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How does gender shape the adoption of sustainable agricultural practices? Evidence from Belgium

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ABSTRACT

While many studies focus on the adoption of sustainable agricultural practices (SAP), gender is an often-overlooked factor in research on high-income countries, especially in Europe. This is remarkable as women constitute a substantial and increasing part of the agricultural workforce, and the gender disparities they face are gaining attention from civil society and policy makers. We address this research gap by exploring how gender shapes the adoption of SAP in the field crop sector in Wallonia, Belgium. We conduct semi-structured interviews with 29 farmers and a thematic analysis, distinguishing between the practices of reduced input use, soil conservation and agrobiodiversity. Our results suggest that gender plays a key role in SAP adoption, and acts as a mediating factor in terms of attitudes and perceptions about SAP, farms' economic diversification, membership of farmer groups, access to equipment and advisory services, and dependency on outsourcing. Some of these act as enablers for women farmers but most represent barriers. We reveal some novel insights, particularly linked to the field crop sector, which represents 24 % of European land use and tends to be more masculine than other previously studied sectors. To stimulate the adoption of SAP, policies should prioritize gender-inclusive agricultural environments and address women-specific challenges. Greater inclusion could encourage more women to pursue farming careers, thereby enhancing their skills, training and confidence. It would also foster knowledge-sharing, resource access, and technical support, which are all crucial for higher levels of SAP adoption.

1. Introduction

Since the 20th century, farming systems in high-income countries have deeply transformed, due to the increased use of synthetic inputs and mechanization, and the selection of high-yielding crops. While these changes have brought large productivity gains, their negative environmental impacts have been increasingly demonstrated (Candel, 2022; Webb et al., 2020). In response, a growing body of research has explored the factors that influence the adoption of sustainable agricultural practices (SAP), including reduced synthetic input use, soil conservation and agrobiodiversity (e.g. Canessa et al., 2024; Dessart et al., 2019; Godfray et al., 2010).

Yet, this extensive literature has largely failed to understand how gender shapes the adoption of SAP in high-income countries, as most studies are "gender-blind" (Ball, 2020; Canessa et al., 2024; Foguesatto et al., 2020; Serebrennikov et al., 2020). This is remarkable given that women constitute a substantial and increasing part of the agricultural workforce; e.g. 23 % in Europe in 2020 (Eurostat, 2025). Civil society and policy makers have recently started to recognize the crucial role women can play in agricultural sustainability as well as the gender disparities they may face (Buraud et al., 2023). The limited evidence for high-income countries is in sharp contrast to research focusing on lower-income countries, which has highlighted specific challenges that women farmers face regarding SAP adoption, such as lower bargaining power, higher vulnerability to climate shocks and unequal access to capital, information, land, and resources (Alvi et al., 2021; Ball, 2020; Doss, 2013; Jain et al., 2023; Meinzen-Dick et al., 2014, 2019). While this research is highly informative, gender dynamics might be different in high-income countries due to environmental, social and political differences (Ball, 2020; Meinzen-Dick et al., 2014; Williams et al., 2024).

The few case studies on gender and agriculture in high-income countries identify a significant role of women in the adoption of SAP, but are limited in geographical and sectoral scope. Most of these contributions are situated in the United States (Barbercheck et al., 2014; Chiappe and Butler Flora, 1998; Leslie et al., 2019; Pilgeram and Amos,

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2015; Trauger, 2004; Trauger et al., 2010). Moreover, these case studies usually focus on women farmers solely, not investigating how masculinity interacts with SAP adoption (Azima and Mundler, 2022; Peter et al., 2000; Sachs, 2023). In addition, these studies rarely zoom into the specific agricultural practices, thereby providing limited understanding of the agronomic impact of gender. Also, because these studies focus on alternative systems, such as small-scale organic or agroecological farms, they often exclude the large majority of farming systems, such as field crops. Field crops comprise 24 % of land use in Europe, and are characterized by intensive synthetic input use and highly mechanized production systems, making them particularly relevant for the investigation of SAP adoption (Carrola et al., 2014; Eurostat, 2021).

We address these limitations by investigating how gender shapes the adoption of SAP in field crop farms in Wallonia, the southern region of Belgium. We opt for a qualitative approach as this provides a more in-depth analysis of little-known phenomena (Castleberrya and Nolen, 2018). We conduct semi-structured interviews with 29 farmers, including 11 women and 18 men.[1] Our sample comprises a wide range of different adoption intensities of several SAP, including reduced input use, soil conservation and agrobiodiversity,[2] and a variety of decision-making positions for men and women farmers. Through a thematic analysis, we answer our main research question: how does gender mediate the factors that influence the adoption of SAP in field crops? This question allows us to contribute to a better understanding of the interactions between gender and SAP adoption in a more systemic way. It also allows us to link gender to specific SAP, thereby contributing to policy debates on both social and environmental sustainability in agriculture.

2. Literature review

2.1. Sustainable agricultural practices

Sustainable agricultural practices (SAP) in field crops can be grouped into multiple broad categories[3] (Gerrard et al., 2011; Scialabba, 2014; Zahm and Girard, 2023). The first category of SAP is related to a reduced use of synthetic pesticides and mineral fertilizers. For pesticides, it involves reducing the number of active substances, choosing less harmful options, and adopting good spraying practices, such as anti-drift gels, air injecting booms, and spraying outside pollinator activity periods. For fertilizers, it emphasizes balancing mineral and organic inputs and optimizing application techniques. The second category of SAP is related to soil conservation practices, which focus on reducing the depth and frequency of mechanical soil disturbance, maintaining constant soil cover, and incorporating straw and crop residues into the soil (Ferdinand and Baret, 2024; Knowler and Bradshaw, 2007). The third category of SAP is related to agrobiodiversity. This involves increasing crop diversity through spatial and temporal crop rotation, integrating variety mixes, and incorporating landscape elements such as headlands, grass strips, hedges, ponds, agroforestry and isolated trees. These categories are highly interconnected. For example, increasing agrobiodiversity helps reduce pesticide use and prevents soil degradation (Gerrard et al., 2011). As a result, SAP are often combined within farming systems such as conservation agriculture, organic farming, and agroecology.

