

The empirical QCA analysis started with the test to identify necessary conditions for positive product innovation (outcome Y1=1). As discussed above, in this thesis, **the thresholds for necessity are set at 0.90 and 0.80 for consistency and coverage,** respectively.

Figure 14: Analysis of necessary conditions for present product innovation

Analysis of Necessary Conditions

Outcome variable: PRODINNOV

Conditions tested:

	Consistency	Coverage
INT	0.692308	0.473684
GDO	0.692308	0.642857
ONLINE	0.538462	0.500000
B2C	0.923077	0.600000
SIZE	0.615385	0.444444
LONGEVITY	0.615385	0.421053

(compiled by the author)

As **Figure 14** shows, no condition meets both thresholds. However, B2C comes very close to them. On the one hand, it displays a consistency of 0.92, indicating it is a necessary condition for product innovation. On the other hand, coverage is below the 0.80 threshold (0.60). This indicates that **B2C is a theoretically relevant necessary condition** to obtain Y1=1, i.e. for a company to be able to introduce product innovations, but it might be empirically less relevant. Nevertheless, B2C coverage was considered fairly high. This result (and interpretation) is significant in the subsequent test for sufficiency, as B2C was expected to be positively correlated with the outcome of product innovation.

In addition, **the necessary test confirms that firm size is not a necessary condition for product innovation**. This result confirms the findings of the literature review, according to which innovation is not a prerogative of big companies, and both small and micro-firms can innovate (Baumann & Kritikos, 2016; Hall et al., 2009).

On a different note, the results of this analysis add depth to those studies that claim that collaborative approaches and networking are a key element to introducing innovation (Bjerke and Johansson, 2022; De Martino and Magnotti, 2017; Klerkx, 2009). In this thesis, networking and collaboration are mirrored in two conditions: internationalization and GDO. Indeed, in the interviews, it emerged that all companies that operate internationally or in the GDO channel established relationships with external agents such as brokers and other intermediaries. However, neither condition is necessary for product innovation. This does not deny the importance of networking and collaborative behaviors but stresses that if these factors do have a positive impact on product innovation, it is because of their joint effect together with other factors as well. For process innovation, in turn, internationalization is a relevant necessary condition for the presence of the outcome (for further discussion, refer to Chapter 5.4).

5.3.2 Test for Sufficient Conditions

Figure 15: Truth table for present product innovation

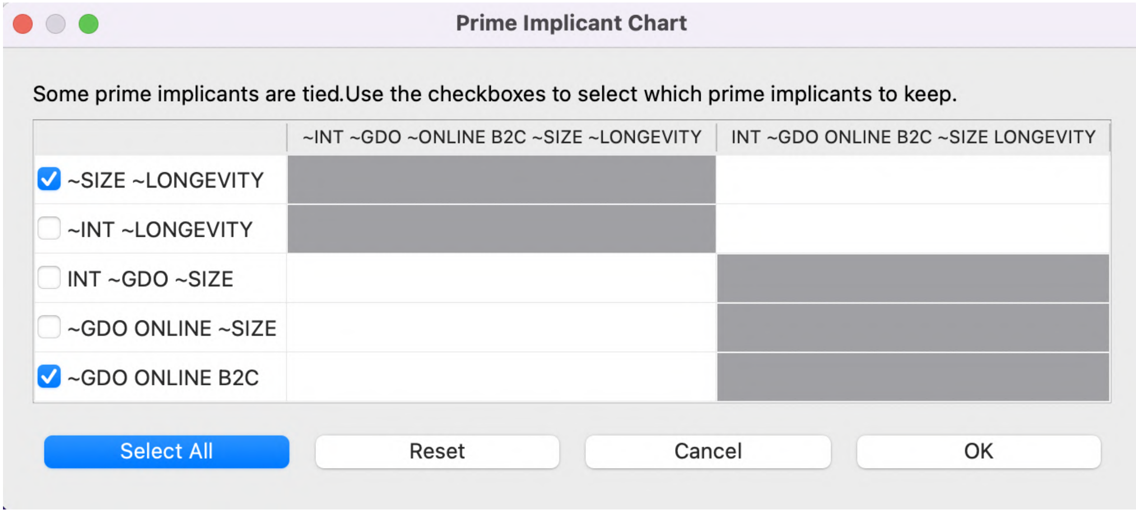
INT	GDO	ONLINE	B2C	SIZE	LONGEVITY	number	PRODINNOV	cases	raw consist.	PRI consist.	SYM consist
0	0	0	1	0	0	1	1	cases	1	1	1
0	1	0	1	0	0	1	1	cases	1	1	1
0	1	1	1	0	0	1	1	cases	1	1	1
1	0	1	1	0	1	1	1	cases	1	1	1
1	1	0	1	1	1	1	1	cases	1	1	1
1	1	0	1	1	0	2	1	cases	1	1	1
1	1	1	1	1	1	7	0	cases	0.571429	0.571429	0.571429
0	0	0	1	0	1	2	0	cases	0.5	0.5	0.5
1	0	1	0	1	1	3	0	cases	0.333333	0.333333	0.333333
1	0	0	1	1	0	1	0	cases	0	0	0
1	1	1	1	0	1	1	0	cases	0	0	0
1	0	0	0	1	1	1	0	cases	0	0	0
1	1	1	0	1	1	1	0	cases	0	0	0
0	0	0	1	1	1	1	0	cases	0	0	0
1	0	0	1	1	1	1	0	cases	0	0	0

(compiled by the author)

Figure 15 shows the truth table obtained after setting the frequency and consistency thresholds (1 and 0.75, respectively). The analysis of the truth table contains the precious information that **six configurations** (truth table rows), occurring in seven cases, meet the criteria for sufficiency. At this point, the researcher proceeded with the logical minimization to exclude redundant conditions and obtain prime implicants (or solution terms).

