



## What Drives Innovation in Family Farms? The Roles of Socioemotional Wealth and Diverse Information Sources

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### KEYWORDS

Diversity of information sources, External threats, Family farms, Innovation, Socioemotional wealth

**Abstract** Family business literature barely addresses family farms and their innovation behavior. Innovation can be key to mitigate typical threats family farms are faced with, e.g., international competition and climate change. This article investigates socioemotional wealth (SEW) and diversity of information sources as innovation drivers. It also explores the role of diversity of information sources as a moderator. A sample of 911 family farms was used for linear regression analysis. The SEW dimension identification of the family members with the farm positively affects the implementation of innovation measures because the stronger the family members identify with the business, the more important is it for them to preserve the identity endowments. Since innovation is a way to do that, strong identification will motivate family members to innovate. Diversity of information sources is also positively linked to innovation measures. However, it has a negative moderating effect on the relationship between identification and innovation measures. While diverse information sources seem to increase a family farm's ability to innovate by supporting the opportunity identification and utilization, it can also mitigate the farms willingness to innovate when information is ambiguous. The study integrates knowledge from agricultural, innovation and family business research and contributes to a better understanding of the peculiar business type "family farms" and SEW as a multidimensional concept.

### CÓDIGOS JEL M10

### PALABRAS CLAVE

Diversidad de fuentes de información, Amenazas externas, Granjas familiares, Innovación, Riqueza socioemocional

### ¿Qué impulsa la innovación en las granjas familiares? El papel de la riqueza socioemocional y las fuentes de información diversas

**Resumen** La literatura sobre empresas familiares apenas aborda las granjas familiares y su comportamiento innovador. La innovación puede ser clave para mitigar las amenazas típicas a las que se enfrentan las granjas familiares. Este artículo se centra en la riqueza socioemocional (SEW) y la diversidad de fuentes de información como elementos impulsores de la innovación. También explora el rol moderador de las fuentes de información. Se ha utilizado una muestra de 911 granjas familiares. La dimensión identificación de la SEW de los miembros de la familia con la granja afecta positivamente la implementación de medidas de innovación ya que cuanto más se identifican los miembros de la familia con el negocio, más importante es para ellos preservar su identidad. Dado que la innovación es una forma de hacerlo, una fuerte identificación motivará a los miembros de la familia a innovar. La diversidad de fuentes de información también está relacionada positivamente con las medidas de innovación. Sin embargo, tiene un efecto moderador negativo sobre la relación entre las medidas de identificación e innovación. Si bien las fuentes de información parecen aumentar la capacidad de innovación de una granja familiar al respaldar la identificación y utilización de oportunidades, también pueden mitigar la disposición de las granjas a innovar cuando la información es ambigua. El estudio integra el conocimiento de la investigación agrícola, la innovación y la empresa familiar.

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## 1. Introduction

Farms are central to our economy and society because they provide basic supplies by cultivating the soil, growing crops and raising livestock. Additionally, they may engage in activities that go beyond their core activities, e.g. agritourism, hospitality, generating energy from biowaste, etc. (McElwee, 2006). Agricultural production was traditionally run by families (Hayami, 1996). Still today, family farms are worldwide the predominant form of farms (Chavas, 2001). In this paper, farms are regarded as family farms, when they are owned by a natural person and define themselves as family farms.<sup>1</sup>

Recently, the number of farm entities in Europe is decreasing and the average size of the entities is increasing (European Commission, 2013; Lowder et al., 2016). This development is due to changing conditions and new challenges: For instance, modern technologies lead to productivity growth causing international output prices to drop. Yet, economies of scale effects disadvantage small-scale farm entities (Neuenfeldt et al., 2019). The new economic power relations put family farms enormously under pressure. On top of that, they are increasingly affected by natural disasters caused by climate change (Darnhofer et al., 2016). In the long run, family farms can only survive when they adapt to the changing conditions. Innovation can help to do that (Ahmad et al., 2021). However small- and medium-sized businesses (SMEs) in rural areas often lack entrepreneurial orientation (i.e. the willingness of a firm to engage in product market innovations, take risks and pursue innovations proactively; Miller, 1983; for further readings about the concept see Covin & Slevin, 1991; Lumpkin & Dess, 1996; Wiklund & Shepherd, 2005), because lifestyle goals are more important to their owners than developing the business (Galloway & Mochrie, 2006).

In order to promote the long-term survivability of family farms, this paper aims to foster the understanding of what drives them to implement innovation measures, i.e., products, processes or means of production that are new to the farm, which, so far, we know little about it. A literature review by Suess-Reyes and Fuetsch (2016) classifies the motives for innovation in family farms into farm-related (e.g., to reduce risks caused by

pricing pressure or natural disasters), family-related (e.g., to increase family income or create workspace for family members) and/or operator-related (e.g., to pursue personal interests). Yet, the authors attest a general lack of theory use in research on innovation in family farms resulting in disintegrated pieces of knowledge.

Previously, family business researchers have tried to explain strategic decisions in family businesses through socioemotional wealth (SEW), i.e., non-financial benefits the family receives from the business (Gómez-Mejía et al., 2007). According to the SEW perspective, preferences are shaped by existing socioemotional endowments (Miller & Le Breton-Miller, 2014), so that family businesses with rich socioemotional endowments will aim to preserve and increase their SEW (Gómez-Mejía et al., 2011). So far, only a few studies have applied the SEW perspective to investigate innovation decisions (Martínez-Alonso et al., 2018), in the context of family farms even less. Yet, in family farms, where financial benefits are typically low, socioemotional motives can be all the more important for creating awareness that innovation is necessary to tackle external threats.

This study addresses the theoretical gap by investigating how SEW affects the implementation of innovation measures in family farms in the light of external threats through increasing international competition and climate change. Moreover, it also accounts for a factor that may moderate the relationship between SEW and the implementation of innovation measures, namely the use of diverse information sources. Although obtaining information from diverse sources helps to generate innovative ideas (Soda et al., 2021), family farms with rich socioemotional endowments may feel threatened by the ambiguity that information from diverse sources can cause (Simon, 2007), which can weaken the positive effect of SEW on overcoming the general reluctance to innovate.

This study contributes to theory and practice in several ways: (1) By integrating theory from agricultural, innovation and family business research, it takes a first step in overcoming disciplinary boundaries and contributes to the development of an integrated body of knowledge on family farms. (2) It dives into a rather neglected area of research by investigating innovation in the specific context of family farming. It advances the un-

<sup>1</sup> This paper uses a rather broad definition for family farms based on the definition of family businesses by the European Commission (2022), which is appropriate for the purpose of this study for the following reason: Due to the interrelation between family and business, family businesses' strategic decisions, such as innovation decisions, are typically influenced by family interests (Berrone et al., 2012). In farming businesses, this connection is particularly strong (Suess-Reyes & Fuetsch, 2016). Due to the geographic proximity of the family's living and workspace, family members such as spouses or children are often included in farm-related decision-making or farm work (Dumas et al., 1995; Heady, 1952), even though they have no formal function (e.g. farm management or ownership). Thus, the informal influence of the family on the business is typically very strong in farming businesses.

derstanding of family farms by shedding light on the motives that drive innovation and makes suggestions how the innovativeness of this traditionally conservative business type can be increased. (3) As an industry-specific study, it also answers the call from Calabrò et al. (2019) to account for the heterogeneity of family businesses which causes differences in their innovation behavior. (4) It answers the call of family business scholars to treat SEW as a multidimensional construct (e.g., Chua et al., 2015) and underlines the importance of doing so by showing heterogeneous results for the SEW dimensions.