Policy trends move towards higher SAP adoption across Europe but at a slow rate (Candel, 2022; Finger, 2024; Finger and Möhring, 2022; Guyomard et al., 2023). In 2021, 10 % of total European agricultural land was organically certified compared to 3 % in 2000 (European Environment Agency, 2023)). Mineral fertilizer use dropped by 16 % between 2017 and 2022, while pesticide use decreased by 6 % since 1990 and number of active substances dropped by 46 % (Eurostat, 2024; Schneider et al., 2023). However, the percentage of reported monitoring sites with pesticides exceeding thresholds both in surface and in groundwater in Europe are similar to those of a decade ago (European Environment Agency, 2024). Despite this limited progress, policy ambitions have downsized in recent years (Finger et al., 2024).

2.2. The role of gender in the adoption of sustainable agricultural practices

Most studies that investigate the factors influencing the adoption of SAP are based on the Theory of Planned Behavior (TPB) (Serebrennikov et al., 2020). Originally developed by Ajzen (1991), the TPB is a useful framework to address the complexity of farmers' adoption processes, which is a direct function of attitudes, social norms, and perceived behavioral control. Rather than relying on the assumption that farmers base their decisions on a rational evaluation of profitability, the TPB recognizes that the intention to adopt a practice is also a function of attitudes and social norms (Serebrennikov et al., 2020; Wauters and Mathijs, 2014). To improve the understanding behind the TPB, Serebrennikov et al. (2020) distinguish between categories of factors that influence SAP adoption: 1) socio-demographic factors such as gender, age, experience and education level; 2) individual factors such as environmental attitudes, personal habits, tolerance to risk, perception of SAP and social norms; 3) farm factors such as size, land tenure, geo-climatic characteristics, farm revenue, farm composition and localization; 4) external factors such as extension services, advisory services, media, relationships and farm organizations; and 5) institutional factors such as fiscal and regulatory policies and market stability.

While most of these categories present rather consistent results, the socio-demographic factors show mixed results, particularly regarding gender (Burton, 2014; Coulibaly et al., 2021; Rizzo et al., 2023; Serebrennikov et al., 2020; Tey and Brindal, 2012). This can be explained by the fact that gender does not influence SAP adoption through a simple, linear correlation (Burton, 2014). For instance, while women can have more positive perceptions of SAP, their reduced access to information and assets could prevent them to effectively adopt SAP. For this reason, it is important to analyze gender as a mediating factor.

The concept of gender refers to the differences in roles, behaviors and identities between men, women and other gender identities. These differences are created through social, cultural and historical processes that define the frontiers between these identities. Therefore, we briefly outline how the role of women in agriculture in Europe has changed over time. The profound transformation processes that affected farming systems during the 20th century dramatically increased labor productivity levels, thereby requiring fewer workers (Mazoyer and Roudart, 1997). Over time, field work became a highly mechanized task, often carried out by men (Lagrave, 1983; Tchékémian, 2014). As a result, a gendered division of labor was developed: agricultural work, particularly fieldwork, became masculine while women became responsible for administrative tasks, domestic work and agricultural assistance to their spouses (Lagrave, 1983; Seuneke and Bock, 2015; Tchékémian, 2014). The lack of official descriptors for their occupation led women farmers to be considered as "without profession" or "housewives", resulting in their invisibility in official farm manager censuses (Lagrave et al., 2021; Pilgeram et al., 2020). In the 1990s, the official status "farmer's spouse" was coined to define the occupation of farm women (Tchékémian, 2014;

[1] We acknowledge that gender is a fluid concept and that a binary distinction between men and women overlooks other gender dynamics. However, in our study, we only encountered respondents who self-identified as men or women.

[2] Other SAP categories include water and energy use efficiency, but these are less relevant in our context. Field crops in Wallonia are rainfed, so the adoption of more efficient irrigation techniques is not a priority. Energy efficiency is mostly related to gasoline use for tractors, which was not brought up during the interviews.

[3] The term "sustainable agricultural practices" rarely finds a unique definition and can include many different concepts. While we recognize the social and economic pillars of sustainability, the terms SAP used in this study pertain to environmentally sustainable practices.

Tourtelier et al., 2023).

The few studies on gender and SAP adoption in high-income countries have pointed to four main differences between men and women farmers. First, women face greater challenges in accessing land in conventional farming systems, as inheritance practices often favor men (Pilgeram and Amos, 2015; Tourtelier et al., 2023; Trauger, 2004). As a result, they tend to manage smaller farms (Ferto and Bojnec, 2025; Schmidt et al., 2021; Tourtelier et al., 2023; Trauger et al., 2010). Second, women are traditionally less involved in mechanized work and the operation of heavy machinery, instead performing more manual labor (Tourtelier et al., 2023; Trauger, 2004). Third, due to their traditional domestic roles as cooks and caretakers, women farmers tend to be more aware of health issues related to synthetic inputs, particularly pesticides (Chiappe and Butler Flora, 1998; Tourtelier et al., 2023; Trauger, 2004). Fourth, women are more likely to participate in short food supply chains as they often appreciate the direct social contact with customers more (Azima and Mundler, 2022; Schmidt et al., 2021; Trauger et al., 2010; Wells and Gradwell, 2001). Studies on gender have mostly focused on women farmers' experiences, and few studies focus on masculinity as influencing SAP adoption. These studies have highlighted interesting interactions between masculinity and SAP, such as how masculine social norms such as strength, autonomy, control and stoicism echo conventional practices (Azima et al., 2024; Peter et al., 2000; Saugeres, 2002).

These differences may contribute to a higher adoption of SAP among women. Farming systems that emphasize SAP require less mechanization and fewer synthetic inputs but are more labor-intensive, which aligns with the smaller farm sizes often managed by women and their traditional roles on farms (Leslie et al., 2019; Trauger, 2004; Unay--Gailhard and Bojnec, 2021; Wells and Gradwell, 2001). Additionally, farming systems that rely on selling through short food supply chains are more commonly associated with SAP adoption (Enthoven and Van den Broeck, 2021). The few case studies with a substantial representation of field crop farms find that women-led farms are more likely to adopt agrobiodiversity measures, especially landscape elements (Ferto and Bojnec, 2025; Unay-Gailhard and Bojnec, 2021).