As previously discussed, the process of logical minimization results in three solutions: the complex, the parsimonious, and the intermediate solution. The discussion of this thesis is focused on the latter, as it allows the researcher to take into consideration configurations that might not have been empirically observed in the cases involved in the study but still rely on plausible assumptions about the relationship between conditions and outcome (Figures 16 and 17). Please note that, for transparency purposes, both the complex and the parsimonious solutions are disclosed in Appendices D and E.

Figure 16: Prime implicants chart for positive product innovation



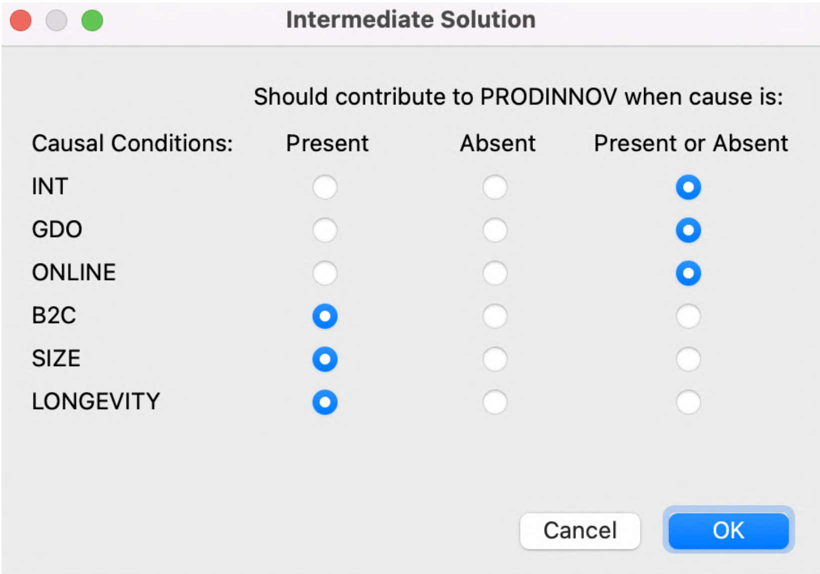
(compiled by the author)

Figure 16 displays the prime implicant chart that shows that the sufficiency test obtained more than one prime implicant that covers the same primitive expressions. The researcher manually selected which prime implicants to keep based on the results obtained from the test for necessity and the literature review analysis.

Based on the evidence gathered during the literature review, **company size** (SIZE) and **longevity** are expected to be positively correlated to innovation. In addition, the test for necessity shows that **B2C** is close enough to be a relevant necessary condition for product innovation. Therefore, to proceed with the test for sufficiency, the first and last prime implicants were kept into consideration. Indeed, the first (~SIZE ~LONGEVITY) investigates the combined effect of the absence of size and longevity on product innovation, while the last (~GDO ONLINE B2C) takes into consideration the combined effect of B2C, which is close to being necessary for the outcome, with online maturity and absent GDO.

These assumptions were registered in the intermediate solution tab as well (**Figure 17**) and are reflected in the intermediate solution (**Figure 18**).

Figure 17: The intermediate solution tab



(compiled by the author)

Figure 18: Intermediate solution for positive product innovation

```
Model: PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- INTERMEDIATE SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
Assumptions:
B2C (present)
SIZE (present)
LONGEVITY (present)
                                        raw        unique
                                      coverage    coverage    consistency
                                     ----------  ----------  ----------
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY    0.153846    0.0769231   1
~INT*GDO*B2C*~SIZE*~LONGEVITY        0.153846    0.0769231   1
INT*GDO*~ONLINE*B2C*SIZE             0.230769    0.230769    1
INT*~GDO*ONLINE*B2C*LONGEVITY        0.0769231   0.0769231   1
solution coverage: 0.538462
solution consistency: 1


Cases with greater than 0.5 membership in term
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY: MARTINGAZZANI (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~INT*GDO*B2C*~SIZE*~LONGEVITY:
LUOVO (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term INT*GDO*~ONLINE*B2C*SIZE:
BRIOORGANIC (1,1),
  INSALATADELLORTO (1,1), KIWINY (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*ONLINE*B2C*LONGEVITY:
CASAROTTI (1,1)
```

(compiled by the author)

The **solution coverage** is relatively high (**53.8%**), which entails that **this is a valuable model** to identify the sufficient configurations of conditions that allow introducing product innovation in those organic agri-food companies that share similar characteristics to this study subjects.

In this case, coverage indicates that configuration number three is the most significant one. Indeed, not only is its raw coverage the highest compared to the other solution terms, but it uniquely covers 23% of the outcome without the influence of any other configuration.

The first important takeaway from the sufficient configurations is that **B2C is present in all solution terms**, strengthening the importance of this specific trigger. Further analysis of the four sufficient configurations led to three simpler, more straightforward equations:

A B2C*~SIZE*~LONGEVITY*~INT { ~ONLINE / GDO } ⟶ PRODUCT INNOVATION

B INT*GDO*B2C*SIZE~ONLINE ⟶ PRODUCT INNOVATION

C INT*ONLINE*B2C*LONGEVITY*~GDO ⟶ PRODUCT INNOVATION

The most significant result in terms of comparative power is **equation A**, which summarizes the first and second prime implicants of the intermediate solution. This equation tells us that **a sufficient strategy to support product innovation for organic, micro agri-food companies that are B2C oriented, were recently founded (after 2000), and have not approached foreign markets yet relies on investing in the GDO channel**. As in this dissertation, the GDO trigger is considered connected to the engagement in networking or collaborative behaviors, this result is in line with McAdam et al.'s (2014) theory, according to which collaborative behaviors enhance small companies' innovation capabilities.

Nevertheless, as confirmed by the test for necessity, GDO is not a necessary condition for innovation, which can be achieved by said companies as long as they do not have a mature presence online.

