

# The Adoption of Discontinuous Technologies in the Time of COVID-19: Criticisms for Micro Family Businesses

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## Abstract

The COVID-19 emergency has imposed on companies a new way of working through technologies that have ensured business activity. This article analyses the dynamics of the adoption of technology in micro family businesses at the time of COVID-19, focusing on the phase in which the decision is made to adopt a technology. In particular, it analyses the influence of the family on the adoption of discontinuous technologies. The sample studied was constituted by 20 micro-enterprises from southern Italy. In particular, all the companies included in the research are part of Coldiretti, the largest association that represents and assists Italian farms. The companies studied were examined with a qualitative analysis conducted between March and June 2020 through semi-structured telephone interviews due to problems related to the coronavirus pandemic. The present research identifies the micro-level factors affecting the decision to adopt discontinuous technology in order to detect more clearly how innovation in the context of the family business takes place in a different and distinctive way. This study also illustrates some practical implications derived from the model developed and provides useful indications for future studies.

## 1. Introduction

The adoption of technology is an incremental and cumulative change, characterised by revolutionary and discontinuous periods (Tushman and Anderson, 1986). In recent years, most of the corporate changes were born to dominate existing and emerging markets, through discontinuous technologies. Discontinuous technologies can be defined as fundamental changes that modify the company through the adoption of a dominant technology (Maula *et al.*, 2013).

During the first months of 2020, the COVID-19 pandemic had affected several countries all over the world, including Italy. The whole world has faced the consequences of the COVID-19 pandemic which has led to a radical and sudden reconsideration of the organisation of work. In fact, in order to survive, companies have reinvented themselves, becoming increasingly characterised by technology (Shafi *et al.*, 2020; Alon *et al.*, 2020; Dwivedi *et al.*, 2020). COVID-19 has created not only a worldwide contagion but also a social contagion in terms of organisational management of work and especially the adaptation of companies to technology (George *et al.*, 2020). From a business point of view, the pandemic has transformed the technological infrastructure of companies by accelerating the adoption of technologies, on a large scale, changing attitudes, balance and business organisation of work (George *et al.*,

2020). In fact, the pandemic has accelerated the adoption of discontinuous technologies: even family businesses have had to adapt to technologies and renew their products and production processes (Erdogan *et al.*, 2020).

In recent years, research on the adoption of technology in family businesses had already been a topic of interest among scholars (De Massis *et al.*, 2013; Duran *et al.*, 2016). Recent literature studies have reported that the introduction of discontinuous technologies often represents an unknown factor for family firms (Raymond and St-Pierre, 2005; Popa *et al.*, 2018), especially for micro-enterprises that are unable to adequately respond to innovative changes and technological progress (Reeg, 2013). In fact, these companies do not have sufficient resources, especially financial and managerial, and are not prepared for such interruptions that could go longer than expected (Prasad *et al.*, 2015; Bartik *et al.*, 2020). The impact of dominant technology adoption for a micro family firm is particularly relevant when considering the main difficulties that micro family businesses have to face (Masino, 2008).

While researchers around the world examine the effects of the pandemic (Bol *et al.*, 2020; DeFilippis *et al.*, 2020; Gualano, 2020; Pieh *et al.*, 2020), we must emphasise that in companies the impact of COVID-19 was not equal (Alon *et al.*, 2020; Dwivedi *et al.*, 2020), especially for micro family businesses (Shafi *et al.*, 2020). The pandemic has increased the self-awareness of the iniquity in companies (George *et al.*, 2020) of technologies useful to fight and survive the ongoing change, through effective and adequate business models and innovative adoptions (Alon *et al.*, 2020; Dwivedi *et al.*, 2020; Shafi *et al.*, 2020).

In this research, the adoption of discontinuous technologies in family businesses is considered dominant and induces significant changes in the work processes of companies especially in light of the needs caused by COVID-19 lockdown that has stimulated everywhere a great increase in the use of technology.