It is important to note that most studies investigating gender in agricultural settings have done so through a binary man/woman lens (Pfammatter and Jongerden, 2023). This binary understanding of gender excludes LGBTQ + people who do not identify with neither of these binary identities. Studies specific to LGBTQ + farmers have also investigated discriminations in agricultural settings and how this affects their experiences and their farming practices (Hoffelmeyer et al., 2023; Leslie, 2017, 2019).

3. Methodology

3.1. Research area

Our case study is located in Wallonia, the southern region of Belgium, covering 55 % of the country (i.e. 16,901 km^2). According to the 2020 national agricultural census data, men represent 76 % of all 11,970 farmers[4] in Wallonia (Statbel, 2020). There are three main legal statuses that describe farmers: 1) farm managers, defined as the person with the highest responsibility of daily farm management, 2) farmers' spouses, who work on the farm with their spouse and often have a lower level of responsibility, and 3) other family members who work on the farm as well. Men farmers are mostly represented in farm manager positions, with 87 % men and 13 % women, while women farmers are mostly represented in the position of farmers' spouses, with 83 % women and 17 % men. The majority of other helping family members are men as well (79 %).

We focus on the field crop sector, which represents 56 % of agricultural land in the region and is situated in the loam belt (Statbel, 2022a). Field crops comprise cereals, forage maize, potatoes, sugar beets, temporary grassland and field vegetable production. They represent 24 % of total agricultural productivity in Belgium with € 2747 million of produced value in 2022 (Statbel, 2022b). The use of pesticides, fertilizers and mechanization is typically intensive while the adoption of SAP is relatively low. For example, only 10 % of the field crop farms were organically certified in 2023. As the sector is rainfed, water efficiency issues are less relevant than in irrigated sectors.

3.2. Data collection and sample

The sampling method is a combination of convenience sampling and snowball sampling. We interviewed farmers until data saturation was reached, and no new insights emerged, with a sufficient variation in terms of SAP adoption, and men's and women's decision-making positions. Our requirements for variation in SAP were to interview both organic and non-organic farms, with the latter comprising more intensive, productivist agricultural systems as well as farms specialized in conservation agriculture and less intensive systems. Our requirements for decision-making positions were to have at least two participants of each gender with high and low decision-making responsibilities. After the interview with the 16th participant, no new concepts emerged from the interviews, so the 13 additional participants were interviewed for sample variation purposes, and to ensure a conservative data saturation claim. The final sample includes 11 women and 18 men,[5] coming from 22 farms, of which seven are organically certified (Fig. 1). Compared to similar studies, our sample is considered relatively large. For instance, Tourtelier et al. (2023) conducted a similar study with a sample of 10 participants from France; Azima et al. (2024) also conducted a similar study with a sample of 19 farmers from Québec; or Trauger (2004) who conducted a study with a sample of 20 farmers in Pennsylvania, USA.

The distribution of the sample is representative for the distribution of field crop farms in Wallonia, which are dominantly situated in the loam belt, the Northern part of the region (Statbel, 2022a). Table 1 provides data over each interview while Table A1 gives a detailed description of the sample, as well as the code that is used to describe the participants in the discussion.

We collected qualitative data through semi-structured interviews, which are a popular data collection method used in qualitative methods (Alvesson, 2003). These interviews are based on a few open-ended questions that provide a flexible framework for in-depth discussions, allowing us to ask as many follow-up questions as needed. This allows researchers to investigate and understand how participants' experiences influence their actions and their attitudes (Qu & Dumay, 2011). A preliminary step was taken at the beginning of each interview to describe the anonymization process, and to gather consent from participants to record the discussions and to use the data in our research. Additionally, to ensure that participants were comfortable, it was specified that they could decline to answer any given question during the interview. The first section of the interview guide (Table A2) aimed at presenting the participant and the farm. The second section of the guide focused on our research questions and contained three main questions that could later be triangulated. This allowed for 1) a thorough discussion on farming practices with no specific focus on gender, 2) a thorough discussion on gender dynamics in agriculture with no specific focus on SAP adoption, and 3) a discussion identifying links between gender and farming practices directly. The last section of the interviews was dedicated to closing statements and sharing additional contacts. This was especially useful to find missing profiles from our sample such as women farmers being sole decision makers on their farm.

[4] The term farmer used in this study excludes non-family paid workforce, also known as "agricultural employee".

[5] Although our methodology welcomed non-binary gender identities, all of the participants identified either as man or woman, and did not provide any data on how non-binary gender identities might influence farmers' experiences.

Fig. 1. Location of the 22 sampled farms in Wallonia. Source: DA_ SPW ARNE.

Table 1
Summary of the interviews and farm characteristics (Low/Medium/High indicate level of SAP adoption).

Date of interview	Participants' ID	Interview joint/separate & length	Province	Farm management	Farm size (ha)	Inputs	Soil conservation	Agro-biodiv.
18/03/24	M1	86 min.	Walloon Brabant	M1	100	Medium	Medium	High
18/03/24	M2	133 min.	Walloon Brabant	M2	65	High	Medium	High
20/03/24	M3	68 min.	Walloon Brabant	M3	70	Medium	Medium	Med
20/03/24	M4, M5	Separate 80min.	Walloon Brabant	M5, M4 helping father	125	Medium	Low	Low
20/03/24	W1, M6	Separate 97 min.	Walloon Brabant	M6, W1	100	High	Low	Medium
22/03/24	M7	75 min.	Liège	M7	400	High	High	High
23/03/24	M8, W2	Joint 107 min.	Walloon Brabant	M8, W2 assisting small tasks	146	Medium	Low	Low
23/03/24	W3	35 min.	Hainaut	W3 and husband (not interviewed)	50	Low	Low	Low
25/03/24	W4, M9	Separate 111 min.	Namur	W4, husband M9 manages own farm	140	Low	Low	Low
25/03/24	W5	80 min.	Namur	W5 and husband (not interviewed)	120	Medium	Low	Low
26/03/24	M10	103 min.	Walloon Brabant	M10	108	Medium	High	Medium
26/03/24	M11	124 min.	Walloon Brabant	M11	150	High	Medium	High
26/03/24	M12, W6, M13	Joint 47 min.	Namur	Couple M12 & W6 and their son M13	150	Medium	Medium	Low
27/03/24	M14	105 min.	Hainaut	M14	25	High	Medium	Medium
27/03/24	W7	70 min.	Hainaut	W7, and husband (not interviewed)	140	Medium	Medium	Medium
29/03/24	M15	76 min.	Hainaut	M15 and wife (not interviewed)	125	Medium	Low	Low
29/03/24	M16	78 min.	Walloon Brabant	M16	25	High	Medium	Medium
04/04/24	W8	40 min.	Walloon Brabant	W8, and husband (not interviewed)	150	Medium	Low	Low
04/04/24	M17	86 min.	Luxembourg	M17	64	High	High	High
10/04/24	M18	102 min.	Walloon Brabant	M18	200	High	High	High
01/05/24	W9, W10	Joint 102 min.	Walloon Brabant	W9 with helping mother	40	Low	Low	Low
01/05/24	W11	77 min.	Walloon Brabant	W11	120	Low	Low	Low