Equation B is the most significant in terms of coverage since it explains, by itself (unique coverage), 23% of the outcome. This prime implicant reveals that B2C SMEs (and big companies) that have not achieved online maturity yet can strategically foster product innovation by investing in **both internationalization AND the GDO channel.** Once again, this result is in line with the literature review that highlights the positive impact of networking, here reflected in internationalization and GDO, for innovation. Even though it might not be a necessary condition, it does have a joint positive (sufficient) effect on product innovation. Finally, equation B confirms that both big and small firms can introduce innovations (Baumann & Kritikos, 2016; Hall et al., 2009).

Finally, **equation C** shows that up to 7.7% of the companies that present product innovation are historical (founded before 2000), international, B2C firms that have a mature online presence and are not directly handling the GDO channel. Specifically, it highlights that historical, B2C, organic agri-food companies that have no connection with the GDO channel can achieve product innovation by strategically focussing their innovation strategy on two fronts simultaneously: internationalization and building an online presence.

5.4 Tests for Positive Outcome Y2

5.4.1 Test for Necessary Conditions

Figure 19: Analysis of necessary conditions for present process innovation

Analysis of Necessary Conditions

Outcome variable: PROCINNOV

Conditions tested:

	Consistency	Coverage
INT	0.882353	0.789474
GDO	0.588235	0.714286
ONLINE	0.705882	0.857143
B2C	0.764706	0.650000
SIZE	0.764706	0.722222
LONGEVITY	0.823529	0.736842

(compiled by the author)

The analysis of necessity for process innovation (*outcome Y2*) reveals that internationalization (INT) is a relevant necessary condition for process innovation, as its consistency and coverage levels (0.88 and 0.79) are both very close to the necessary thresholds (0.90 and 0.80). In addition, longevity comes close to being a relevant necessary condition with a consistency level of 0.82 and coverage of 0.74.

While internationalization being necessary is more straightforward, the interpretation of the second condition, longevity, might not be as easy. It indicates that longevity (which classifies companies founded before 2000) is theoretically a necessary condition that, however, on an empirical level, only covers 74% of the outcome. In this thesis, longevity is considered to mirror entrepreneurial expertise, which was identified as a factor that is positively correlated with innovation capacity by the relevant literature (Parsons, 2015; Bjerke and Johansson, 2022; Läpple et al., 2015). Therefore, the results of the necessity test add depth and information to the findings of the literature review, adding a key component to expertise, i.e. firm longevity.

5.4.2 Test for Sufficient Conditions

Figure 20: Truth table for present process innovation

INT	GDO	ONLINE	B2C	SIZE	LONGEVITY	number	PROCINNOV	cases	raw consist.	PRI consist.	SYM consist
0	1	1	1	0	0	1	1	cases	1	1	1
1	0	0	1	1	0	1	1	cases	1	1	1
1	0	1	1	0	1	1	1	cases	1	1	1
1	1	1	1	0	1	1	1	cases	1	1	1
1	0	0	0	1	1	1	1	cases	1	1	1
1	1	1	0	1	1	1	1	cases	1	1	1
1	0	0	1	1	1	1	1	cases	1	1	1
1	1	1	1	1	1	7	1	cases	0.857143	0.857143	0.857143
1	0	1	0	1	1	3	0	cases	0.666667	0.666667	0.666667
1	1	0	1	1	0	2	0	cases	0.5	0.5	0.5
0	0	0	1	0	1	2	0	cases	0.5	0.5	0.5
0	0	0	1	0	0	1	0	cases	0	0	0
0	1	0	1	0	0	1	0	cases	0	0	0
0	0	0	1	1	1	1	0	cases	0	0	0
1	1	0	1	1	1	1	0	cases	0	0	0

(compiled by the author)

The truth table displays eight sufficient configurations for process innovation (those with a raw consistency higher than 0.75). The logical minimization process, in turn, allowed identifying five prime implicants, as the figure below shows.

Figure 21: Intermediate solution for positive process innovation

```
Model: PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- INTERMEDIATE SOLUTION ---
frequency cutoff: 1
consistency cutoff: 0.857143
Assumptions:
INT (present)
SIZE (present)
LONGEVITY (present)
                                     raw       unique
                                   coverage   coverage   consistency
                                  ---------- ---------- ----------
GDO*ONLINE*B2C                    0.470588   0.0588235  0.888889
INT*~GDO*~ONLINE*B2C*SIZE         0.117647   0.0588235  1
INT*~GDO*~ONLINE*SIZE*LONGEVITY   0.117647   0.0588235  1
INT*ONLINE*B2C*~SIZE*LONGEVITY    0.117647   0.0588235  1
INT*GDO*ONLINE*SIZE*LONGEVITY     0.411765   0.0588235  0.875
solution coverage: 0.764706
solution consistency: 0.928571


Cases with greater than 0.5 membership in term GDO*ONLINE*B2C: BARDUCA (1,1),
  FRANTOIOVALNOGAREDO (1,1), LATTEBUSCHE (1,0), LATTERIASOLIGO (1,1),
  LUOVO (1,1), ORTOROMI (1,1), PERLAGE (1,1),
  SGAMBARO (1,1), SPUMANTIVALDO (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*B2C*SIZE: ALBIO (1,1),
  LADECIMA (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*SIZE*LONGEVITY: ALBIO
(1,1),
  BORTOLIN (1,1)
Cases with greater than 0.5 membership in term INT*ONLINE*B2C*~SIZE*LONGEVITY: CASAROTTI
(1,1),
  FRANTOIOVALNOGAREDO (1,1)
Cases with greater than 0.5 membership in term INT*GDO*ONLINE*SIZE*LONGEVITY: BARDUCA
(1,1),
  LATTEBUSCHE (1,0), LATTERIASOLIGO (1,1), ORTOROMI (1,1),
  PERLAGE (1,1), PESCATORIPOLESINE (1,1), SGAMBARO (1,1),
  SPUMANTIVALDO (1,1)
```

(compiled by the author)

This solution has a **high coverage** (76.5%), which indicates that the model is suitable to highlight the sufficient configurations of conditions that lead to process innovation.