The present study aims to integrate and improve the research conducted by König, Kammerlander, and Enders (2013) and fill the gaps left by such research. König's (2013) studies examined the adoption of discontinuous technologies in family businesses, but neither analysed the adoption of discontinuous technologies in micro family businesses nor addressed the specific area, of Southern Italy. Moreover, we have identified, based on the suggestions of some scholars (e.g., Hernández-Linares and López-Fernández, 2018; Rondi *et al.*, 2019; Kanadli *et al.*, 2020) further gaps: the intergenerational involvement in the adoption of discontinuous technologies in family businesses is a topic still to be explored (De Clercq and Belausteguigoitia, 2015; Qiu and Freel, 2020). Our goal is to fill the gaps mentioned above and to investigate the adoption of discontinuous technologies in microenterprises in Southern Italy, during the COVID-19 emergency, but also the link between the involvement of the intergenerational strategy and the adoption of discontinuous technologies in family microenterprises in Southern Italy.

We rely on 20 interviews of micro family businesses taken from Southern Italy. The companies were selected based on their experience with the adoption of new dominant/discontinuous technologies during the COVID-19 pandemic. The study analyses the dynamics of technology adoption in micro-family firms, focusing attention on the stage where the decision to adopt technology is made. To address this point, we focus on the following research questions: (i) How much has the COVID-19 emergency affected the adoption of discontinuous technologies? (ii) What are the variables that influence intergenerational involvement in the discontinuous technologies adoption of micro family businesses?

Our study aims to fill these gaps by identifying the factors that influence the adoption of new technologies in family micro-firms of Southern Italy during the COVID-19 pandemic. The purpose of this research is to study micro family businesses in Southern Italy through qualitative research carried out through the collaboration of Coldiretti, the largest association representing and assisting Italian agriculture. We follow a logic of theoretical and literal replication in the selection of cases to examine how the experiences of micro family businesses associated with successful adoption and failure strategies can be generalised to the theoretical constructs of our model. The next section develops the research model of the study, placing it in the context of previous research. Next, we describe the strategy and design of the research, report the data analysis and results, and discuss the implications of these results.

## 2. Theoretical background

### 2.1. Family businesses and adoption of discontinuous technologies

Discontinuous technological change is a very important topic in the organisational sciences (Christensen, 1997; Chesbrough, 2001; Hill and Rothaermel, 2003). It refers to the creation and acquisition of value “that deviates from the norm of continuous incremental innovation” (Anderson and Tushman, 1990) and from the traditional trajectory of innovation (Christensen and Bower, 1996; König *et al.*, 2012). Discontinuous technologies are radical and disruptive and differ in the perceived value of the product (Bowman and Ambrosini, 2000), in the processes underlying their creation (Christensen and Bower, 1996; Hulin and Roznowski, 1985), but also in the way the value is acquired (Bowman and Ambrosini, 2003). It is possible to understand that the definition of adequate responses to these radical changes represents a crucial node for all types of companies (Horváth *et al.*, 2019). To respond to the COVID-19 emergency, companies have had to adopt numerous technologies to replace human intervention (Budd *et al.*, 2020; Elavarasan, 2020; Golinelli *et al.*, 2020).

Familial micro-enterprises were also required to adopt discontinuous technologies to respond to changing business and family needs, ensuring continuity (Craig and Dibrell, 2006) and the likelihood of survival between generations (Jaskiewicz *et al.*, 2015).

The literature on family businesses has long pointed out that discontinuous technologies in family businesses have made knowledge and other working practices obsolete (Anderson and Tushman, 1990). The adoption of technologies can lead to new scenarios that upset the status quo in the context of family businesses (Bessant *et al.*, 2005). In fact, several studies have tried to identify models to understand and analyse the adoption of technologies in family businesses, but the research has produced many contradictory contributions and inconsistent results on this issue (Calabrò *et al.*, 2019).

The researchers who studied the adaptation of discontinuous technologies in the family business focused on four dimensions: the speed of organisations in recognising technological discontinuities (Miller and Friesen, 1980; Szymanski *et al.*, 1995); the intensity of exploration of discontinuous technologies (Gilbert and Newbery, 1984; Christensen and Bower, 1996); the resistance to the use of resources of the new technology implemented (Block and MacMillan, 1985); and the flexibility to replace consolidated routines with new ones (Tripsas and Gavetti, 2000; Feldman and Pentland, 2003).

Moreover, the literature on discontinuous technologies has focused primarily on large firms (Johnston *et al.*, 2007; Love and Roper, 2015; Khalifa A.B., 2016), but family firms need a separate discussion that highlights their approach (Calabrò *et al.*, 2019). Although König *et al.* (2013) have expanded their studies on the family business and the adoption of discontinuous technologies. The researchers have not studied the adoption of discontinuous technologies in microenterprises.