In the following theory section, the central terms will be defined, and the hypotheses will be developed based on the literature. In the subsequent method section, the data collection process, the sample, the measurements and the statistical procedure will be described. After that, the analytical results will be presented. Concluding, the results will be interpreted and discussed.

## 2. Theoretical Background and Hypotheses Development

### 2.1. SEW: an innovation motivator in situations of external threat

SEW are non-financial benefits such as emotions and relationships business family members receive from their business (Gómez-Mejía et al., 2007). They form the affective endowment of a family business that is intrinsically and inseparably attached to kinship ties (Cruz et al., 2012; Martínez-Romero & Rojo-Ramírez, 2016). SEW is what makes family businesses distinct from non-family businesses. It constitutes a family business' primary frame of reference, which means that the socioemotional endowments will significantly affect the family business' decision making in a way that the benefits derived from the business will be preserved and accumulated (Berrone et al., 2012). Since preferences depend on existing endowments (Miller & Le Breton-Miller, 2014), families with rich SEW will be particularly eager to preserve and accumulate their socioemotional endowments (Gómez-Mejía et al., 2011).

Constituting the primary frame of reference, SEW also influences innovation decisions. Yet, the findings from studies investigating the effect of SEW on innovation (e.g. Fitz-Koch & Nordqvist, 2017; Gast et al., 2018; Gómez-Mejía et al., 2011; Kammerlander & Ganter, 2015) are ambiguous, pointing to both negative and positive effects. This may be the result of different contexts in which the studies were conducted. While in relatively stable environments with low competitiveness, innovation may be regarded as an unnecessary risk for the SEW, in dynamic and competitive environments, regularly adapt-

ing one's resources, procedures and products is a necessity for survival (Eisenhardt & Martin, 2000). Family businesses are known to develop an extraordinarily high willingness to take risks if they are faced with economically difficult situation (Fuetsch & Suess-Reyes, 2017). Only then, the family will be able to continue to profit from the socioemotional endowments (Classen et al., 2014). In agriculture, where family farms, and consequently their SEW, are exposed to all kinds of threats such as climate change causing natural disasters and international mass producers beating down market prices (Darnhofer et al., 2016), innovation measures can make a family farm more resilient and help to establish a competitive advantage by creating additional consumer value (Bessant, 2019). Consequently, despite its uncertain outcomes, innovation measures provide a good chance to prevent SEW loss. Therefore, it is expected that, in the given context, the positive effects of SEW on the family farms' willingness to implement innovation measures will overweight.

This study draws on the three-dimensional concept of SEW suggested by Hauck et al. (2016). The concept includes the dimension renewal of family bonds through dynastic succession (R), emotional attachment of family members (E) and identification of the family members with the business (I). Since the relationships between these dimensions can be causal, overlapping, synergistic or substitutional, it is important to treat SEW as a multidimensional construct (Chua et al., 2015). It is hypothesized that the dimensions influence the implementation of innovation measures as follows:

For family businesses that strive to renew their bonds with the business through dynastic succession, the business embodies the family's heritage, which they want to continue in the future (Berrone et al., 2012). Large, international market players and natural disasters put family farms enormously under pressure. This often has a negative effect on their economic performance. In general, the potential successor's intention to continue the family's heritage is higher, if the family business performs well (Zellweger et al., 2012). Thus, under the difficult circumstances, the willingness of potential successors to take over the farm may decrease. If the family wants to renew its bonds with the farm through dynastic succession, the active owners have to make the farm more attractive for the next generation. Innovation helps to build a farm that is adaptive to external changes and viable over a long period of time (Ahmad et al., 2021; Bessant, 2019). Thus, if families strive to renew their bonds with the farm through dynastic succession, they will be more likely to innovate in order to be able

to hand over a modern and competitive farm. Furthermore, due to their wish to preserve the family heritage for the future, these family businesses tend to develop a long-term perspective (Le Breton-Miller & Miller, 2006), which leads to strategic decisions with an extended time frame (Chrisman & Patel, 2012). As innovation requires investments in uncertain future returns (Flammer & Bansal, 2017; March, 1991), innovators have to be patient until the innovation pays off. Thus, long-term orientation can be conducive to innovation decisions. Indeed, it was found that small family businesses who are long-term oriented have a higher innovation output (Werner et al., 2018). Family farms that wish to renew their bonds through dynastic succession will therefore be more willing to make innovation investments for the future. This leads to the following hypothesis:

**Hypothesis 1a.** *The desire to renew family bonds through dynastic succession is positively related to the implementation of innovation measures.*

Emotional attachment of the family members refers to the degree to which positive emotions play a role in building and maintaining binding social ties within and beyond family boundaries (Memili et al., 2015). These emotions arise out of the family members' common history with the farm consisting of shared experiences, knowledge, feelings and memories (Berrone et al., 2012; Lawler, 2001). Since the family business creates a sense of belonging, affection and "togetherness", family members derive positive emotional value from it (Nikolakis et al., 2022). Family members with strong emotional attachment, will strive to preserve this emotional value. When the family farm's survival is endangered by external threats such as intense competitive pressure or climate change, the positive emotions can erode since economic stress can burden the relationships between the family members (Sprung, 2022). Thus, in order to preserve the positive emotions, family farms with strong emotional attachment of their family members, will probably be more willing to implement innovation measures because they potentially foster the viability of the farm (which constitutes the foundation of their positive emotions). Moreover, emotional attachment promotes family members' commitment to the business (Corbetta & Salvato, 2004; Memili et al., 2015), which may encourage family members to put more time and effort in the development and implementation of innovative ideas. If potential successors are strongly emotionally invested in and committed to the farm, the current generation may invest more in innovation measures in order to hand over a healthy and competitively

viable farm. Previous findings from SMEs research show that emotional attachment is generally associated with a positive influence on innovativeness (Filser et al., 2018). Thus, it is hypothesized that:

**Hypothesis 1b.** *Emotional attachment of the family members is positively related to the implementation of innovation measures in family farms.*

In family businesses, the two systems family and business are usually closely intertwined, so that the boundaries between them can become blurry (Stevens et al., 2015). The business may adopt values and goals of the family and vice versa, leading to the notion that the business is an extension of the family (Berrone et al., 2012). This intermeshing causes a unique identity among family members that is inseparably tied to the business (Aldrich & Cliff, 2003; Chua et al., 1999). When family members identify closely with the farm, a loss to the farm also means a loss to the family. Thus, high identification of the family members with the farm may motivate them to invest in innovation measures because innovation can help to secure the farm's well-being and positive identity endowments (which are the basis of the unique identity; Gast et al., 2018). Furthermore, family members who feel a tight connection to their business, tend to care much about the public image of their business (Berrone et al., 2010). Thus, family farms with a strong identity will most likely want to make a good impression on neighbors, customers and other stakeholders. In agriculture, green innovations aiming at pollution prevention or protection of biodiversity offer a great opportunity to confer an environmentally and socially responsible image (Ma et al., 2017). Family farms that care for their public image will thus be more motivated to innovate. This leads to the following hypothesis:

**Hypothesis 1c.** *Identification of the family members with the farm is positively related to the implementation of innovation measures in family farms.*