As can be seen, **internationalization** appears in four out of five configurations. This is explained by the fact that its coverage falls slightly below the minimum necessity threshold. In addition, internationalization does not appear only in the first configuration, which displays a very low unique coverage (0.058). **Longevity** is present in three configurations out of five, which confirms its importance, even though it is not a strictly relevant necessary condition because of its lower coverage.

As can be seen in **Figure 21**, the first and last solution terms (*configurations*) have a high raw coverage: 0.47 and 0.41, respectively. This indicates that up to 47% and 41% of the cases that display process innovation are explained by those configurations. However, it is important to note that the unique coverage is much lower (0.06), which indicates that the configurations alone only explain 6% of the outcome.

Nevertheless, a more in-depth analysis of the five prime implicants is important as it may identify which conditions play a decisive role, thus outlining best practices and guidelines for organic agri-food companies that aim at fostering process innovation. The result of such an analysis is the following:

$$\text{D}\quad \text{GDO*ONLINE*B2C} \longrightarrow \text{PROCESS INNOVATION}$$

$$\text{E}\quad \text{INT*SIZE*}{\sim}\text{GDO*}{\sim}\text{ONLINE} \begin{cases} \text{B2C} \\ \text{LONGEVITY} \end{cases} \longrightarrow \text{PROCESS INNOVATION}$$

$$\text{F}\quad \text{INT*ONLINE*LONGEVITY} \begin{cases} \text{B2C*}{\sim}\text{SIZE} \\ \text{GDO*SIZE} \end{cases} \longrightarrow \text{PROCESS INNOVATION}$$

Equation D highlights that B2C, GDO, and ONLINE are sufficient (when all present) for an organic agri-food company to introduce process innovation. Indeed, up to 47% of the companies that were involved in this study and that introduced a process innovation displayed this configuration.

Equation E tells us that for SMEs and big companies active in international markets that have not reached online maturity and are not active on the GDO channel yet, investing in the B2C channel is a sufficient strategic choice to foster innovation. However, as discussed above, B2C is not a necessary condition, and process innovation can be achieved without it by more mature companies (those founded before 2000 in this thesis sample). This equation might be interpreted in a different way too. It shows that B2C companies that are not mature online and are not active in the GDO channel should focus their innovation strategy on expanding both in terms of **company size** AND **internationalization**. The same strategic investment is convenient also for mature companies (founded before 2000) that are not present in neither the GDO channel nor have reached online maturity. This stresses the importance of internationalization and firm size.

Again, this confirms the literature findings that firm size is not crucial for innovation *per se*, but it positively impacts process innovation when paired with other factors. (Yagüe-Perales et al., 2020) In addition, this result stresses the significance of internationalization and, thus, networking opportunities.

Equation F underlines that both micro, B2C businesses founded before 2000 and SMEs and big companies founded before 2000 and active in the GDO can foster innovation by strategically investing in both internationalization AND online maturity.

The results of QCA show how this study can both confirm some findings from the literature review and expand its scope, adding valuable information regarding how different conditions (triggers or variables) affect innovation differently when combined.

Conclusion

This dissertation aims at analyzing whether organic agri-food companies are still innovative in a global scenario that is increasingly complex and competitive. This research issue is tackled by answering two central research questions:

> *Q1: What does innovation look like within organic agri-food companies in the Veneto region? What types of innovations were introduced over the years?*
>
> *Q2: What factors, or configurations of factors, have led and are still leading to innovation within the organic agri-food companies in Veneto?*

The research involved two methods of analysis: coding through the Gioia Method (*coding*) and crisp-set Qualitative Comparative Analysis (*csQCA*).

On the one hand, coding allowed the researcher to deeply analyze secondary data in the form of interview transcripts and recordings, exploiting the researcher's initial low knowledge of the organic agri-food industry to voice the interviewees' perceptions and opinions. This analysis method made it possible to identify a general research issue and slowly narrow it down to the two aforementioned research questions. Coding also allowed this thesis to keep track of the complexity of qualitative data before reducing it to dummy variables.

This first research methodology identified two types of innovation within the organic agri-food companies included in this thesis: product innovation and process innovation. In addition, it also brought to light a series of macro factors that, according to the respondents, fostered innovation in their companies: technical issues, market pull, adverse events (including the recent Covid-19 pandemic), networking (comprising business and personal trips), and personal values. This proved that organic agri-food companies are resilient and able to respond to a challenging environment by continuing their business and introducing innovations.

CsQCA, on the other hand, rationalizes the relevant qualitative information into dichotomous variables that can be analyzed via software investigating which conditions (or configurations thereof) are necessary or sufficient to obtain product or process innovation. This systematic approach adds rigor to the qualitative portion of the analysis, building models that are relevant to describe companies with similar characteristics to those of the study subjects.

Specifically, B2C and internationalization were identified as necessary conditions for product and process innovation, respectively. As regards the sufficiency test solutions, four configurations were identified as sufficient for product innovation and five for process innovation.

In addition, the rigorous csQCA analysis shows a series of case-specific innovation strategies, i.e. strategies that are suitable for companies that share a specific profile. The most significant strategies identified in this dissertation are as follows: B2C, micro firms founded after 2000 and that are not present in international markets could benefit from investing in the GDO retail channel to foster product innovation. B2C bigger firms (either SMEs or big companies) that are not online mature yet can cultivate product innovation by strategically investing in both internationalization and the GDO channel. In addition, B2C mature companies (founded before 2000) that are not active in the GDO channel can strategically encourage product innovation by investing in both internationalization and building a mature online presence. As far as process innovation is concerned, investing in both expanding company size (from micro to small companies) and internationalization was proven to be a sufficient strategic choice to foster process innovation for two types of companies: either B2C companies that are not online mature, nor active in the GDO channel, or mature companies (founded before 2000) that have not achieved online maturity nor are active in the GDO channel. Finally, investing in both internationalization and online maturity is a sufficient strategic choice to support process innovation for two company profiles: B2C micro businesses founded before 2000 and bigger companies founded before 2000 that are active in the GDO.