Our theory is based on the gaps left by the existing literature (e.g., Hernández-Linares and López-Fernández, 2018; Rondi *et al.*, 2019; Kanadli *et al.*, 2020) and investigates the adoption of discontinuous technologies in family businesses during the COVID-19 emergency.

## **2.2. Discontinuous technologies and intergenerational relationships**

Family businesses are characterised by the presence of several generations of family members in the organisational and economic management of the company, which makes the balance between economic and family objectives unstable (Kotlar and De Massis, 2013), so that family problems fall on the company and vice versa (Caputo *et al.*, 2018).

During the COVID-19 emergency, the adoption of discontinuous technologies caused an effort in micro-enterprises in Southern Italy, which influenced and accentuated intergenerational differences and difficult relationships between parents and children (Chrisman *et al.*, 2012; Kidwell *et al.*, 2013). Some studies (Großmann and Von Schlippe, 2015; Caputo *et al.*, 2018; Caputo *et al.* 2019) have identified how generational differences influence discontinuous technological adoption and how the presence of several generations can be a strength for some family businesses (Bammens *et al.*, 2010), or for others, a limit to the change towards the adoption of discontinuous technologies (Craig and Dibrell, 2006; Kammerlander *et al.*, 2015; Lambrechts *et al.*, 2017).

The intergenerational involvement in the adoption of discontinuous technologies is an issue that has several gaps (De Clercq and Belausteguigoitia, 2015; Qiu and Freel, 2020) also due to the problems related to the cooperative family management of the company, the availability and openness of the company to the adoption of technologies. In the management of family businesses, discontinuous technologies have created some chaos (Hughes, 2017) both because of the conservative nature of family businesses, but also in light of the new working situation created by the pandemic still in progress.

Although some studies have begun to analyse the effect of the interaction of strategic intergenerational involvement on technology adoption (De Clercq and Belausteguigoitia, 2015), the link between the contemporary presence of several generations and the decision to adopt discontinuous technologies is still little explored (Feranita *et al.*, 2017; Calabrò *et al.*, 2019). This study aims to fill these gaps, contribute and investigate how the adoption of discontinuous technology (De Massis *et al.*, 2013) is also influenced by intergenerational relationships (De Clercq and Belausteguigoitia, 2015).

## **2.3. Discontinuous technologies and agricultural family businesses**

All over the world, the COVID-19 pandemic has put commercial operations in crisis (Choi, 2020). The emergency has also affected, in particular, micro agricultural enterprises in Southern Italy, disrupting and dismantling, global supply chains (Ivanov, 2020).

Many family-owned micro-enterprises have made efforts by adopting discontinuous technologies in their activities to replace human resources, in order to ensure the supply of fresh food (Hobbs, 2020; Ker, 2020) to the whole community. In literature, family microenterprises have not received enough attention compared to the vast literature on large enterprises (Brouthers *et al.*, 1998; Johnson *et al.*, 2003). A microenterprise is for definition a company that employs fewer than five workers (Harfield, 2001; Johnson, 2003).

During the COVID-19 emergency, agricultural micro-enterprises in Southern Italy suffered a shock due to labour shortages, caused by restrictions on the movement of workers. This situation has in fact affected the ability of agricultural micro-enterprises to collect, work and produce on the agricultural market (Barichello, 2020).

Despite strict measures such as the imposition of trade barriers and export restrictions, micro agricultural enterprises in Southern Italy continued to work during the pandemic to ensure the needs of the community (Rohit, 2020) through the adoption of discontinuous technologies that replaced human labour. This study analyses the adoption of discontinuous technologies in family microenterprises during the COVID-19 emergency in light of the gaps in the literature there is a demand for more research in this area (Harfield, *et al.* 2001; Johnson *et al.*, 2003; Konig, 2013).

### 3. Methodology section

The overall objective of the study was to conduct a qualitative research through a survey that aims to identify the adoption of discontinuous technologies in family microenterprises, the organisational and family changes that these technologies bring on the family and strategic structure of microenterprises in Southern Italy at the time of COVID-19. Qualitative research is particularly suitable to analyse organisational processes (Bluhm *et al.*, 2011; Doz, 2011; Graebner *et al.*, 2012; Gioia *et al.*, 2013) thanks to a robust research approach (Eisenhardt and Graebner, 2007).