The interviews were conducted in March, April and May 2024 by one female interviewer and one queer female interviewer. The gender of the researchers likely influenced the discussions, both because women farmers might have felt more comfortable sharing discrimination experiences, and because men might have refrained from sharing sexist views. If multiple farmers from the same farm were willing to participate in the interviews, we asked if they were willing to do the interviews separately or jointly.

3.3. Data analysis

Our analysis follows a thematic approach informed by the Theory of Planned Behavior (TPB), originally developed by Ajzen (1991), and particularly the TPB-based framework developed by Serebrennikov et al. (2020) (Figure A3). This framework categorizes factors influencing SAP adoption into five groups: socio-demographic, individual, farm, external, and institutional factors. We adopted this framework to structure our thematic analysis for its ability to highlight the transversal links between gender and SAP adoption.

We applied Gioia's methodology to guide the thematic analysis in a transparent and robust way (Gioia, 2021; Gioia et al., 2013, 2022). Interview transcripts were coded for gender and SAP-related content, and two subsets of all mentions of gender and barriers/enablers of SAP were created. We identified 1st order concepts within these subsets and cross-analyzed them to retain only those where links between gender and SAP could be identified. The 39 resulting 1st order concepts were grouped into 2nd order themes and categorized in five factors using the TPB-informed framework. We added a sixth category, "masculinity," to provide a useful introduction on gender dynamics in agriculture in the results. The coding process is visualized in Figure A4 in the appendix.

To enhance the transferability of our results and provide more detailed information on specific farming practices, we disaggregate the data on key SAP categories: 1) input use (e.g., reduced PPP/fertilizer use, organic certification), 2) soil conservation practices, and 3) agro-biodiversity (e.g., crop diversity and landscape elements). These three categories represent the main challenges in the Walloon field crop context.

4. Results

4.1. Masculinity

The first fundamental observation is that the field crop sector is a masculine system. Out of the 22 farms in the sample, 12 are managed by men, seven are managed as a couple and only three are managed by women. Most other actors involved in the agricultural sector, like veterinarians, extension agents and salesmen, are also men. For instance, W5 described her surprise when she left her career to work as a farmer's spouse with her husband:

> *"I was noticing it was only men, all the time. The retailers are mostly men; there are very few women that come. […] I only see men."*

Field crops were also described as being especially masculine compared to other sectors, for instance by W7:

> *"I think that in this sector [women] are not very frequent. In horticulture or in vineyards in France there's maybe a bit more women. In the field crop sector, frankly, there's really not a lot of women. In 2024 I still get asked "So, do you drive the tractor?" That's the question: Do you drive the tractor?"*

On all farms in our sample, the mechanized work is done by men while women are usually responsible for administrative work, animal care, small assisting tasks and manual labor like weeding. Every woman farmer in our sample identified machinery as the major hurdle that prevents them to take part in field work. For instance, W7 explained that although the new generation of farmers is more inclusive of women, machinery remains an important hurdle for women:

> *"If there are no women it's because it's the old generation. Although there is one truth, it's that the field work, the tools, the machinery, it's dimensioned for men. […] Before mechanization, women went to the fields, they would turn the hay, mow the grassland, make sheaves of wheat. The work was also divided, but women were in the fields."*

M8 explained that he never encounters women when he goes out to do field work:

> *"I went to a meeting for chicory, they do one meeting per year, and there was maybe two or three women in the crowd, there were about a hundred of us. [Sexism] remains despite everything because it's mostly men in the fields. When I go spraying at five or six in the morning, it's always the same ones, all men. I don't have a memory of ever seeing a woman."*

These gendered differences are reproduced and transmitted over generations. W2 explained the difference between the upbringing between boys and girls in farming families:

> *"The boy goes to the fields with his dad, because he is more attracted to machinery. Here, the girls, I have never wanted them to go near the machinery and the tractors. […](to her husband) If we had had a boy, do you think he would have come with you on the tractor? M8: Yes, there is a difference at that level."*

This is, in turn, linked to the inheritance of farms and land, which is traditionally done from father to son. Of the 22 sampled farms, seven are planned to be taken over by sons while only four by daughters.[6] In three of the seven farms designated for transmission to sons, a daughter also expressed interest. However, as soon as the sons showed any interest, the transfer was automatically directed to them. Multiple participants also expressed that it was very important to have boys in a farming family. For instance, M2, who is aware of gender discrimination in agriculture and does an effort to fight them, mentioned:

> *"I fight for [the stereotypical gendered labor division] to not be the case, but there are little spaces where it intervened. With the idea of having a child, I could not imagine something else than a boy, at first. We kept the surprise until the last moment and, in the end, I hoped for it to be a girl, and I regret not having any, because we had two boys. There are still stereotypes but we fight to make them disappear."*

For these reasons, farming was described by W5 as a "macho" world, and sexism and discriminations were described as the norm by many participants, like W1:

> *"It's not easy being accepted. We get comments and we get cut off when we're talking, they're not listening to what we are saying. It's as if I was absent."*

However, participants noted that an increasing number of women are becoming farm managers and doing fieldwork, and that gender norms are evolving towards better inclusivity of women. For instance, M11 said:

> *"There has always been a patriarchy in farms, it was often the boys who took over. However, I am seeing an increasing number of cases where girls take over."*

These assertions on women farmers' agency also relied a lot on the future generation of women farmers. For instance, W11 shared her enthusiasm when seeing younger women at the biggest agricultural fair in Belgium:

[6] Nine farms did not know who would take over the farm, indicating worries about generational renewal.