This study presents some limitations, mainly in relation to the use of secondary data, as this limits the available information and, thus, the choice of the triggers investigated through QCA. Nevertheless, this allowed the researcher to highlight how Qualitative Comparative Analysis is a resilient research method that is applicable even to data that was not gathered for this specific purpose. Future research might gather additional information, specifically regarding innovation triggers, and investigate how they relate to those investigated in this thesis. In addition, further research could analyze more deeply the issue of asymmetric causation, investigating whether and how the absence of any condition (or configuration thereof) can explain the absence of the outcomes. Although these results were included in this dissertation's appendices, their analysis requires more resources in terms of time and would not have answered the research questions that investigate the presence of innovation.

This dissertation makes several contributions to the innovation field of research. While the relevant literature often focuses on one dimension of innovation at a time, coding gave voice to interviewees' perceptions, expanding the focus of the analysis to all three dimensions of innovation: the micro-level, the firm-level, and the macro-level.

In addition, the relevant literature often focuses on one innovation trigger at a time, overlooking how companies are complex and living entities where each trigger (or *condition*) is related to one another. In turn, QCA simultaneously investigates multiple triggers, highlighting how different conditions coexist in a company and how their interaction shapes innovation.

Furthermore, pure statistical research often identifies "fixed" models that rely on the assumption that they can be applied to real case scenarios with little to no modification. On the contrary, QCA keeps into consideration the differences between every single case during all the steps of the analysis, thus obtaining a series of unique models that also keep into consideration the peculiarities of real-life organizations. In other words, the differences between the cases observed are precisely the strength of QCA, not its weakness.

Finally, Qualitative Comparative Analysis combines the rigor of software-based, data-driven methods and qualitative analysis, thus elaborating not one but multiple models for strategic innovation.

Consequently, this dissertation contributes to the literature and expands its scope even further, suggesting strategic choices that might foster product or process innovation in companies that share enough similarities to those involved in the study.

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Appendix A: Product Innovation Spreadsheet

AZIENDA	TECHNICAL TRIGGER	MARKET PULL	COVID	ADVERSE EVENTS	NETWORKING	TRIPS	PERSONAL VALUES	OTHER
CEREAL DOCKS GROUP								
ORTOROMI	quando la GDO ha preso il sopravvento producendo PL => necessità di sviluppare il proprio brand (2014), identità					esperienza in fiera di frullati commercializzati dai portoghesi => richiesta di mercato (attori commerciali) di frullati italiani => estensione brand		
BORTOLIN REMO, GIOVANNI E MARIO S.S. DI BORTOLIN ALESSANDRO, GIOVANNI E MARIO SOC. AGRICOLA								
FRANCESCO BARDUCA SRL		opinione pubblica => cambio pack (R-PET, cartone… palstic-free o riciclabile)				viaggi in Olanda (di studio, es Coldiretti) --> coltivazione di baby leaf + confezionamento (4a gamma)		
EL TAMISO SOCIETÀ COOPERATIVA AGRICOLA								
LUOVO DALLE DOLOMITI		richiesta da cliente => uova a guscio bianco						
AZIENDA AGRICOLA LE CARLINE DI DANIELE PICCININ								
LATTEBUSCHE LATTERIA DELLA VALLATA FELTRINA S.C.A.	necessità tecniche (bio separati dal resto) => linea formaggi bio confezionati	attenzione al mercato => product extension a formaggi e prodotti tipici, GELATO (tra i primi)					valore sostenibilità (eliminazione sprechi, riduzione trasporti) => concentrazione del siero x alimentazione animale/cosmetica coerenza scelta bio => pack sostenibiile	
AZIENDA AGRICOLA QUIRINA DI SALVAN CARLO	necessità di rotazione terreni => cereali (grano duro)							
SOCIETÀ AGRICOLA BEPI BORDIGNON S.S.	rotazione => cereali antichi => trasformati in farine vendute in spaccio aziendale							

Appendix B: Product Innovation Data Matrix

COMPANY	PRODINNOV	INT	GDO	ONLINE	B2C	SIZE	LONGEVITY
AGRICOLAGRAINS	**0**	1	0	1	0	1	1
ALBIO	**0**	1	0	0	1	1	1
ALLEORIGINI	**0**	0	0	0	1	1	1
BARDUCA	**1**	1	1	1	1	1	1
BORDIGNON	**1**	0	0	0	1	0	1
BORTOLIN	**0**	1	0	0	0	1	1
BRIOORGANIC	**1**	1	1	0	1	1	1
CASAROTTI	**1**	1	0	1	1	0	1
CEREALDOCKS	**1**	1	0	1	0	1	1
ELTAMISO	**0**	1	0	1	0	1	1
FRANTOIOVALNOGAREDO	**0**	1	1	1	1	0	1
INSALATA DELLORTO	**1**	1	1	0	1	1	0
JUVENILIA	**0**	0	0	0	1	0	1
KIWINY	**1**	1	1	0	1	1	0
LADECIMA	**0**	1	0	0	1	1	0
LATTEBUSCHE	**1**	1	1	1	1	1	1
LATTERIASOLIGO	**0**	1	1	1	1	1	1
LECARLINE	**0**	1	1	1	1		1
LUOVO	**1**	0	1	1	1	0	0
MARTINGAZZANI	**1**	0	0	0	1	0	0
NONNAGIOVANNINA	**1**	0	0	1	1		0
ORTOROMI	**1**	1	1	1	1	1	1
PERLAGE	**0**	1	1	1	1	1	1
PESCATORIPOLESINE	**0**	1	1	1	0	1	1
QUIRINA	**1**	0	1	0	1	0	0
SGAMBARO	**1**	1	1	1	1	1	1
SPUMANTIVALDO	**0**	1	1	1	1	1	1
TERREDELFIUME	**1**	0	0	1	1		0