A set of micro-enterprises in Southern Italy in the agricultural sector was deliberately chosen as a sample and was for us a useful heuristic tool for data collection and reporting. Table 5.1 shows the data related to the companies involved. Altogether, 20 interviews were conducted through a qualitative approach to analyse the impact of discontinuous technologies at the time of COVID-19 in the Italian agricultural sector hard hit by the epidemic. We were granted access to 20 micro-enterprises in Southern Italy: the number of selected companies includes exclusively family businesses in the agricultural sector that have adopted discontinuous technologies in their organisational equipment.

The use of qualitative interviews has allowed understanding the subjective experiences of family entrepreneurs of micro-enterprises in Southern Italy during the pandemic (Graebner *et al.*, 2012). Specifically, ad hoc and non-standardised reactions to the crisis were sought; the interviews added liveliness, concreteness and richness to the research phenomenon (Denzin and Lincoln, 2005; Bluhm *et al.*, 2011; Graebner *et al.*, 2012). We adopted an inductive research approach based on semi-structured interviews with the owner/manager of each family microenterprise. We have chosen to study the micro-enterprises of agricultural families in Southern Italy for the following reasons: because during COVID-19 the agricultural sector continued running; and also, the pandemic put in crisis the commercial operations all over the world (Choi, 2020); the agricultural sector suffered significant declines due to the shortage of

manpower that guaranteed (Ker, 2020; Hobbs, 2020) the collection and processing of agricultural products (Barichello, 2020).

#### 4. Sample

A targeted sampling technique was used (Morse *et al.*, 2002; Guest *et al.*, 2006), and key informants were interviewed, that is, members of the top management team (entrepreneurs who created the family business or the next generation of entrepreneurs). The approach that was used ensured variation, through the principles of appropriateness and adequacy (Gaskell, 2000; Seawright and Gerring, 2008). In addition, the information obtained allowed to obtain data of both similarities and differences between the cases (Guest *et al.*, 2006).

The data analysis was carried out, as a common practice of qualitative research, after each interview until reaching the quota of 20 interviews (Eisenhardt, 1989; Morse *et al.*, 2002; Guest *et al.*, 2006; Boddy, 2016).

#### 5. Context and data collection

Our study focuses on the adoption of new technologies in agricultural family micro-enterprises in southern Italy at the time of COVID-19. In this model, the companies involved are part of the agricultural sector because during the COVID-19 emergency they continued their work because they produced basic necessities. In addition, farms have been beneficiaries of the 'Enterprise 4.0' law and have received State aids, for investments in discontinuous technologies for the technological transformation of production processes. Interviews were collected for all 20 companies of Southern Italy between March and June 2020 through semi-structured telephone interviews due to problems related to the coronavirus pandemic. All interviewees were told the project was about the adoption of new technologies in agricultural family micro-enterprises in southern Italy. We developed an interview protocol with questions about discontinuous technologies adopted, the organisational and family changes that the company had from technology and the impact of the COVID-19 emergency on the adoption of discontinuous technologies. The interviews were audio-recorded and lasted about an hour, and were subsequently transcribed. They were asked about their experience with adopting technology, their interactions with family members, the difficulties they were experiencing with the COVID-19 emergency, the way they adopted discontinuous technologies and the impact the technology had on their work and organisational processes in light of the ongoing pandemic situation. The interviews were all conducted with first or second-generation entrepreneurs. We used as sources of data interviews where companies analysed are all part of Coldiretti's association that represents and assists farms. The majority of the interviews were conducted to new generation entrepreneurs since the contacts of the micro family businesses were given by Coldiretti of the youth section.