## 2.2. Diversity of information sources as innovation facilitator

SEW determines what a family farm strives to do. However, in order to leverage the positive attitude towards innovation, it is also important what the farm *can* do (Vilkinas et al., 2019). In that regard, information, i.e., context-specific data containing relevant meaning, is a crucial resource that forms the basis of decisions and actions (Liew, 2007). It facilitates the recognition of entrepreneurial opportunities (Gaglio & Katz,

2001), helps to pin down one's own strengths and weaknesses, estimate possible innovation outcomes and identify which resources yet need to be acquired to achieve a goal (Zott et al., 2011). Innovation is a complex and dynamic task, which requires expertise from different fields (DellaPosta & Nee, 2020). For instance, in family farms information regarding new farming methods, new technological developments, latest market trends and consumer needs, etc., could be useful for the development of innovations. This information can hardly be provided by one actor alone. Businesses that combine information from different sources were found to be more innovative than others (Grillitsch & Trippel, 2014). A high diversity of information sources may equip family farms with the ability to identify and utilize opportunities. Thus, diverse information sources may increase a family farm's ability to innovate. This leads to the hypothesis that:

**Hypothesis 2.** *Diversity of information sources is positively related to the implementation of innovation measures in family farms.*

### 2.3. The moderating role of diverse information sources

While it is argued, in this study, that the diversity of information sources has a positive influence on the family farm's innovation ability and, consequently, on the implementation of innovation measures, it may also interact with the motivational effect of SEW on innovation. Using information from diverse sources increases the probability of information ambiguity, which can cause uncertainty in innovation decisions (Eppler & Mengis, 2004). Although ambiguous information is necessary to a certain degree to trigger critical reflections and open up new perspectives (Laros & Košinár, 2019), too much ambiguity can be overwhelming resulting in a retreat from the intended task due to a perceived lack of control (Budner, 1962; Rüegg-Stürm, 2001; Simon, 2007). In situations like these, family farms may behave more cautiously and respond with confusion, doubt or fear of failure (Schommer et al., 2001). These negative emotions are detrimental to flexible thinking, creativity and problem-solving (Baas et al., 2008; Roskes et al., 2012) - abilities that are crucial for innovation. Thus, diversity of information sources may interfere with the positive effect SEW can have on innovation.

For instance, family farms that wish to renew their family bonds with the farm through succession, may be unsettled regarding which path to choose for their future development. Diverse information sources can provide a more differentiated picture about the environment and the family farm itself. This can open up a number

of possibilities for innovation (Laros & Košinár, 2019) but it can also cause uncertainty regarding innovation outcomes or ambiguity about which innovations to pursue (Eppler & Mengis, 2004). Consequently, it may prompt family farms to withdraw from innovation opportunities due to the fear of failure or a development that harms the attractiveness of intra-family succession in the perception of the potential successor. For instance, making use of diverse sources to inform oneself about an alternative cattle species, may make a family farmer aware about a number of risks for dynastic succession that come with switching the livestock. This can create doubts regarding the innovation decision. The fact that innovation measures often require cost-intensive investments, which can create path dependencies (Zhu et al., 2006) meaning that the choices made today, e.g. about which animal species to breed, determine choices in the future (Dosi, 1982), makes the problem even more severe. Since potential successors not seldomly pursue other occupational paths at first and develop their interest in the farm very late (Kimhi, 1994), the current manager is often left alone with decisions like these. The perceived complexity of the decision due to the use of information from diverse sources may reduce the likelihood that family farms implement innovation measures at all. Thus, a high diversity of information sources is expected to curb the motivating effect of the desire to renew family bonds through dynastic succession on innovation measures. This leads to the following hypothesis:

**Hypothesis 3a.** *Diversity of information sources negatively moderates the effect of the desire to renew family bonds through dynastic succession on the implementation of innovation measures.*

When family members are emotionally attached, they obtain positive emotions such as affection and a sense of belonging and "togetherness" from the family business (Nikolakis et al., 2022). Using diverse information sources can lead to diverging opinions among the family members, e.g., about which ideas to move forward, which and how many resources to use or how the final innovation output should look like (Liang et al., 2009). Although task conflicts will probably not endanger the relationships between family members with strong emotional attachment, they add complexity to these relationships. The ease of the collaboration based on blind understanding, unconditional trust and a common vision may be diluted by the information plurality brought into the family by diverse sources. Therefore, emotional attachment between the family members may not facilitate the implementation of inno-

vation measures to the same extent as under the condition of lower diversity of information sources. Furthermore, mental overload, which can be caused by conflicting information from diverse sources, reduces the feeling of commitment to the business (Ali et al., 2022) that emotionally attached family members usually have. Commitment can act as innovation motive; however, if information from diverse sources causes commitment problems through mental overload, emotional attachment cannot fully unfold its motivational effect on innovation measures. Consequently, it is hypothesized that:

**Hypothesis 3b.** Diversity of information sources negatively moderates the effect of emotional attachment of the family members on the implementation of innovation measures.

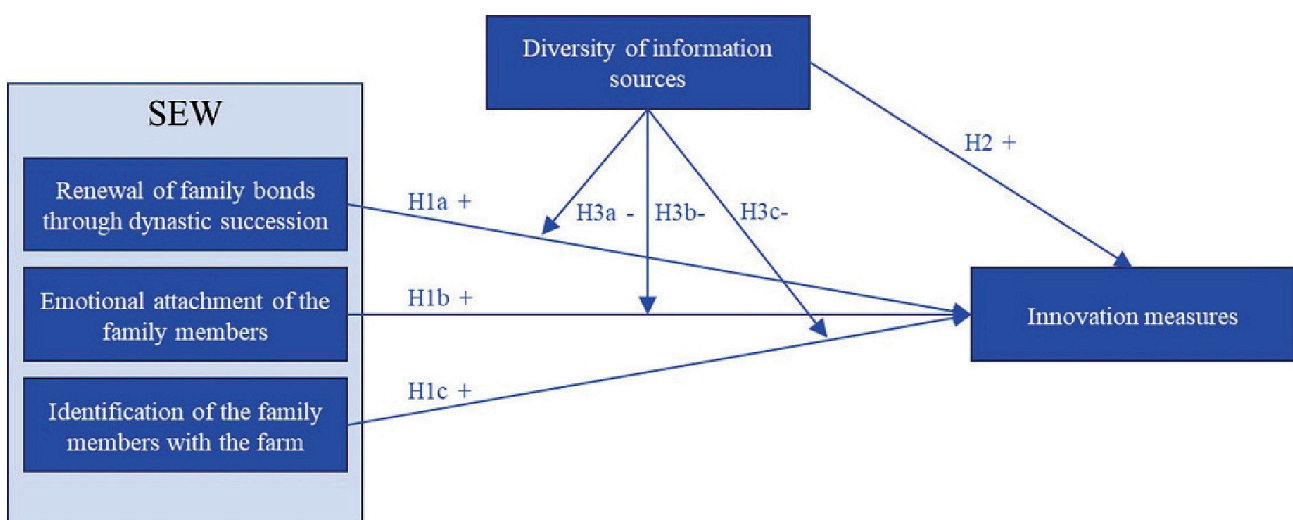
The use of diverse information sources may also evolve a combined effect on innovation together with the identification of the family members with the farm. Diversity of information sources can create dynamic and multifaceted situations, which were shown to have a destabilizing effect on identity (Sveningsson & Alvesson, 2003). Since family farms with a strong identification of their family members will aim to preserve their identity endowments, they will probably perceive information from diverse sources as irritating and disturbing and develop a resistance to it. Thus, they may not process and use this information as open-mindedly, which can induce them to forgo chances for new innovation measures. This means that information from diverse sources and strong identification may interact in a way that strong

identification diminishes the positive effect of diverse information sources on the implementation of innovation measures. Vice versa, diversity of information sources may also weaken the positive effect of identification on innovation because the high degree of uncertainty that information from diverse sources can cause, can make family farms more cautious (Schommer et al., 2001). If the family members identify strongly with the farm, they may be particularly worried about possible innovation failure because a failure would reflect on family members' personal performance, abilities and self-worth (Berrone et al., 2012; Dyer & Whetten, 2006; Ng et al., 2022). The high motivation for the implementation of innovation measures that family members usually experience when they identify strongly with their farm, may thus be tarnished by increased worries (regarding the risk that innovation involves) triggered by the diversity of information sources. Both argued effects are statistically the same (interaction of diverse information sources with identification). For reasons of consistency, this paper focuses on the second effect, which argues a moderating effect of diverse information sources on the SEW dimension identification of the family members with the farm. This leads to the following hypothesis:

**Hypothesis 3c.** Diversity of information sources negatively moderates the effect of the identification of the family members with the farm on the implementation of innovation measures.

Figure 1 depicts the theoretical model with all hypotheses.

Figure 1. Theoretical model



### 3. Method

#### 3.1. Data collection and sample description

The data was collected through an online questionnaire survey among Lower Austrian family farms between November 2015 and January 2016. The Austrian province of Lower Austria is a particularly suitable research area for this study, because it is the largest producer of agricultural goods in Austria ([Amt der Niederösterreichischen Landesregierung Abteilung Landwirtschaftsförderung, 2019](#)) and its landscape is very diverse with both plain and mountainous regions. Due to its significance and diversity Lower Austria offers multiple opportunities for innovation in farming.

In preparation of the survey, 4,500 farms were randomly selected from a database by Agrarmarkt Austria containing all Lower Austrian farms that have received subsidies in the past. Since previous studies have shown that the response rate can be substantially increased by pre-contacting potential respondents telephonically ([Dillman et al., 2014](#)), these farms were called to explain the purpose of the study and to invite them to participate in the survey. Furthermore, the farms were asked if they were family farms by self-definition. When they confirmed and agreed to take part in the survey, they were sent an email with the link to the online questionnaire. In total, 2,617 farms answered the call (after calling them at least three times on different days and at different hours) out of which 1,813 agreed to participate. Those who agreed were sent an email invitation with the link to the online questionnaire and, in case they did not fill it out, a weekly reminder for three weeks to take part in the survey. In order to dispel potential data privacy concerns, respondents were assured anonymity. Out of the 1,813 farms that received the questionnaire, 1,228 started it and 954 completed it. This corresponds to a response rate of 36.5% (based on the completed questionnaires in relation to the questionnaires sent out) which goes far beyond the average response rate of 21% reported by [Pielsticker and Hiebl \(2020\)](#).

Even though 90 % of all farms in Austria are family farms in the sense that they are family-managed ([Bundesministerium für Nachhaltigkeit und Tourismus, 2019](#)) and the respondents were asked telephonically if they defined themselves as family farms, the sample was once more checked for the family's influence on the farm. In accordance with the definition of SEW as the affective endowment of "family owners", farms that were not owned by the respondent or a family member of the respondent were excluded from the sample. Thus, the final sample

contains 911 family farms.

The farms in the sample differ in terms of their production focus, occupation type and size: 54 % of the farms pursue cash-crop farming, 53 % animal husbandry, 36 % forestry, 18 % forage production, 16 % viticulture, 10 % fruit and vegetable growing, 10 % energy production and 8 % offer accommodation and/or hospitality. 60 % of the farms are run as main occupation and 40 % as sideline business. Most of the family farms (62 %) are managed by one person alone. In 80% of the cases only one generation is involved in management, in 16 % two generations are involved. On average the farms in the sample consist of 50 hectares and employ two to three employees on a regular basis. Accounting for seasonal fluctuations the average number of employees is six to seven. Austrian farms are generally small-structured (45 hectares on average; [Bundesministerium für Nachhaltigkeit und Tourismus, 2019](#)), which makes it all the more important for them to innovate in order to achieve competitive advantages on the globalized market. Regarding their financial endowment, the majority of the farms (57.5 %) have, at most, financial resources to maintain the day-to-day operations available.

#### 3.2. Measurements

In this section the variables used in the analysis are described. More detailed descriptions about the measurements are disclosed in Table A1 in the appendix.

##### 3.2.1. Dependent variable

*Innovation measures* are defined as the implementation of new products, processes or means of production. What is regarded as "new" often depends on the context. Agriculture is a rather traditional sector and the first- or early-mover strategy is typically rare among farming businesses. Mostly, they prefer to observe novelties in the market for a while, to see if they prove successful, before implementing them as innovation measures themselves ([Long et al., 2016](#)). Assuming a generally low level of innovativeness in the sector, it is most suitable for the context of family farms to define "new" as something that is perceived to be new by the family farm (based on [Zaltman et al., 1973](#)). Thus, to measure *innovation measures*, respondents were asked how many new products, processes or production means a farm implemented in the last five years in comparison to other farms of the same type. More specifically, the items are related to the use of (a) new machines, (b) new or remodeled agricultural buildings, (c) new supplies and equipment, (d) new processes and (e) new crops and breeds

and are measured on a 6-point Likert scale. Since objective indicators (e.g. profits through innovations or number of patents) are difficult to obtain, relative measures are a suitable and widely used alternative for measurement (Ritala et al., 2015). Unlike other studies that investigate innovation as an orientation, this study measures it as a manifest, action-related variable. This avoids the problem of the intention-action gap, which arises where intentions do not bring about the desired actions (Schepers et al., 2021). The scale is reflective. The value of the variable is calculated as the mean of the five items of the scale. With a Cronbach's alpha of 0.72 the scale's reliability is good (Hair et al., 2007).

### 3.2.2. Independent variables and the moderator variable

To measure SEW, this study uses the three-dimensional REI scale by Hauck et al. (2016). The items were slightly adapted to the family farm context. All dimensions are reflective measures and are calculated as the mean of their item's values (scales ranging from 1 to 6).

- *Renewal of Family Bonds through Dynastic Succession* refers to the family's eagerness to continue its legacy by safeguarding long-term family control over the farm through intra-family succession. Three items measure this attitude on a six-point Likert scale with good reliability (Cronbach's alpha = 0.71).
- *Emotional Attachment of Family Members* measures the extent to which family relationships bring emotions into the family farm context. These positive or negative emotions result from the family members' shared past and can affect business decisions in the present and future. The three-item scale (ranging from 1 to 6) used in this study has excellent reliability (Cronbach's alpha = 0.92).
- *Identification of Family Members with the Farm* is the degree to which family members think of the family farm as an extension of themselves. It is measured with four items on a six-point Likert scale with excellent reliability (Cronbach's alpha = 0.91).

The independent and moderator variable *diversity of information sources* measures the number of different types of information sources used by the farm. Out of a list of six farm-internal (e.g., performance indicators) and -external information sources (e.g. industry magazines), respondents were asked to select those that guide decisions in their farm. The variable is a formative measure and is calculated as the sum of the selected innovation measures. Thus, the variable takes a value

between 0 and 6, where a high number signifies a great diversity of information sources.