Appendix C: Process Innovation Data Matrix

COMPANY	PROCINNOV	INT	GDO	ONLINE	B2C	SIZE	LONGEVITY
AGRICOLAGRAINS	**1**	1	0	1	0	1	1
ALBIO	**1**	1	0	0	1	1	1
ALLEORIGINI	**0**	0	0	0	1	1	1
BARDUCA	**1**	1	1	1	1	1	1
BORDIGNON	**0**	0	0	0	1	0	1
BORTOLIN	**1**	1	0	0	0	1	1
BRIO_ORGANIC	**0**	1	1	0	1	1	1
CASAROTTI	**1**	1	0	1	1	0	1
CEREALDOCKS	**0**	1	0	1	0	1	1
ELTAMISO	**1**	1	0	1	0	1	1
FRANTOIOVALNOGAREDO	**1**	1	1	1	1	0	1
INSALATA DELLORTO	**0**	1	1	0	1	1	0
JUVENILIA	**1**	0	0	0	1	0	1
KIWINY	**1**	1	1	0	1	1	0
LADECIMA	**1**	1	0	0	1	1	0
LATTEBUSCHE	**0**	1	1	1	1	1	1
LATTERIASOLIGO	**1**	1	1	1	1	1	1
LECARLINE	**1**	1	1	1	1		1
LUOVO	**1**	0	1	1	1	0	0
MARTINGAZZANI	**0**	0	0	0	1	0	0
NONNAGIOVANNINA	**0**	0	0	1	1		0
ORTOROMI	**1**	1	1	1	1	1	1
PERLAGE	**1**	1	1	1	1	1	1
PESCATORIPOLESINE	**1**	1	1	1	0	1	1
QUIRINA	**0**	0	1	0	1	0	0
SGAMBARO	**1**	1	1	1	1	1	1
SPUMANTIVALDO	**1**	1	1	1	1	1	1
TERREDELFIUME	**0**	0	0	1	1		0

APPENDIX D: Complex and Parsimonious Solutions for Positive Product Innovation

Complex Solution

```
Model: PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- COMPLEX SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                                            raw       unique
                                          coverage    coverage   consistency
                                          ----------  ----------  ----------
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY         0.153846    0.0769231   1
~INT*GDO*B2C*~SIZE*~LONGEVITY             0.153846    0.0769231   1
INT*GDO*~ONLINE*B2C*SIZE                  0.230769    0.230769    1
INT*~GDO*ONLINE*B2C*~SIZE*LONGEVITY       0.0769231   0.0769231   1
solution coverage: 0.538462
solution consistency: 1


Cases with greater than 0.5 membership in term
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY: MARTINGAZZANI (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~INT*GDO*B2C*~SIZE*~LONGEVITY:
LUOVO (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term INT*GDO*~ONLINE*B2C*SIZE:
BRIOORGANIC (1,1),
  INSALATADELLORTO (1,1), KIWINY (1,1)
Cases with greater than 0.5 membership in term
INT*~GDO*ONLINE*B2C*~SIZE*LONGEVITY: CASAROTTI (1,1)
```

Note that the complex solution is identical to the intermediate solution, which means that easy counterfactuals do not allow a further simplification of the complex solution terms.

Parsimonious Solution

```
Model: PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                          raw       unique
                        coverage    coverage   consistency
                       ----------  ----------  ----------
GDO*~ONLINE            0.307692    0.230769    1
~SIZE*~LONGEVITY       0.230769    0.153846    1
~GDO*ONLINE*B2C        0.0769231   0.0769231   1
solution coverage: 0.538462
solution consistency: 1


Cases with greater than 0.5 membership in term GDO*~ONLINE: BRIOORGANIC (1,1),
  INSALATADELLORTO (1,1), KIWINY (1,1), QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~SIZE*~LONGEVITY: LUOVO (1,1),
  MARTINGAZZANI (1,1), QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~GDO*ONLINE*B2C: CASAROTTI (1,1)
```

APPENDIX E: Complex and Parsimonious Solutions for Positive Process Innovation

Complex Solution

```
Model: PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- COMPLEX SOLUTION ---
frequency cutoff: 1
consistency cutoff: 0.857143
                                              raw        unique
                                            coverage    coverage    consistency
                                           ----------  ----------  ----------
INT*~GDO*~ONLINE*B2C*SIZE                  0.117647    0.0588235   1
INT*~GDO*~ONLINE*SIZE*LONGEVITY            0.117647    0.0588235   1
INT*ONLINE*B2C*~SIZE*LONGEVITY             0.117647    0.117647    1
INT*GDO*ONLINE*SIZE*LONGEVITY              0.411765    0.411765    0.875
~INT*GDO*ONLINE*B2C*~SIZE*~LONGEVITY       0.0588235   0.0588235   1
solution coverage: 0.764706
solution consistency: 0.928571


Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*B2C*SIZE: ALBIO (1,1),
  LADECIMA (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*SIZE*LONGEVITY: ALBIO
(1,1),
  BORTOLIN (1,1)
Cases with greater than 0.5 membership in term INT*ONLINE*B2C*~SIZE*LONGEVITY: CASAROTTI
(1,1),
  FRANTOIOVALNOGAREDO (1,1)
Cases with greater than 0.5 membership in term INT*GDO*ONLINE*SIZE*LONGEVITY: BARDUCA
(1,1),
  LATTEBUSCHE (1,0), LATTERIASOLIGO (1,1), ORTOROMI (1,1),
  PERLAGE (1,1), PESCATORIPOLESINE (1,1), SGAMBARO (1,1),
  SPUMANTIVALDO (1,1)
Cases with greater than 0.5 membership in term ~INT*GDO*ONLINE*B2C*~SIZE*~LONGEVITY: LUOVO
(1,1)
```