<b>Farms in southern Italy</b>				
	<i>Typology</i>	<i>Dimensions / Employees</i>	<i>Place where it is located</i>	<i>Product/service offered</i>
1	Family business	<10	Eboli	Edible flowers, rocket and cut salads
2	Family business	<10	Teggiano (SA)	Walnuts and hazelnuts
3	Family business	<10	Mugnano (NA)	Fruits and vegetables
4	Family business	<10	Cervinara(AV)	Chestnuts, cherries
5	Family business	<10	Giffoni Valle Piana	Olive oil
6	Family business	<10	Poggiomarino	Fruits, vegetables, preserves
7	Family business	<10	Calvizzano (NA)	Fruit and some vegetables
8	Family business	<10	Roccamascerana	Fruit, vegetables, preserves and catering
9	Family business	<10	Sant'Antonio Abate NA	Tomatoes and puree
10	Family business	<10	Pietramelara (Caserta)	Buffalo breeding, forage production
11	Family business	<10	Rotondi (AV)	Fruit, wheat, olives
12	Family business	<10	Giugliano	Fruits, vegetables, preserves
13	Family business	<10	Foggia	Wine, olives and fruit
14	Family business	<10	Salerno	Fruit, wheat, hazelnuts
15	Family business	<10	Montesarchio (AV)	Fruits, vegetables, preserves
16	Family business	<10	Paolisi (BN)	Buffalo breeding, forage production
17	Family business	<10	Rotondi (AV)	Fruit, wheat, olives
18	Family business	<10	Giugliano	Fruits, vegetables, preserves
19	Family business	<10	Taurasi (AV)	Wine, olives and fruit
20	Family business	<10	Arpaia (BN)	Fruit, wheat, hazelnuts

Table 5.1. Focus group description.

Sources: our own processing.

## 6. Data analysis

In the present study, a constructivist Grounded Theory approach (Charmaz, 2006) was used, which was considered suitable for identifying factors influencing the adoption of new technologies in family microenterprises in Southern Italy during the COVID-19 pandemic.

Data were collected through semi-structured telephone interviews with a sample of 20 entrepreneurs in the agricultural sector in Southern Italy selected according to the criteria of theoretical sampling (Charmaz, 2006; Glaser, 1978). The data were analysed using a process of iterative theoretical coding between the literature and the data obtained from the interviews and through a process of transformation and interpretation. The analysis allowed the data to be sorted and organised by transcribing the interviews and then coding them.

The transcribed interviews were analysed using the Grounded Theory content analysis procedure. This procedure involves three sequential stages of coding: the first stage of analysis, defined as ‘open coding’, that is, a preliminary identification of concepts that fit the data; the second stage of analysis is ‘axial coding’ and consists of the aggregation of codes into broader categories; and finally, the third stage of analysis is ‘selective coding’ which involves the abstraction from the data and the interpretive detection of connections in order to find the ‘central category’ (i.e., pivotal concepts at the basis of the entire process under investigation). Figure 6.1 shows the complex and systematic coding procedure.

Quotations	Open Coding	Axial coding	Selective coding 1. First order categories
" I am a third generation entrepreneur and I believe that discontinuous technologies allow us to grow and consolidate over time"	Discontinuous technology for growth and development	Company lasts over time	1. Technology adoption linked to a microenterprise growth and consolidation strategy
"Adopting discontinuous technology allowed us to work despite pandemic issues"	Covid-19 work experience	Adoption of technology to solve problems	1. Technology enables work
"I'm afraid to adopt new technology at such a sensitive time "	Job fear linked to Covid-19	Uncertainty of technology adoption	1. Fear of technology
" My grandfather and father don't always agree with technology adoption, they are old school, but with a lot of effort I get it done, then with the pandemic there was the coup de grace"	New generation pushes technology adoption	Covid-19 has helped the new generation	1. Ability of the business owner to convince family members to follow him or her in adopting new technology
"Corporate tensions spill over into the family and bring discussions about every area, not just technology adoption,	Family conflicts	Conflict resolution skills	1. Ability of the owner/decision maker to resolve internal family tensions related to the purchase of

Figure 6.1. Examples of the coding procedure.

Sources: our own processing.

The work on the interview transcripts provided us with useful elements for the development of the process and for defining its evolutionary stages.

The analysis was supported by the software Maxqda (Weber, 1964; Kuckartz, 1991) which supported and assisted the data processing, keeping an explicit trace of all the coding phases. Maxqda allowed easy retrieval of citations for each code by moving from data to categories.

The coding process allowed us to build a rooted model by identifying relationships between second-order themes and aggregate analytic dimensions and a more abstract general model.



After detailed and careful work and reflection on the data, significant issues emerged. Figure 6.2 illustrates the structure of the data that emerged from the coding process.