"And in fact, in Libramont, you see young girls with long nails that drive the machines, and you think "Snap, there has been a change at some point.". […] It's a different education that does this."

4.2. Socio-demographic factors

Two socio-demographic factors were brought up by the participants: age and agricultural training levels. Most men farmers follow a traditional trajectory towards farming with an informal education, often within the family, then a formal education, and an early takeover of the family farm. This is the trajectory of 14 out of 18 men farmers in our sample and one woman out of 11. Women farmers, however, tend to follow a different trajectory, where they are encouraged to follow a non-agricultural career, and come back to the family farm later in their lives. In most of these cases, they leave a non-agricultural career and either start working with their spouse or they take over the family farm. A striking element brought up by multiple participants is that when women become farm managers, it is often because the family farm is left without a succession after a loss. W5 explained:

« When it's a woman farm manager, it's because there has been a tragedy, it's because the husband passed away. That's how it is, the only women I know as head of farm, there has been a tragedy."

Another key difference is women's more limited agricultural training compared to men, as W9 described:

"Sometimes you need to dare to trust yourself. But me, because I did not do agricultural studies, I learned late. And the [mandatory courses to access the farming profession] are good, that's great, but 2 years of evening classes doesn't replace a bachelor's or a master's degree. And it doesn't replace 50+ years of field experience either."

These differences in trajectory towards farming result in men being younger and more trained when they start their career, which was identified as an important factor of SAP adoption. M2 explained that transitioning towards sustainable farming is a long process, and makes less sense towards the end of the career:

"It's easier to change a guy like me who took over at 35 than a guy who is 55 or 60, and that has five or 10 years to go. He thinks "Me, I'm not going to change my whole way of doing things."

Furthermore, training was consistently identified as a crucial factor when adopting more SAP. Conventional farming was described by M14 as "following a pre-made recipe", while transitioning towards SAP is very knowledge-intensive.

4.3. Individual factors

Two main individual factors were identified: gender social norms influencing attitudes towards SAP, and differences in passion for agriculture. When asked about gender differences in farming practices, most participants responded that there was surely a difference, but had trouble describing it, like M1:

"I think [women] have a different way of seeing things. In what, I don't know, but we're quite different."

Further discussions with participants enabled a better description of how social norms influence attitudes. First, participants highlighted that masculine social norms such as strength and power seemed to echo conventional practices, while feminine social norms such as care echo sustainable farming. Furthermore, women were consistently identified as having a higher preference towards organic farming. These links were often made in light of the domestic tasks that women are responsible of such as cooking and educating children. Participants explained that this made women farmers more aware of the potential presence of pesticides in food, and the threat of pesticides to the health of their family, more importantly of their children. W1 explains:

« I think women are more attentive in general. When they prepare [the pesticide treatments], they are more concerned by what's going inside, at least our generation […]. Because the place of women, at least in my parents' time, was in the kitchen. They were closer to the food."

This is also explained by M17:

« Men, we are all going to be more sensitive to the machinery, and with women there is a higher sensitivity to life and the relationship with animals."

Additional elements were brought up such as the masculine tradition of being a provider, the fact that men are included in a traditionalist vision of agriculture, and that big machinery and pesticides satisfy masculine norms such as danger and courage. Women on the other hand, were associated with other values such as care for human health, and a higher sensitivity to environmental issues, although this was also challenged by a few participants such as M2:

"Women are not the answer to the world's problems. […] In traditional farms, women are sometimes the worst. […] I think they take in a lot so you shouldn't mess with them."

One last interesting result on how social norms influence SAP adoption was that farmers who hunt (only men farmers in our sample) consistently identified hunting as the main reason why they implemented SAP. M1 explains:

"[As hunters], we are more aware of what hedges can bring. We are aware of the evolution in the decrease in game and in birds and that agriculture is partly responsible. If I could plant 10 more kilometers of hedges on my farm I would."

This quite strongly contrasts with statements from other farmers who tended to downplay the impacts of agriculture on the environment, specifically on biodiversity. Lastly, most sustainable farmers in our sample considered it essential to stay at the forefront of the transition towards sustainable agriculture, like M7:

"Evidently, the conventional system needs to change direction. That's for sure. I always said I did not want to be in the locomotive [of the transition towards sustainable agriculture], but indirectly, I am."

They view their work as farmers more holistically, considering the impact of agriculture on the soil, environment, nutritious quality of their produce, and human health. This passion for agriculture is more pronounced among men, as nine of the 11 women farmers do not express it, and 16 out of 18 men farmers have been passionate about farming since their childhood. For instance, M14 was surprised when he was asked why he was a farmer:

"Why I started being a farmer? Well, because it was my destiny!"

Although all passionate farmers in our sample do not necessarily have high SAP adoption, it was a commonality between all the farmers who do. They felt responsible for providing solutions to the transition towards sustainable agriculture.

4.4. Farm factors

We identify two main farm factors in our data: farm characteristics and economic diversification projects. Participants did not identify differences in farm characteristics between men and women. When asked if there were gender differences in farm size and land tenure, participants consistently explained that they did not see differences in these aspects. However, participant M2 identified how land ownership encourages the uptake of landscape elements:

"People that introduce agroforestry, it's people that are owners of their land and they shouldn't even be considered in the same world. I would like

to implement more [hedges], but the major barrier is that I am not the landowner."

Women were identified as major initiators of economic diversification projects by multiple participants like W4:

"*This large trend of having grocery stores on the farm, that's women. Women take care of that because men work in the fields.*"

In turn, economic diversification was considered a major enabler of SAP adoption in two major ways. First, economic diversification is a way to move away from mainstream value chains and create alternative value chains that allow for diversified production and value-added production, which often reduces the use of inputs and allows for more diverse crop species. For instance, M4 described the difference between the mainstream potato value chain in Wallonia, which is done through potato contractors, and his direct sales value chain:

"A contractor has a contract for a certain number of tons. […] So, he does the maximum to have the maximum yields. Us, because it's for individuals, we don't use too much fertilizer so that the potatoes don't blacken or explode."