### 3.2.3. Control variables

Family businesses are very heterogeneous regarding structural conditions. These can affect innovation inputs and outputs (Werner et al., 2018). Thus, structural variables need to be taken into account when investigating innovation in family farms. The regression analysis includes *farm size in hectares*, *family farm generation* and *occupation type* (sideline vs. main occupation) as control variables. Furthermore, the resource situation of the family farm can also affect the farm's ability to implement innovation measures. Since agriculture is generally a resource-constrained environment (Poole, 2017), it is particularly important to take this factor into account. Thus, the *availability of financial resources* (1 - low to 4 - high) is controlled for in the analysis. In addition, external factors can influence family farms' innovation behavior. Due to climate change, natural disasters are a factor of increasing relevance in agriculture. Thus, the number of *natural disasters suffered* (one or less vs. multiple) is also controlled for in the analysis. Previous studies indicate that farms often adopt risk-mitigating innovations when they are exposed to natural disasters (Miao & Popp, 2014). Finally, previous studies have shown that a collaboration of family members from different generations on the management and the ownership level may affect the family business' innovation behavior. Multiple generations bring heterogeneous knowledge, skills, perspectives and experiences into the farm, which can facilitate innovation (Frank et al., 2019; Fuetsch, 2022; Sciascia et al., 2013). Thus, the number of *family generations in management* and *in ownership* are also controlled for in this study.

Table 1 shows the descriptive statistics of all variables.

## 4. Results

Before testing the hypotheses, bivariate correlations among all variables were evaluated. They are depicted in Table 2. With the exception of the correlation coefficients between the REI dimensions of the SEW scale, which are below +/- 0.6, all correlation coefficients between independent variables are below +/- 0.3. This equals moderate and low correlation levels (Evans, 1996). Unless correlation coefficients are close to +/- 0.8, problems with multicollinearity are not to be expected (Shrestha, 2020; Young, 2018). For additional assurance, variance inflation factors (VIF) were calculated. While Hair et al. (1995) suggest a maximum VIF level of



	Min.	Max.	Mean	SD
Innovation measures	1	6	3.19	1.11
Farm size in hectares	1	690	50.05	56.88
Family farm generation	1	4	3.40	0.88
Sideline business	1	2	1.40	0.49
Availability of financial resources	1	4	2.41	0.79
Multiple natural disasters suffered	1	2	1.37	0.48
Family generations in management	1	3	1.22	0.49
Family generations in ownership	1	3	1.19	0.43
Identification of family members with the farm	1	6	4.81	1.17
Emotional attachment of family members	1	6	4.74	1.13
Renewal of family bonds through dynastic succession	1	6	4.91	1.13
Diversity of information sources	1	6	2.60	1.09

10, Hair et al. (2010) recommend that VIF should not exceed 4. All VIF in the analysis are below or equal to 2.0, which is far below the problematic thresholds. Therefore, there is no indication for a multicollinearity problem.

To test the hypotheses, hierarchical linear regression analysis was conducted. The analysis was run with SPSS 25.0.0.1. In order to avoid multicollinearity problems with interaction terms, all met-

ric variables in the analysis were mean-centered (Dawson, 2014). In a first model, the effects of the control variables were tested. In the next step, the SEW dimensions and diversity of information sources were included to test the main effects. In the final model, the interaction terms of the SEW dimensions and diversity of information sources were included to test the moderation effects.

	1	2	3	4	5	6	7	8	9	10	11	12
1 Innovation measures	1	0.165***	-0.01	-0.185***	0.183***	0.113***	0.066*	0.051	0.193***	0.166***	0.321***	0.242***
2 Farm size in hectares		1	0.106**	-0.276***	0.206***	0.096**	0.014	0.116***	0.141***	0.023	0.129***	0.165***
3 Family farm generation			1	-0.084**	0.071*	0.107**	0.002	0.092**	0.062*	-0.068*	0.026	0.042
4 Sideline				1	0.129***	0.094**	0.001	0.086**	0.088**	0.004	0.177***	0.155***
5 Availability of financial resources					1	-0.066*	0.006	0.127***	0.084*	0.019	0.132***	0.044
6 Multiple natural disasters suffered						1	0.073*	0.054	0.032	0.028	0.048	0.113***
7 Family generations in management							1	0.226***	0.015	-0.049	0.058	0.042
8 Family generations in ownership								1	0.063	-0.044	0.057	0.034
9 Renewal of family bonds through dynastic succession									1	0.479***	0.598***	0.074*
10 Emotional attachment of family members										1	0.523***	0.065*
11 Identification of family members with the farm											1	0.149***
12 Diversity of information sources												1

n = 911; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

The results of the linear regression analysis are shown in Table 3.

with the farm has a positive effect ( $\beta = 0.235$ ,  $p < 0.001$ ). Furthermore, diversity of information

**Table 3.** Regression results (dependent variable: innovation measures)

Model	1		3		4	
	Beta	Robust S.E.	Beta	Robust S.E.	Beta	Robust S.E.
Farm size in hectares	0.091**	0.001	0.053	0.001	0.049	0.001
Family farm generation	- 0.053	0.042	- 0.051	0.041	- 0.058	0.040
Sideline	- 0.134***	0.082	- 0.084*	0.079	- 0.083**	0.079
Availability of financial resources	0.158***	0.047	0.129***	0.044	0.132***	0.044
Multiple natural disasters suffered	0.108**	0.076	0.078*	0.073	0.071*	0.072
Family generations in management	0.060	0.078	0.042	0.071	0.047	0.071
Family generations in ownership	- 0.007	0.081	- 0.008	0.079	- 0.006	0.079
Renewal of family bonds through dynastic succession			0.007	0.038	0.006	0.038
Emotional attachment of family members			0.020	0.041	0.028	0.040
Identification of family members with the farm			0.235***	0.040	0.218***	0.040
Diversity of information sources			0.178***	0.035	0.191***	0.033
Renewal of family bonds through dynastic succession * diversity of information sources					0.072	0.038
Emotional attachment of family members * diversity of information sources					0.041	0.040
Identification of family members with the farm * diversity of information sources					- 0.146***	0.037
R <sup>2</sup>	0.085		0.184		0.195	
Adjusted R <sup>2</sup> .	0.078		0.174		0.183	
$\Delta$ in R <sup>2</sup>	0.085***		0.099***		0.011**	

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; All VIF  $\leq 2$

Model 1, which controls for context variables, shows that farm size ( $\beta = 0.091$ ,  $p < 0.01$ ), the availability of financial resources ( $\beta = 0.158$ ,  $p < 0.001$ ) and multiple natural disasters suffered ( $\beta = 0.108$ ,  $p < 0.01$ ) contribute positively to the implementation of innovation measures. However, running the farm as a sideline business is negatively related to innovation measures ( $\beta = -0.134$ ,  $p < 0.001$ ). The effects of the family farm generation, family generations in management and family generations in ownership are not significant. Model 1 explains 8.5 % of the variance of the dependent variable.