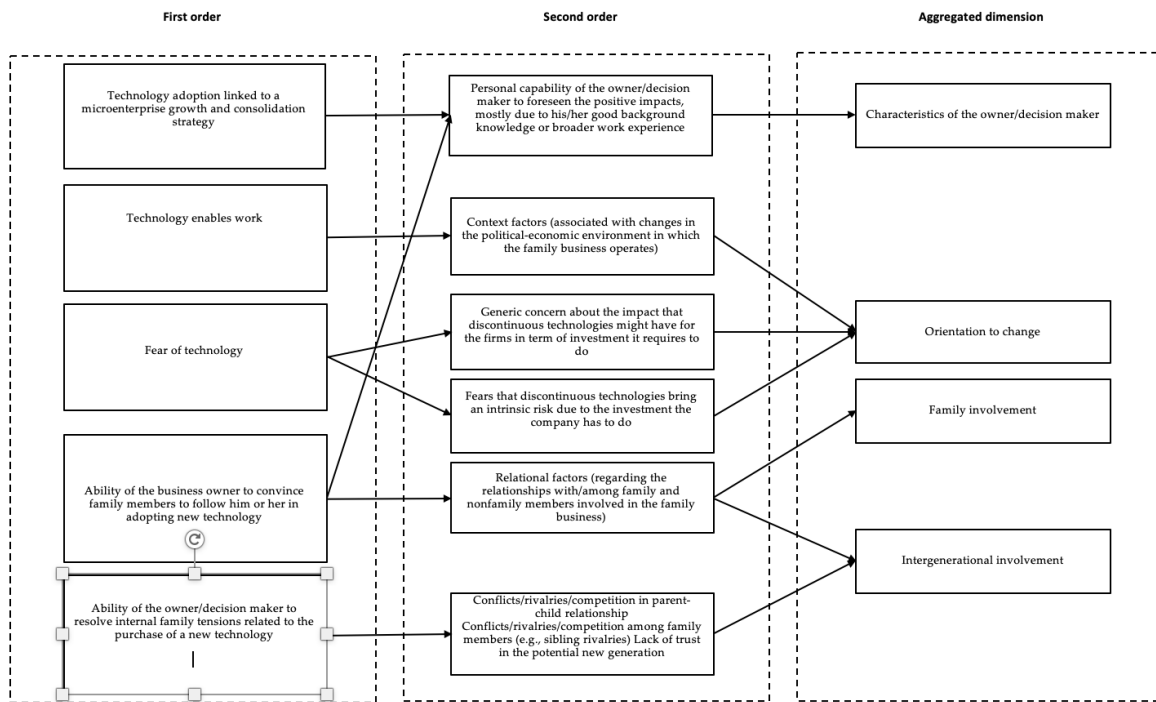


Figure 6.2. Coding tree and conceptual development.

Sources: our own processing.

## 7. Findings

The general model that we used in our study is shown in Figure 7.1. Our analysis revealed important data on the adoption of discontinuous technologies in family microenterprises during the COVID-19 emergency and the organisational responses of companies. Our study identified the process that leads to the adoption of discontinuous technology in family microenterprises in Southern Italy. The emergence of a business need as was the case with the COVID-19 epidemic led to the adoption of discontinuous technologies to ensure business activity and community needs.

The companies subjected to analysis have adopted discontinuous technologies to fill labour shortages due to the pandemic's limits in agro-food practices. In fact, the choice of adoption is motivated not only by business needs but is felt by the company itself, because it must adapt to the environment and the changes taking place in it. An agricultural entrepreneur in telephone interviews stressed this need:

The COVID-19 epidemic highlighted the business problems related to discontinuous technologies that were present in the company, we had to adopt new technologies because the workforce was difficult to find. Many workers came from other countries. We had to pick the fruit from the trees, and despite the current crisis, we adopted new machinery.

Moreover, the results revealed that intergenerational involvement influences the adoption of discontinuous technologies by family microenterprises in Southern Italy. In fact, family members, who work in the company and in particular the new generations, might be a limit (old generation) or an opportunity (new generation) to the adoption of discontinuous technologies.