Second, economic diversification brings positive relationships with clients and peers, which encourages SAP. M1 and M16 both explained that producing food through alternative value chains is very demanding, and that the satisfaction they get from client contacts is one of the elements that motivates them to continue their sustainable projects.

4.5. External factors

Regarding external factors, we identify that outsourcing of field work, technical advisory services, and farmers' groups all show gender tendencies and influence the adoption of SAP. Women farm managers were associated with higher outsourcing of field work consistently throughout the interviews. Interestingly, the three women sole farm managers W4, W9, and W11 all outsourced a maximum amount of field work. While W4 and W11 sometimes do field work, when necessary, W9 never does. W7, the only agriculturally trained woman of our sample who is very involved in the agronomic decision making on the farm she co-manages with her husband, acknowledged that if her husband was not there, she would have to outsource a lot of the field work:

"If I didn't have [my husband], there would be constraints, there are things I would struggle to do. I would have to outsource a part of the work."

This was also identified as an increasing trend by multiple farmers, like M8:

"[Outsourcing] is very much the trend now with farmers, to retain control over your assets."

M1 additionally specified it was a trend mostly among women. Furthermore, outsourcing was seen as having a negative impact on SAP adoption because the lack of skilled workforce pushes farmers that rely on their services to simplify their practices. This often reduces the diversity of crops, discourages the presence of landscape elements, reduces soil conservation efforts and encourages preventive use of inputs. Similarly, farm managers with lower levels of training often rely on commercial advisory services that tend to increase the use of inputs. W7 explained:

"The product retailer comes and tries to scare people, he will say "There are many aphids in your wheat field, you must do a [insecticide] treatment." But it's not true."

This was confirmed by W11, who has a lower level of training:

"Where I have the most difficulties is the decision making. I have technicians who advise me, but in my model, my technicians are my retailers. […] My big problem is that as a woman, I don't have the knowledge (because I learned late), about which insect is which.[…] I don't have the confidence because I don't have the basic agricultural training."

Multiple farmers highlighted that the training received by outsourcing companies' workforce is very basic and follows conventional practices. This affects both the ability of this workforce to apply soil conservation practices, and the implementation of landscape elements, as evidenced by M18:

"All of [the workers], there is no one to lift the other up, that's for sure, they don't even see [the hedges]. They are indifferent, if we plant hedges and we don't tell them where the posts are, they are going to till them for sure. And even with posts, every year, we have to replant them, every year. For them, nature is an obstacle and if they can, they destroy it, it's really the right word."

Among farmers with high adoption of SAP, the transition from traditional commercial advisory services to independent advisory services was seen as a key element. These independent advisory services can be accessed through different channels, but are often accessed through farmers' groups. For instance, farmer M14 estimated that he reduced his pesticide use by 25–50 % after switching from commercial advisory to independent advisory provided by a local farmers' group. During the interviews, farmers' groups were the main space where women farmers experienced sexism and discriminations. This results in an underrepresentation of women in farmers' groups meetings, as W7 explained:

"I would say that I am completely atypical because whether I go to a technical meeting on beets or cereal or whatever, […] I am practically the only woman, […] I know some women farmers who I find very interesting that don't want to go to a meeting because they wouldn't feel at ease, and sometimes also because their husband doesn't want them to!"

Farmers' groups were also identified as a way to access machinery, mostly through CUMA[7] that can provide specialized machinery to farmers. This was considered especially helpful by farmers trying to adopt soil conservation practices. One last way farmers' groups were identified as an enabler of SAP adoption is through joint purchases of inputs. M3 explained that this allows farmers to order the exact amount of inputs they intend on using, which reduces the likelihood of them "finishing the barrel".

4.6. Institutional factors

Institutional factors, such as fiscal and regulatory policies and market stability, were often mentioned during the interviews as important enablers of SAP adoption. However, gender was not perceived as an influencing factor, and responses from men and women farmers showed no notable differences. This suggests that in our sample gender does not affect institutional factors.

5. Discussion

5.1. Gendered barriers and enablers for SAP adoption

In some respects, the findings from this case study on field crop farms in Wallonia are consistent with previous research, while in other respects, they diverge. First, the general finding that Walloon field crops are masculine and that women face sexism and discriminations is consistent with research across other contexts (Sachs, 2023; Tourtelier et al., 2023). Similar testimonies on gendered labor patterns, where men carry out the field work and women are responsible for other tasks, and inheritance systems that favor sons over daughters have been described

[7] Coopérative d'utilisation du matériel agricole, EN: Cooperative of use of agricultural equipment.

by other studies (Chiappe and Butler Flora, 1998; Pilgeram and Amos, 2015; Trauger, 2004; Trauger et al., 2010). Yet, across our sample there is consensus that the sector is evolving towards higher inclusivity of women farmers. Participants consistently highlighted that women are increasingly becoming farm managers, because the social norms associated with farming are evolving. Women farmers also asserted their own presence in agricultural spaces. They often celebrated the progress made towards more equality, mainly through the implementation of the legal status of the farmer spouse, while also stressing that progress is still needed.

Our results suggest that women farmers take over farms later in their lives and with lower agricultural training levels. This is in line with Walloon statistics that identify that the peak age at which men take over farms is 24 years old, and that the peak age for women is 33 (Buraud et al., 2023). However, these numbers are not specific to field crops. In a French case study, Tourtelier et al. (2023) also highlighted that women farmers in their sample took over farms after a previous career. However, in their case, the women did it on a voluntary basis, which contrasts with our sample where the women who took over farms did so in order to replace a retired or passed family member. In their study, they also highlighted that people going into farming after a previous non-agricultural career often went into sustainable projects, particularly women in small-scale production. The striking opposition in these results from two similar contexts stresses the importance of disaggregating research between production types.