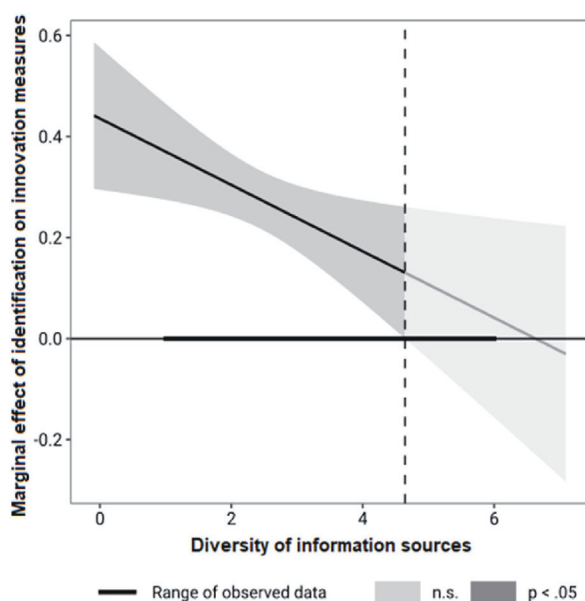
Model 2 additionally includes the SEW dimensions and diversity of information sources. Only one of the three SEW dimensions is significantly associated with the implementation of innovation measures. Identification of the family members

sources also has a significant positive effect ( $\beta = 0.178$ ,  $p < 0.001$ ) on innovation measures. This model contributes 18.4 % to the explanation of the implementation of innovation measures, 9.9 % of which are contributed by the independent variables.

Model 3 additionally includes the moderation effects between the SEW dimensions and diversity of information sources. In this final model, three context variables are significant, namely the occupation type sideline ( $\beta = -0.083$ ,  $p < 0.01$ ), the availability of financial resources ( $\beta = 0.132$ ,  $p < 0.001$ ) and multiple natural disasters suffered ( $\beta = 0.071$ ,  $p < 0.05$ ). Furthermore, as in the previous model, the identification of the family members with the farm ( $\beta = 0.218$ ,  $p < 0.001$ ) has a positive effect on the innovation measures. The other SEW dimensions have no

significant influence. Therefore, hypothesis 1c is supported, while hypotheses 1a and 1b are not supported. Diversity of information sources is significantly and positively related to innovation measures ( $B = 0.191$ ,  $p < 0.001$ ), which supports hypothesis 2. Regarding the moderating role of the diversity of information sources, the interactions with identification of the family members with the farm is significant and negative ( $B = -0.146$ ,  $p < 0.001$ ). The Johnson-Neyman technique is used in order to ascertain in which range of values the moderator unfolds its moderating effect (Hayes, 2013). Figure 2 shows that the positive marginal effect of identification of the family members with the farm on the implementation of innovation measures declines with an increasing value of diversity of information sources. The grey area depicts the 95% confidence interval. The marginal effect is significant, when both the upper and lower bound of the interval are on the same side of the zero line. This is the case, when diversity of information sources takes a value below 4.64, which is true for 95.17% of the sample. Thus, hypothesis 2c is supported. The interactions of diversity of information sources with the renewal of family bonds through dynastic succession and emotional attachment of family members are not significant. Thus, hypotheses 2a and 2b are not supported. This final model explains 19.5% of the variance of the dependent variable. Compared to Model 2, the difference in  $R^2$  is 1.1%, which represents the explanatory value of the moderation effects added in Model 3.

**Figure 2.** Marginal effect of identification of the family members with the farm on the implementation of innovation measures for different values of diversity of information sources



## 5. Discussion

### 5.1. Interpretation of the results

Innovation can be key for family farms to tackle the external threats posed by global competition and climate change (Palmer et al., 2001). However, farmers often do not see themselves as entrepreneurs (Haugen & Vik, 2008; McElwee, 2006) and are reluctant to innovate. These circumstances make innovation in family farms an interesting and important topic. The focus of this paper was directed at the question of “what drives innovation in family farms” and to investigate the role of the SEW dimensions renewal of family bonds through dynastic succession, emotional attachment of the family members and identification of the family members with the farm as innovation motives. Furthermore, this study investigated the role of diverse information sources as innovation facilitator and moderator in the relationship between the SEW dimensions and innovation measures.

#### 5.1.1. About the context of innovation in family farms

Regarding the context of innovation, the analysis has revealed that the conditions in family farms are difficult. The regression results show that family farms with fewer financial resources implement fewer innovation measures indicating that innovation requires a certain financial effort. However, financial resources are generally limited in agriculture (Poole, 2017), which is also confirmed by the descriptive results of this study. Less than half of the investigated farms possess enough financial resources that allow them to make investments that go beyond maintaining the status quo. Even less capital-intensive innovation measures may be restrained through a scarcity of financial resources due to psychological reasons because scarce financial means make it difficult to compensate possible future losses caused by failed innovations (Barbieri & Mahoney, 2009). This makes SEW as a motivator to overcome the psychological barrier of innovation in family farms all the more important.

Another significant context factor for innovation is the natural environment. The positive effect of multiple natural disasters suffered on innovation confirms that natural disasters are a big issue for family farms. However, it also shows that family farms have recognized innovation as a strategy to tackle this external threat. In the long run, climate change may contribute to an “entrepreneurial awakening” of family farms, which traditionally have been rather conservative.

#### 5.1.2. About SEW as a driver for innovation in family farms

The proposed positive effects of the SEW dimensions renewal of the family bonds through dy-

nastic succession and emotional attachment of the family members on innovation could not be supported. Renewing family bonds is a long-term goal. Usually, this long-term perspective can motivate innovation because the family farms understand that innovation is an investment in possible future gains (March, 1991) that bring the farm forward. However, when family farms are faced with immediate threats such as competitive pressure from international market players and climate change, they may develop a more short-term focus. Previous experiments have shown that people behave differently when threat is imminent opposed to when it is distant (Mobbs et al., 2007). Today, the question of the short-term survival of the farm might often times be more pressing than who will continue the family legacy. Thus, although family farms often strive to continue the farming business through intra-family succession, innovation decisions will probably be shaped by more immediate goals such as becoming more resistant to climate change or more independent from large food retailers rather than renewing the family bonds with the farm. The emotional attachment of the family members has probably not been proven relevant for the implementation of innovation measures because most family farms in the sample are managed by one person alone (62 %). When one person carries the main responsibility for the decisions, the relationships between the family members are less important for innovation decisions. Moreover, emotional attachment may not be effective on innovation because the deteriorating external conditions, a high workload and a low-income level (Crocket, 2004) may undermine their desire to continue their shared history by creating new common experiences and feelings. Yet, this study has shown that the identification of the family members with the farm significantly drives the implementation of innovation measures. If family members identify strongly with the family farm, they think of it as an extension of the family, which makes gains and losses of the farm feel like gains and losses of their own (Berrone et al., 2012). Thus, they will be particularly eager to secure the wellbeing of the farm. Furthermore, in farms with a strong identification of the family members, making a good impression on others is often an important goal (Berrone et al., 2010). Since innovation can foster resilience and adaptability in the context of external threats such as international competition and climate change and help to develop the farm sustainably, it is a way for family members to achieve their identity-driven goals. That way, strong identification can motivate family farms to innovate because innovation allows them to continuously benefit from the positive feelings they get out of