The data of our study shows that discontinuous technology is introduced by the new generation of entrepreneurs, stimulated by the study and the relationship with the Coldiretti association. The new generation entrepreneur from our data is the family innovator who determines whether discontinuous technology is relevant or irrelevant (Christensen and Bower, 1996) and assesses how to introduce the topic in the family. The generation of the older family entrepreneur is used to working manually, does not accept the adoption and technological change in his business.

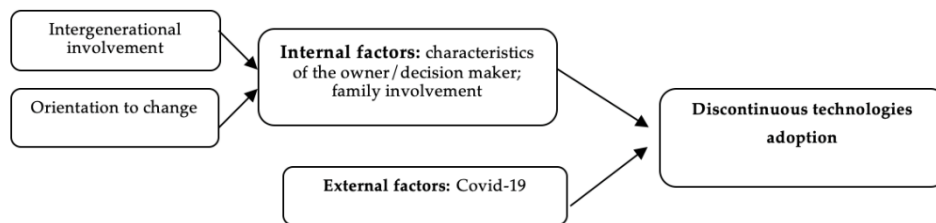


Figure 7.1. Model of adoption of discontinuous technologies.

Sources: our own processing.

## 8. Family/Intergenerational involvement

The family-owned microenterprises examined in this study are all established businesses that have been established from generation to generation. The main goal of the family business owners interviewed is to maintain control of the business and pass the business on to the next generation. In fact, some new generation entrepreneurs reported:

Imagine, our company for three generations has done a job a certain way: manually. When I started working at the company, my parents were concerned that I was taking a step a rash in terms of adopting the technology. My parents only saw the downsides of it: they said, for example, that the ground had to be prepared differently to use the machinery, or that a different kind of worker with other skills was needed... in short, they only saw the downsides and didn't see the upsides. Instead, I'm a dreamer.

Out of fear of investment, the 'older' generations that started the family business are concerned about the longevity of the company and pursue 'continuity' strategies. The first generation despite the COVID-19 outbreak initially deflected the new generation from adopting discontinuous technology for fear of destabilising the company, reducing risk, and not impacting the business. The 'older' generation entrepreneur's desire to pursue and

maintain control discourages adoption for fear of technological and financial investment: “We have some machinery, but my family is still tied to maintaining tradition”. These reasons are motivated by the fear of weakening family control or increasing the risk profile of the business. For example, one new generation entrepreneur said that “the technological problem in our company is my father”. The initial interpretation of adopting discontinuous technology is one of fear. Consistent with the predictions found in theory about the family business, generational turnover is a significant resource for the companies in our study as they evolve their business and adopt discontinuous technology. We were told, for example, that:

I come from a family that has always been traditional and entrenched in certain work habits and mindsets. The transition wasn't easy, I'm happy with it today, but there's always a struggle to introduce machines, despite the fact that our business has become very tech-savvy over the years. I mean, my parents and grandfather also understood the advantages and benefits that come with technology, but getting to this point has been difficult.

Ultimately, in almost every interview, the final thought was as reported by an entrepreneur, “[a]dopting discontinuous technologies was a no-brainer when the COVID-19 pandemic put my parents up against a wall; produce was spoiling in the fields because we didn't have labour to harvest due to restrictions and lockdown”.

## 9. Characteristics of the decision-maker / orientation to change

In the interviews, qualitative coding revealed that young family entrepreneurs are able to perceive the benefit of new technology. For example, we were told in reference to the discontinuous technologies adopted and the impact on the labour and environmental system:

We adopted a biogas plant for energy self-efficiency using animal waste. We sensed that there was some good behind this discontinuous technology. In fact, the wastewater machine produces methane and electricity for the entire company. We save a lot of money.

The new generation wants to adopt the discontinuous technology to make work easier, but mostly because they want to continue the family business. In fact, they reported, “technology is the future for all family businesses like mine. The benefits are both economic, but in terms of time reduction and better product quality”.

## 10. Discussion

The present work is among the first empirical studies to investigate the adoption of discontinuous technologies during the Codiv-19 emergency. Moreover, the work provides the first evidence of the influence of the ongoing pandemic on family micro-firms in Southern Italy. The sample of 20 family farms analysed provided interesting results that we believe support coherent research streams.