Differences in attitudes have had a prominent place in the literature on gender and SAP adoption, and our results mostly converge with previous studies. For instance, our results are in line with research stating that masculine social norms are associated with strength, independence and control, and encourage a productivist paradigm (Coldwell, 2007; Peter et al., 2000; Saugeres, 2002). In their study investigating how masculine social norms affect men farmers' mental and physical health, Roy and Hočevar (2019) also highlight a strong passion for agriculture in their sample. In addition, our results confirm that women tend to encourage organic farming because of higher concerns for human health (Azima et al., 2024; Burton, 2004; Tourtelier et al., 2023). However, one element in our results that is not well represented in the literature is the strong effect of hunting on environmental awareness and SAP adoption. Hunting farmers recognized the impact of agriculture on biodiversity and challenged the traditional vision of agriculture that opposes farming and nature. We argue that it is not hunting itself that enhances environmental awareness and attitudes of farmers, but rather participation in outside leisure activities that foster connection between people and wildlife. To the best of our knowledge, no studies have investigated the specific link between farmers' leisure activities and environmental awareness. However, previous literature in other contexts have highlighted that outdoor activities and contact with wildlife enhance environmental awareness and behavior (Nisbet et al., 2009; Palmberg and Kuru, 2000).

One way our results differ from previous studies is the fact that farmers in our sample did not seem to find gender differences in farm size and land tenure. Most studies show that women's farms are on average smaller than men's farms (Ball, 2020; Barbercheck et al., 2014). For instance, in Wallonia, women farmers manage 41.5 ha farms on average, and men 59.5 ha (Buraud et al., 2023). However, this statistic pertains to all sectors, including the horticulture sector where farm sizes are much smaller compared to the field crop sector, and where women farmers are relatively more active. The absence of differences in farm size and land tenure is also likely due to the limited possibilities of becoming a field crop farm manager. Due to field crop farms' capital-intensive nature because of extensive land use and machinery heavy operations, starting a new field crop farm is rare. Because women mostly become farm managers through inheritance, their farms are not necessarily different from men's farms.

Our results on economic diversification, whereby part of the produce is sold through shorter value chains, are in line with previous research that women farmers are more likely to be involved in diversification activities because this aligns with the traditional division of farm labor. Other studies have documented this before, and suggest that these activities may empower women farmers (Azima and Mundler, 2022; Tourtelier et al., 2023; Trauger et al., 2010). The link between short value chains and sustainable production has been studied, with mixed results (Enthoven & Van den Broeck, 2021). In our case study, the effects on SAP adoption is mainly positive, as economic diversification through short value chains allows farmers to move away from mainstream production models, where market pressure tends to favor intensive practices.

One main result is the apparent link between gender and labor outsourcing. Outsourcing is increasing in many European farming systems but not many scientific studies cover this topic. An exception is the study by Nguyen et al. (2022), who identify complete fieldwork outsourcing as an emerging phenomenon in France. As generational renewal declines, more farm managers without agricultural ambitions take over "as a last resort", treating farming as a side job and depending entirely on outsourcing for both fieldwork and advisory services. This trajectory is more likely to be followed by women farmers, as evidenced by all three women sole farm managers in our sample who outsource. In these cases, outsourcing was associated with a reduced uptake of SAP. However, some of the most sustainable farms in our sample also relied heavily on labor outsourcing. The difference with these cases is that the farm manager (all men in our sample) is a farmer with extensive experience and training, and that the decision making is done by the farmer himself. Further studies on the links between labor outsourcing and SAP adoption are needed to understand how this farming model can foster sustainable agricultural models, and how gender mediates this relationship.

The absence of gendered differences in financial support is in contrast to other studies that highlighted differences between farms managed by men and women (Ferto and Bojnec, 2025; Ferto and Bojnec, 2025; Schmidt et al., 2021). These differences stem mostly from differences in the types of farms managed by women and men, with women typically more active in sectors with lower subsidies or smaller farms. Within the field crop sector, such differences do not seem to exist, and support is received equally by men and women.

5.2. Limitations

There are some limitations that we need to recognize when interpreting our results. First, our qualitative research approach prevents us from weighing the relative importance of findings. For instance, we reveal conflicting factors, such as women farmers having a more negative attitude towards pesticides yet facing barriers to reduce their pesticide use. As such, we cannot determine whether men or women are more likely to adopt SAP or whether certain results hold more significance. This needs to be investigated jointly with quantitative research methods, which should preferably rely on a probability sampling strategy. Notably, our sample lacks one key profile: a woman farmer who conducts the fieldwork herself. While we tried to include such a profile in our sample, we were unable to find them. Second, our analysis did not cover water and energy use efficiency, which are also important dimensions of environmental sustainability. While these issues are less relevant in our specific context, other studies could focus more explicitly on them. Third, our binary approach to gender reflects the composition of our sample, which includes only men and women. Future research on LGBTQAI + communities in farming, such as Hoffelmeyer et al. (2023), Leslie (2017) and Pfammatter and Jongerden (2023), could provide valuable insights into how non-binary gender identities influence the adoption of SAP. Finally, our research focus on gender does not include intersectional analysis of the relationships between gender and other forms of inequalities such as race, ethnicity, and sexuality (Pilgeram et al., 2022; Sachs, 2023).

6. Conclusion

In this study, we investigate how the adoption of SAP is shaped by gender, an often-overlooked factor in research on high-income countries, especially in Europe. Our findings from the field crop sector in Wallonia, Belgium, highlight four main points. First, while attitudes towards SAP are key drivers for adoption, women farmers are not inherently more environmentally conscious. They usually prioritize nutritious quality and food safety, leading to a negative attitude towards pesticides, but face many barriers to SAP adoption. In contrast, men typically follow farming trajectories that lead to higher SAP adoption, as they tend to take over the farm at a younger age and receive formal agricultural training. Some also favor hunting, resulting in lower pesticide use and increased landscape elements. Second, economic diversification through short food supply chains is typically women's responsibility. These alternative market channels are often associated with less inputs and more agrobiodiversity. Third, limited access to farmer groups represents a key barrier to women, restricting their networks with fellow farmers, and reducing access to equipment and advisory services. This is particularly important for the adoption of soil conservation measures, which requires specialized machinery, and the reduction of pesticides and fertilizers. Fourth, women tend to rely more on outsourcing, making it harder to reduce inputs, implement soil conservation and promote agrobiodiversity. Meanwhile, men see outsourcing as an opportunity to upscale SAP, as they feel more confident directing fieldworkers.