their identification with the farm. Depending on the farmer's type of identity, the significance of these motives may differ. Due to the strong value of tradition in agriculture, many farmers still do not think of themselves as entrepreneurs (Haugen & Vik, 2008; McElwee, 2006). They possess a producer-farmer identity (Stenholm & Hytti, 2014) and may fear that entrepreneurial activities weaken their identity as farmers (Padel, 2001). This identity is typically associated with a conservative strategic approach, which aims at operating profitably and expanding the farming capacity under the constraints of the prevailing social norms. Appearance vis-à-vis others is an important factor for their behavior (Burton, 2004), so that the family members of these farms will care a lot about the public image if their identification with the farm is strong (Berrone et al., 2010; Deephouse & Jaskiewicz, 2013). These farms will most likely prefer incremental adaptations that meet societal expectations. Farmers with an entrepreneur-farmer identity, on the other hand, strive to improve their farm actively by challenging prevailing social norms (Stenholm & Hytti, 2014). They are willing to take the risk of radical innovations and promote diversification and pluri-activity (Vesala & Vesala, 2010). Their identity builds on having control over their own farm and mastering externally imposed challenges rather than receiving approval from others. For them, having control produces a feeling of pride, which forms the basis of their identity (Dessein & Nevens, 2007). Innovation offers a chance to achieve that. Thus, although driven by different motives depending on the type of identity, family members who identify strongly with the farm will be more willing to innovate despite the uncertainty of the innovation's outcome. This confirms that innovation strategies and a family farming ideology do not necessarily exclude each other (Hildenbrand & Hennon, 2008). Furthermore, another reason for the positive effect of the family members' identification with the farm on the implementation of innovation measures is that identification is positively associated with organizational effectiveness, which means that goals are more likely to be realized if the identification is high (Barros et al., 2017). Therefore, the probability that innovative ideas are transferred into actual innovation measures is higher. Altogether and in line with previous research (e.g. Cabrera-Suárez et al., 2014; Eddleston, 2011), this study provides evidence that the identification of the family members with the business constitutes a key factor of family business behavior.

### 5.1.3. About the role of diversity of information sources for innovation in family farms

While motivations such as identification are the psychological cause for action (Schacter et al.,

2011) and are required to make entrepreneurial decisions (Edelman et al., 2010), information also affects the family farm's ability to innovate. Family farms that obtain their information from diverse sources will be able to recognize opportunities more easily (Gaglio & Katz, 2001), assess situations more accurately and find effective ways to achieve their goals (Zott et al., 2011). Furthermore, since information is the primary requirement to build knowledge (i.e. actionable information, Tiwana, 2001), it helps to put goals into action (Wilcox King & Zeithaml, 2003). As hypothesized, the diversity of information sources has a significant positive effect on the implementation of innovation measures. However, the role of diverse information sources for innovation is complex. The results also support the hypothesized negative moderation effect on the relationship between identification of the family members with the farm and innovation. This means that in family farms that use a greater diversity of information sources, identification of the family members with the farm has a weaker positive effect on innovation than in family farms that use less diverse information sources. This negative moderating effect can be explained by increased information ambiguity when information is retrieved from diverse sources. Ambiguous information can generate uncertainty (Stephens et al., 2021) and a feeling of loss of control over the situation (Budner, 1962). Persons with low tolerance for uncertainty may experience stress, be unable to make decisions and avoid uncertain situations (Dugas et al., 2005). Since innovation failure would reflect upon the family members' personal performance, abilities and self-worth and upon the family farm image when family members identify strongly with the farm, strong identification can cause a rather low tolerance for uncertainty. This seems to curb the positive effect that strong identification usually has on the implementation of innovation measures.

## 5.2. Practical implications

This study confirms findings from previous studies (e.g., Busse et al., 2014; Ulvenblad et al., 2018), which suggest that a lack of financial resources can inhibit innovation in family farms. Family businesses are often reluctant to raise external funds because they want to maintain their independence from lenders who could exert an influence on strategic decisions (Chrisman et al., 2015; Pijanowski, 2014). A study among wineries showed that compared to non-family businesses, the debt ratio in family businesses is significantly lower (Soler et al., 2017). However, relying too much on equity capital and government subsidies restricts a farm's entrepreneurial possibilities. In fact, external capital can facilitate innovation

and decrease dependencies from market developments, the climate and government subsidies. Since small businesses in traditional sectors often have difficulties to acquire bank loans for innovation investments (Harel & Kaufmann, 2022), family farms could make greater use of mortgages. A previous study shows that only very few family farms use this possibility to increase their chances of receiving a bank loan (Süss-Reyes et al., 2016).

Furthermore, in order to help family farms that are not yet entrepreneurially oriented to overcome their traditional patterns of thinking and increase the degree of their innovativeness, one could make use of their image-focused innovation motives. Showing these family farms appreciation for their manifold functions in the society, could strengthen their identification with the farm and increase their willingness to innovate. Farms do not only produce food and other agricultural products but also maintain the cultural landscape and rural infrastructure, provide space for tourism and leisure, keep the rural culture alive (Nolten, 2010) and prevent the soil from erosion (Gould et al., 1989). Furthermore, emphasizing the importance of their role for building an ecologically sustainable economic system can promote market-pull innovations aiming at pollution prevention or protection of biodiversity (Ma et al., 2017). These can make the family farm more competitive and resilient against climate change. Since behavior and identity reciprocally influence each other (Bem, 1972; Crocetti et al., 2014; Quan et al., 2021), promoting the innovation behavior of family farms with a producer-farmer identity, may trigger an identity change towards an entrepreneur-farmer identity. This study also showed that the diversity of information sources has a positive effect on innovation. Since in family businesses family, social and business networks typically overlap (Seaman et al., 2014), the access to diverse information sources is potentially high in family farms. Using this potential effectively is important for innovation. A study by Lambrecht et al. (2014) shows that building sustainable networks with different types of partners inside and outside of the agricultural sector can support innovation in different ways: suppliers, customers and research institutions are the best knowledge-sharing partners for product innovations, whereas suppliers, customers and peer farmers can help best with process innovations. Marketing innovations can be facilitated through the exchange with peer farmers and customers. Knowing which information sources are most suitable for which innovation types, may help to decide which information to trust when there is information ambiguity. For instance, when aiming to improve the awareness

for and attractiveness of one's products with a marketing innovation, customer feedback or experiences from peer farmers may be more relevant than information from suppliers or researchers.

Moreover, the results indicate that high identification of the family members with the farm decreases their tolerance for uncertainty. Since intolerance of uncertainty biases a person's perception and interpretation of as well as emotional and behavioral response to uncertain situations (Dugas et al., 2005), it is important to foster a family farm's tolerance for uncertainty in order to be better able to handle ambiguous information from diverse sources and use it constructively. Studies on health science education show that tolerance for uncertainty is a dynamic state that can be promoted through repeated exposure to decision-making in uncertain situations (Stephens et al., 2021). Thus, family farms could constantly and consciously collect and reflect information from diverse sources to lose their fear of making decisions based on ambiguous information.

### 5.3 Contributions

This study takes a first step in overcoming disciplinary boundaries by bridging three independent research fields: agricultural research, innovation research and family business research. It applies the established SEW perspective from family business research to a sample of family farms and integrates agricultural, innovation and family business literature in the analysis. Thereby it includes a variety of discipline-specific paradigms, which offers a great potential for a differentiated view (Suess-Reyes & Fuetsch, 2016) and contributes to a cumulative progress of knowledge. Traditionally, family farms' purpose was to supply the family with food and essential goods for living (Friedmann, 1980). Today, they are part of the international economic system and forced to compete with other market participants. In this environment, innovation is key to survive (Ahmad et al., 2021). Although innovation in family businesses has been extensively investigated over the past years, farming, which constitutes a specific context for innovation, has still not been considered enough so far (Suess-Reyes & Fuetsch, 2016). This study advances the understanding of family farms by shedding light on the motives driving innovation in this specific business type and makes propositions for how to enhance family farms' innovativeness.