First of all, it contributes to the research on family businesses, highlighting the solidity, unity and participation that characterise family microenterprises. It complements both the studies

done by De Massis *et al.* (2020) and the studies by Kraus *et al.* (2020). The presence of family in Southern Italian microenterprises is amplified by the emotions associated with decision-making dilemmas among family generations. Family members who are part of the microenterprise must decide whether to adopt discontinuous technology with all the benefits that come with it and yield to generational change or remain anchored to traditions and manual labour, losing out on costs and product quality. Second, he contributes to farm studies and the study of Fairlie (2020) by being among the first studies to highlight the impact that the COVID-19 outbreak had on such farms.

Third, this study contributes to research on discontinuous technology innovation and adoption and the studies of Shafi *et al.* (2020) highlighting the impact that the current crisis has had on changes in business models and the use of technology tools.

In addition, this view provides insight into the distinction between changes planned by the company and the changes needed to manage crisis situations. By virtue of crisis management, the present study complements the research of Wenzel *et al.* (2020) as we highlight a strategic response to a crisis situation.

## 11. Conclusion

The pandemic has altered the way we live and work. In this study, we explored changes in micro-farms in Southern Italy through a qualitative survey. Specifically, this study investigated the adoption of discontinuous technologies during the Codiv-19 emergency. We disagree with the studies of Chrisensens (1997) that offer a single innovator of technologies generalised to all types of farms, while we agree with Konig (2013) that introduces the concept of innovator family and 'family influence as a challenge to the adoption of technological discontinuities.

In addition, we agree with existing studies have on discontinuous change (Christensen, 1997; Chesbrough, 2001; Hill and Rothaermel, 2003) and research that introduced the concept of 'patient capital' (Sirmon and Hitt, 2003) as a competitive advancement of family firms: the mediation of a young family member can influence technology adoption. The present work improves the existing research and demonstrates the impact of the influence of the family on the adoption of discontinuous technologies: investments can be perceived both as a threat to traditional manual labour and an opportunity for change and long-term perspective. The new generation, as shown in the results, with work and persistence, convince the old entrepreneurial generation regarding the adoption of technologies. The present analysis is the first that analyses the situation of discontinuous technologies in Southern Italy's micro family businesses in the agricultural sector during the COVID-19 emergency. In addition, our studies highlight evolution and generational change as an ingredient behind the adoption of technologies. Our model extends the existing studies and literature both in terms of the adoption of discontinuous technologies, and of the family business.

We encourage scholars to help the scientific community better understand the long-term implications of this crisis and how to contribute to future discussions useful in helping family firms.

## 12. Limitations, future research directions and practical implications

Our study has limitations that can guide future research. At the time of our interviews, the Italian economy was experiencing a moment of profound crisis due to COVID-19. Therefore, the picture described by respondents may reflect this trend. Furthermore, our study represents an extreme case that has probably influenced the adoption of discontinuous technologies in the micro agricultural enterprises of Southern Italy. Furthermore, a limit is certainly the number of the sample being studied, in fact, future research could replicate the study on a larger sample and replicate the model in other areas of Italy or Europe comparing the results obtained. Our study analyses the adoption of discontinuous technologies in micro family businesses during the COVID-19 emergency and is based on the assumption that also the family influences the adoption of discontinuous technologies. The researchers could study the model presented and verify if the family influences the adoption of discontinuous technologies in other circumstances as well. These limitations could serve as starting points for future research flows. Our findings also have practical implications for agricultural entrepreneurs of micro-enterprises. In fact, the conclusions obtained here allow us to offer a series of points that can prove useful for agricultural entrepreneurs who are interested in the processes of adoption and implementation of discontinuous technologies. First, the new generation of family entrepreneurs could accelerate the adoption of new discontinuous technologies by encouraging the older generation. According to the results we have obtained here, the micro family businesses that have adopted discontinuous technologies have been driven by the studies and research of the new generation of agricultural entrepreneurs. Second, family businesses may discover through our study that they can use state incentives to adopt discontinuous technologies. Furthermore, for the adoption of new technology, it is useful to outline a number of implications. First of all, we recommend accompanying the adoption of discontinuous technologies that modify the company structure by adequate training involving all employees. Secondly, family members can help the discontinuous process of adopting technology by being an example to follow for the rest of the staff. Finally, it is useful to match the discontinuous process of technological adoption with periods of staff renewal, since technological changes tend to be more rapid when they involve newly hired and young staff.

### Keywords

digital technologies; Covid-19; micro family businesses; discontinuous technologies

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