Parsimonious Solution

```
Model: PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1
consistency cutoff: 0.857143
                          raw        unique
                        coverage    coverage    consistency
                       ----------  ----------  ----------
GDO*ONLINE             0.529412    0.529412    0.9
INT*~GDO*~ONLINE       0.176471    0.0588235   1
INT*~GDO*B2C           0.176471    0.0588235   1
solution coverage: 0.764706
solution consistency: 0.928571


Cases with greater than 0.5 membership in term GDO*ONLINE: BARDUCA (1,1),
  FRANTOIOVALNOGAREDO (1,1), LATTEBUSCHE (1,0), LATTERIASOLIGO (1,1),
  LUOVO (1,1), ORTOROMI (1,1), PERLAGE (1,1),
  PESCATORIPOLESINE (1,1), SGAMBARO (1,1), SPUMANTIVALDO (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE: ALBIO (1,1),
  BORTOLIN (1,1), LADECIMA (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*B2C: ALBIO (1,1),
  CASAROTTI (1,1), LADECIMA (1,1)
```

APPENDIX F: Solutions for Negative Product Innovation

Analysis of Necessary Conditions

```
Analysis of Necessary Conditions

Outcome variable: ~PRODINNOV

Conditions tested:
             Consistency    Coverage
~INT         0.166667       0.333333
~GDO         0.583333       0.636364
~ONLINE      0.416667       0.454545
~B2C         0.333333       0.800000
~SIZE        0.166667       0.285714
~LONGEVITY   0.083333       0.166667
```

Truth Table

INT	GDO	ONLINE	B2C	SIZE	LONGEVITY	number	~PRODINNOV	cases	raw consist.	PRI consist.	SYM consist
1	0	0	1	1	0	1	1	cases	1	1	1
1	1	1	1	0	1	1	1	cases	1	1	1
1	0	0	0	1	1	1	1	cases	1	1	1
1	1	1	0	1	1	1	1	cases	1	1	1
0	0	0	1	1	1	1	1	cases	1	1	1
1	0	0	1	1	1	1	1	cases	1	1	1
1	0	1	0	1	1	3	0	cases	0.666667	0.666667	0.666667
0	0	0	1	0	1	2	0	cases	0.5	0.5	0.5
1	1	1	1	1	1	7	0	cases	0.428571	0.428571	0.428571
1	1	0	1	1	0	2	0	cases	0	0	0
0	0	0	1	0	0	1	0	cases	0	0	0
0	1	0	1	0	0	1	0	cases	0	0	0
0	1	1	1	0	0	1	0	cases	0	0	0
1	0	1	1	0	1	1	0	cases	0	0	0
1	1	0	1	1	1	1	0	cases	0	0	0

Intermediate Solution

```
Model: ~PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- INTERMEDIATE SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
Assumptions:
                                          raw       unique
                                        coverage   coverage   consistency
                                       ---------- ----------  ----------
INT*~GDO*~ONLINE*B2C*SIZE              0.166667   0.0833333   1
INT*~GDO*~ONLINE*SIZE*LONGEVITY        0.166667   0.0833333   1
~GDO*~ONLINE*B2C*SIZE*LONGEVITY        0.166667   0.0833333   1
INT*GDO*ONLINE*B2C*~SIZE*LONGEVITY     0.0833333  0.0833333   1
INT*GDO*ONLINE*~B2C*SIZE*LONGEVITY     0.0833333  0.0833333   1
solution coverage: 0.5
solution consistency: 1


Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*B2C*SIZE: ALBIO
(1,1),
  LADECIMA (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*SIZE*LONGEVITY:
ALBIO (1,1),
  BORTOLIN (1,1)
Cases with greater than 0.5 membership in term ~GDO*~ONLINE*B2C*SIZE*LONGEVITY:
ALBIO (1,1),
  ALLEORIGINI (1,1)
Cases with greater than 0.5 membership in term
INT*GDO*ONLINE*B2C*~SIZE*LONGEVITY: FRANTOIOVALNOGAREDO (1,1)
Cases with greater than 0.5 membership in term
INT*GDO*ONLINE*~B2C*SIZE*LONGEVITY: PESCATORIPOLESINE (1,1)
```

Complex Solution

```
Model: ~PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- COMPLEX SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                                          raw       unique
                                        coverage   coverage   consistency
                                       ---------- ----------  ----------
INT*~GDO*~ONLINE*B2C*SIZE              0.166667   0.0833333   1
INT*~GDO*~ONLINE*SIZE*LONGEVITY        0.166667   0.0833333   1
~GDO*~ONLINE*B2C*SIZE*LONGEVITY        0.166667   0.0833333   1
INT*GDO*ONLINE*B2C*~SIZE*LONGEVITY     0.0833333  0.0833333   1
INT*GDO*ONLINE*~B2C*SIZE*LONGEVITY     0.0833333  0.0833333   1
solution coverage: 0.5
solution consistency: 1


Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*B2C*SIZE: ALBIO
(1,1),
  LADECIMA (1,1)
Cases with greater than 0.5 membership in term INT*~GDO*~ONLINE*SIZE*LONGEVITY:
ALBIO (1,1),
  BORTOLIN (1,1)
Cases with greater than 0.5 membership in term ~GDO*~ONLINE*B2C*SIZE*LONGEVITY:
ALBIO (1,1),
  ALLEORIGINI (1,1)
Cases with greater than 0.5 membership in term
INT*GDO*ONLINE*B2C*~SIZE*LONGEVITY: FRANTOIOVALNOGAREDO (1,1)
Cases with greater than 0.5 membership in term
INT*GDO*ONLINE*~B2C*SIZE*LONGEVITY: PESCATORIPOLESINE (1,1)
```