With the focus on family farms, this study also addresses the call from Calabrò et al. (2019) to account for the heterogeneity of family businesses, which has previously often been ignored in entrepreneurship research. Industry-specific studies like this one refine our understanding of

innovation behavior in general. The agricultural industry poses a specific context where traditionality and high environmental dynamism come together. Given these circumstances, investigating drivers of innovation have shown that identification of the family members with the farm is a key motive for innovation because the farm constitutes the identity base and the primary goal is to secure its survival. Diversity of information sources can cause uncertainty that unsettles family farms and impairs this motivating effect. Nevertheless, it increases the innovation ability by expanding the awareness and action horizon. Furthermore, this study also contributes to the SEW literature. While the majority of prior studies drawing on the literature of SEW uses a unidimensional measurement (Filser et al., 2018), this study differentiates between multiple socioemotional aspects as postulated by other researchers (e.g. Chua et al., 2015). Identification of the family members with the farm turns out to be an important socioemotional driver for family farms' innovation behavior, while the renewal of family bonds with the farm and emotional attachment of the family members are not. The different results for the SEW dimensions confirm the importance of using a multidimensional measurement. Furthermore, this study makes an important contribution to the literature of SEW by confirming the results of previous studies (Cabrera-Suárez et al., 2014; Eddleston, 2011), that the identification of the family members with the farm is the key socioemotional driver for family business behavior and by answering the call of Martínez-Alonso et al. (2018) to conduct more research on the relationship between the SEW dimensions and innovation.

### 5.4. Limitations and future research

This study is based on a sample of family farms with various production foci. Depending on the production focus (or production foci), these farms may be confronted with different conditions. For instance, they may have to follow different regulations or be more or less affected by natural disasters. These conditions can change how SEW influences innovation and what role the diversity of information sources plays. Furthermore, the emotional endowments of family businesses are heterogeneous, which can result in different SEW for different types of businesses (Martínez-Romero & Rojo-Ramírez, 2016; Zellweger & Dehlen, 2011). Although, by investigating family farms, this study has already narrowed the focus to a more homogeneous group of family business, reducing the heterogeneity even further, e.g. by distinguishing between different production foci, could help to generate more differentiated results on SEW and the innovation behavior of family farms.

Another interesting research avenue arises from the different results for the SEW dimensions since only the identification dimension turned out to have a significant effect on the implementation of innovation measures. This could be due to the concurrence of traditionality and environmental dynamism, which causes family farms to use innovation to defend the family member's most important identification base, i.e., the farm, against external threats. However, the immediacy of the threats may relativize the importance of long-term goals such as the renewal of family bonds. Furthermore, the composition of the family probably influences the role of the emotional attachment of the family members for the innovation behavior. The ambiguity of the results from previous studies on the effect of SEW on innovation, which was discussed in the hypothesis development section, underlines the context-dependency of the SEW influence. This calls for literature studies that specifically analyze how the observed effects of SEW on innovation vary depending on the internal and external conditions under which family farms operate.

### 5.5 Conclusion

Conclusively, identification of the family members with the farm is a strong motivational driver for innovation in dynamic and competitive environments and although this positive effect is limited by the ambiguity that can be caused by the use of diverse information sources, the most innovative family farms are those with strong identification of the family members combined with a high diversity of information sources.

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## Appendix

Table A1: Measurements						
<b>FARM SIZE IN HECTARES</b> <i>How many hectares of land do you farm?</i>						
_____ hectares						
<b>FAMILY FARM GENERATION</b> <i>Which generation currently runs the farm? (founder generation = 1<sup>st</sup> generation)</i>						
<input type="radio"/> 1 <sup>st</sup> generation <input type="radio"/> 2 <sup>nd</sup> generation <input type="radio"/> 3 <sup>rd</sup> generation <input type="radio"/> 4 <sup>th</sup> generation and higher						
<b>OCCUPATION TYPE</b> <i>In which form do you run the farm?</i>						
<input type="radio"/> main occupation <input type="radio"/> sideline (i.e. the farm manager additionally generates income from another occupation)						
<b>AVAILABILITY OF FINANCIAL RESOURCES</b> <i>How do you rate the current financial situation of your farm considering all resources available on short call?</i>						
1 <input type="radio"/> very few financial resources are available, which makes it difficult to run day-to-day operations						
2 <input type="radio"/> financial resources to run day-to-day operations are available (smaller investments)						
3 <input type="radio"/> financial resources for medium investments are available						
4 <input type="radio"/> financial resources for larger investments are available						
<b>NATURAL DISASTERS SUFFERED</b> <i>Was your farm hit by natural disasters (e.g., heavy hail, floodings, storms, droughts) <u>to a substantial extent</u> in the past five years?</i>						
<input type="radio"/> never <input type="radio"/> once <input type="radio"/> multiple times						
<b>INNOVATION MEASURES</b> <i>Measured against comparable farms, in the last five years we have implemented innovation measures in the following areas in our farm:</i>						
	<i>Much less</i>					<i>Much more</i>
new devices/machines	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>	6 <input type="radio"/>
operation buildings	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>	6 <input type="radio"/>
new resources adapted to soil conditions (e.g., fertilizers, seeds)	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>	6 <input type="radio"/>
new procedures (e.g., animal husbandry, irrigation, organic farming)	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>	6 <input type="radio"/>
new animal or plant species	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>	6 <input type="radio"/>

RENEWAL OF FAMILY BONDS (adapted from Hauck et al., 2016)						
<i>How much do you agree to the following statements regarding your family farm?</i>						
In our family farm...	<i>Strongly disagree</i>					<i>Totally agree</i>
... continuing the family legacy and tradition is an important goal for my family farm.	1○	2○	3○	4○	5○	6○
... successful farm transfer to the next generation is an important goal for family members	1○	2○	3○	4○	5○	6○
... we are very eager to avoid selling the farm.	1○	2○	3○	4○	5○	6○
EMOTIONAL ATTACHMENT OF FAMILY MEMBERS (adapted from Hauck et al., 2016)						
<i>How much do you agree to the following statements regarding your family farm?</i>						
In our family farm...	<i>Strongly disagree</i>					<i>Totally agree</i>
... the emotional bonds between family members are very strong.	1○	2○	3○	4○	5○	6○
... strong emotional ties among family members help us maintain a positive self-concept.	1○	2○	3○	4○	5○	6○
... family members feel warmth for each other.	1○	2○	3○	4○	5○	6○
IDENTIFICATION WITH THE FARM (adapted from Hauck et al., 2016)						
<i>How much do you agree to the following statements regarding your family farm?</i>						
In our family farm...	<i>Strongly disagree</i>					<i>Totally agree</i>
... family members feel that the family farm's success is their own success.	1○	2○	3○	4○	5○	6○
... the farm has a great deal of personal meaning for family members.	1○	2○	3○	4○	5○	6○
... family members are proud to be part of the family farm.	1○	2○	3○	4○	5○	6○
... it is very important to family members to work in the farm.	1○	2○	3○	4○	5○	6○
DIVERSITY OF INFORMATION SOURCES						
<i>In our family farm our decisions are guided by... (Multiple answers possible)</i>						
<input type="checkbox"/> informal exchange with colleagues. <input type="checkbox"/> industry meetings. <input type="checkbox"/> industry magazines. <input type="checkbox"/> performance indicators. <input type="checkbox"/> individual counselling by the Chamber of Agriculture. <input type="checkbox"/> international events.						