Parsimonious Solution

```
Model: ~PRODINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                          raw       unique
                        coverage    coverage   consistency
                       ----------  ----------  ----------
GDO*~B2C                0.0833333   0.0833333   1
~GDO*~ONLINE*SIZE       0.333333    0.333333    1
GDO*~SIZE*LONGEVITY     0.0833333   0.0833333   1
solution coverage: 0.5
solution consistency: 1


Cases with greater than 0.5 membership in term GDO*~B2C: PESCATORIPOLESINE (1,1)
Cases with greater than 0.5 membership in term ~GDO*~ONLINE*SIZE: ALBIO (1,1),
  ALLEORIGINI (1,1), BORTOLIN (1,1), LADECIMA (1,1)
Cases with greater than 0.5 membership in term GDO*~SIZE*LONGEVITY:
FRANTOIOVALNOGAREDO (1,1)
```

APPENDIX G: Solutions for Negative Process Innovation

Analysis of Necessary Conditions

```
Analysis of Necessary Conditions

Outcome variable: ~PROCINNOV

Conditions tested:
              Consistency     Coverage
~INT          0.500000        0.666667
~GDO          0.500000        0.363636
~ONLINE       0.750000        0.545455
~B2C          0.125000        0.200000
~SIZE         0.375000        0.428571
~LONGEVITY    0.375000        0.500000
```

Truth Table

INT	GDO	ONLINE	B2C	SIZE	LONGEVITY	number	~PROCINNOV	cases	raw consist.	PRI consist.	SYM consist
0	0	0	1	0	0	1	1	cases	1	1	1
0	1	0	1	0	0	1	1	cases	1	1	1
0	0	0	1	1	1	1	1	cases	1	1	1
1	1	0	1	1	1	1	1	cases	1	1	1
1	1	0	1	1	0	2	0	cases	0.5	0.5	0.5
0	0	0	1	0	1	2	0	cases	0.5	0.5	0.5
1	0	1	0	1	1	3	0	cases	0.333333	0.333333	0.333333
1	1	1	1	1	1	7	0	cases	0.142857	0.142857	0.142857
0	1	1	1	0	0	1	0	cases	0	0	0
1	0	1	1	0	1	1	0	cases	0	0	0
1	1	1	1	0	1	1	0	cases	0	0	0
1	1	1	0	1	1	1	0	cases	0	0	0
1	0	0	1	1	0	1	0	cases	0	0	0
1	0	0	0	1	1	1	0	cases	0	0	0
1	0	0	1	1	1	1	0	cases	0	0	0

Intermediate Solution

```
Model: ~PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- INTERMEDIATE SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
Assumptions:
                                         raw        unique
                                       coverage    coverage    consistency
                                      ----------  ----------  ----------
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY     0.25        0.25        1
~INT*~GDO*~ONLINE*B2C*SIZE*LONGEVITY  0.125       0.125       1
INT*GDO*~ONLINE*B2C*SIZE*LONGEVITY    0.125       0.125       1
solution coverage: 0.5
solution consistency: 1
```

```
Cases with greater than 0.5 membership in term ~INT*~ONLINE*B2C*~SIZE*~LONGEVITY:
MARTINGAZZANI (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~INT*~GDO*~ONLINE*B2C*SIZE*LONGEVITY:
ALLEORIGINI (1,1)
Cases with greater than 0.5 membership in term INT*GDO*~ONLINE*B2C*SIZE*LONGEVITY:
BRIO_ORGANIC (1,1)
```

Complex Solution

```
Model: ~PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- COMPLEX SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                                          raw       unique
                                        coverage   coverage   consistency
                                       ---------- ---------- ----------
~INT*~ONLINE*B2C*~SIZE*~LONGEVITY       0.25       0.25       1
~INT*~GDO*~ONLINE*B2C*SIZE*LONGEVITY    0.125      0.125      1
INT*GDO*~ONLINE*B2C*SIZE*LONGEVITY      0.125      0.125      1
solution coverage: 0.5
solution consistency: 1


Cases with greater than 0.5 membership in term ~INT*~ONLINE*B2C*~SIZE*~LONGEVITY:
MARTINGAZZANI (1,1),
  QUIRINA (1,1)
Cases with greater than 0.5 membership in term ~INT*~GDO*~ONLINE*B2C*SIZE*LONGEVITY:
ALLEORIGINI (1,1)
Cases with greater than 0.5 membership in term INT*GDO*~ONLINE*B2C*SIZE*LONGEVITY:
BRIO_ORGANIC (1,1)
```

Parsimonious Solution

```
Model: ~PROCINNOV = f(INT, GDO, ONLINE, B2C, SIZE, LONGEVITY)
Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1
consistency cutoff: 1
                              raw       unique
                            coverage   coverage   consistency
                           ---------- ---------- ----------
~INT*SIZE                   0.125      0.125      1
GDO*~ONLINE*LONGEVITY       0.125      0.125      1
~ONLINE*~SIZE*~LONGEVITY    0.25       0.25       1
solution coverage: 0.5
solution consistency: 1


Cases with greater than 0.5 membership in term ~INT*SIZE: ALLEORIGINI (1,1)
Cases with greater than 0.5 membership in term GDO*~ONLINE*LONGEVITY: BRIO_ORGANIC
(1,1)
Cases with greater than 0.5 membership in term ~ONLINE*~SIZE*~LONGEVITY: MARTINGAZZANI
(1,1),
  QUIRINA (1,1)
```