As women take on a growing role in agriculture amid declining generational renewal rates in Europe, policies should prioritize gender-inclusive agricultural environments and address women-specific challenges to SAP adoption. Gender inclusivity is essential to ensure that all farmers have access to the same tools and resources that are crucial to support SAP adoption. Enhancing gender inclusivity can be done at multiple levels: including and recognizing gender disparities in agricultural policies, creating and supporting women's agricultural groups, supporting women's installation as farm managers, enhancing the visibility of women farmers, and ensuring women are represented at all levels of agricultural decision-making institutions. Greater inclusion could encourage more women to pursue farming careers, thereby enhancing their skills, training and confidence. It would also foster knowledge-sharing, resource access, and technical support, which are all crucial for higher levels of SAP adoption. Additionally, integrating overlooked gender-specific issues into policy, such as the link between gender and outsourcing, could further support SAP adoption.

For research, gender-disaggregated data is needed to uncover insights into social and environmental sustainability. The Farm Sustainability Data Network (FSDN) will be a great asset to investigate these topics on a broader European scale. Research should also go beyond alternative farming systems and consider the full spectrum of SAP adoption within 'conventional' farms. These dominate European agriculture and offer the greatest potential to reduce its environmental impact. Our case study on field crop farms stresses the importance of context when trying to understand and represent women farmers. The focus in the literature on women farmers in sustainable horticulture farms is crucial to enhance understanding and visibility to their roles in these systems. However, the conclusions from these farming systems cannot be extrapolated to other contexts, as it risks to overlook other categories of women farmers that remain underrepresented, as well as to entertain stereotypes such as inherent environmental stewardship among women farmers (Doss et al., 2018).

CRediT authorship contribution statement

Sophie Henrotte: Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Goedele Van den Broeck:** Writing – original draft, Validation, Supervision, Methodology, Funding acquisition, Conceptualization.

Availability of data and material

As agreed with the participants of the interviews, the data used in this study is confidential.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1
Summary of the final sample of 29 participants, and their profile characteristics

ID	Decision-making position	Takeover trajectory	Training level and previous career (if any)
M1	Farm manager	Early takeover of family farm	BSc in agriculture
M2	Farm manager	Early takeover of family farm	Msc in bioengineering
M3	Farm manager	Later takeover of family farm	BSc in agriculture, previous career in non-agricultural field
M4	Helping father	Early takeover of family farm	BSc in agriculture
M5	Farm manager	Early takeover of family farm, joined his father after obtaining his bachelor's in agriculture	BSc in agriculture

(*continued on next page*)

Table A1 (*continued*)

ID	Decision-making position	Takeover trajectory	Training level and previous career (if any)
W1	Co-manager	Joined her husband on the farm when they took over her family's farm	Trained and previous career in non-agricultural field
M6	Co-manager	Early takeover of spouse's family farm w	BSc in agriculture
M7	Farm manager	Early takeover of family farm and manager of multiple farms	MSc in non-agricultural field
M8	Farm manager	Early takeover of spouse's family farm	BSc in agriculture
W2	Helping spouse	Own career outside of farming and helping with assistive tasks	No agricultural training, own career
W3	Helping spouse	Early takeover of family farm with her husband	BSc in agrifood industries, no previous career
W4	Farm manager	Later takeover of family farm	BSc in non-agricultural field, previous non-agricultural career
M9	Farm manager (different farm)	Early takeover of family farm	BSc in agriculture
W5	Helping spouse	Joined her husband later as helping spouse	BSc in non-agricultural field, previous non-agricultural career
M10	Farm manager	Early takeover of family farm	Practical agricultural training
M11	Farm manager	Early takeover of family farm	BSc in agriculture
M12	Farm manager	Early takeover of family farm	BSc in agriculture
W6	Helping spouse	Joined her husband later as helping spouse	BSc in non-agricultural field
M13	Helping son	Helps on the farm, potential takeover	MSc in industrial engineering
M14	Farm manager	Later takeover of family farm	Msc in bioengineering, side career as teacher
W7	Co-manager	Early takeover of family farm	Msc in bioengineering
M15	Farm manager	Early takeover of family farm	Practical agricultural training
M16	Farm manager	Early takeover of family farm	Msc in industrial engineering
W8	Helping spouse	Early takeover of family farm	No agricultural training
M17	Farm manager	Early takeover of family farm	BSc in agriculture
M18	Farm manager	Early takeover of multiple farms	Msc in bioengineering
W9	Farm manager	Later takeover of family farm	No agricultural training, previous non-agricultural career
W10	Helping mother	Joined her husband later as helping spouse	Trained and previous career in non-agricultural field
W11	Farm manager	Later takeover of family farm	No agricultural training, previous non-agricultural career

Table A2
Interview guide

0.Consent		1. Description of data use, anonymization process, ability to end the interview and decline answering questions, and consent for recording
1. Farmer description	Identity	1. Can you present yourself ? Name, gender, age? 2. What is your training level (agricultural and non-agricultural)
	Professional trajectories	3.Which training have you followed? 4.How long have you been working here? 5.What is the name of the farm you are working in?
	Role(s)	6. How would you call your job ? Propositions: *Farm manager, helping spouse, co-manager, peasant* ?* 7. What is/are your role(s) in this farm ?
2. Farm description	Farm identity	8. What types of production are produced here ? 9. How many hectares are in this farm ? 10. How many hectares do you own or lease ? What types of leases? 11. Does the production of this farm have one or more labels? Which ones?
	Workforce	12. How many people are involved/work for/are paid by this farm ? 13. How many estimated hours do you spend on farm labor per week? 14. Do you have a second job? 15. How is decision-making distributed on this farm? In terms of Agricultural production? Marketing? Domestic labor?
3.Gender and Sustainable Agricultural Practices	SAP	16. How would you describe your farming style? 17. How do you implement sustainable practices on your farm? Why? 18. What are the barriers and enablers to the adoption of more SAP?
	Gender	19. Does gender affect the experiences of farmers? How so?
	Gender & SAP	20. Does gender influence the adoption of sustainable farming practices?
4.Supplementary information		21. Do you have anything to add? 22. Do you know other farmers that would be willing to participate in an interview with us?

* In French, paysan (English: peasant), is a term that is preferred by some farmers to the more common term chef d'exploitation (English: Farm manager).

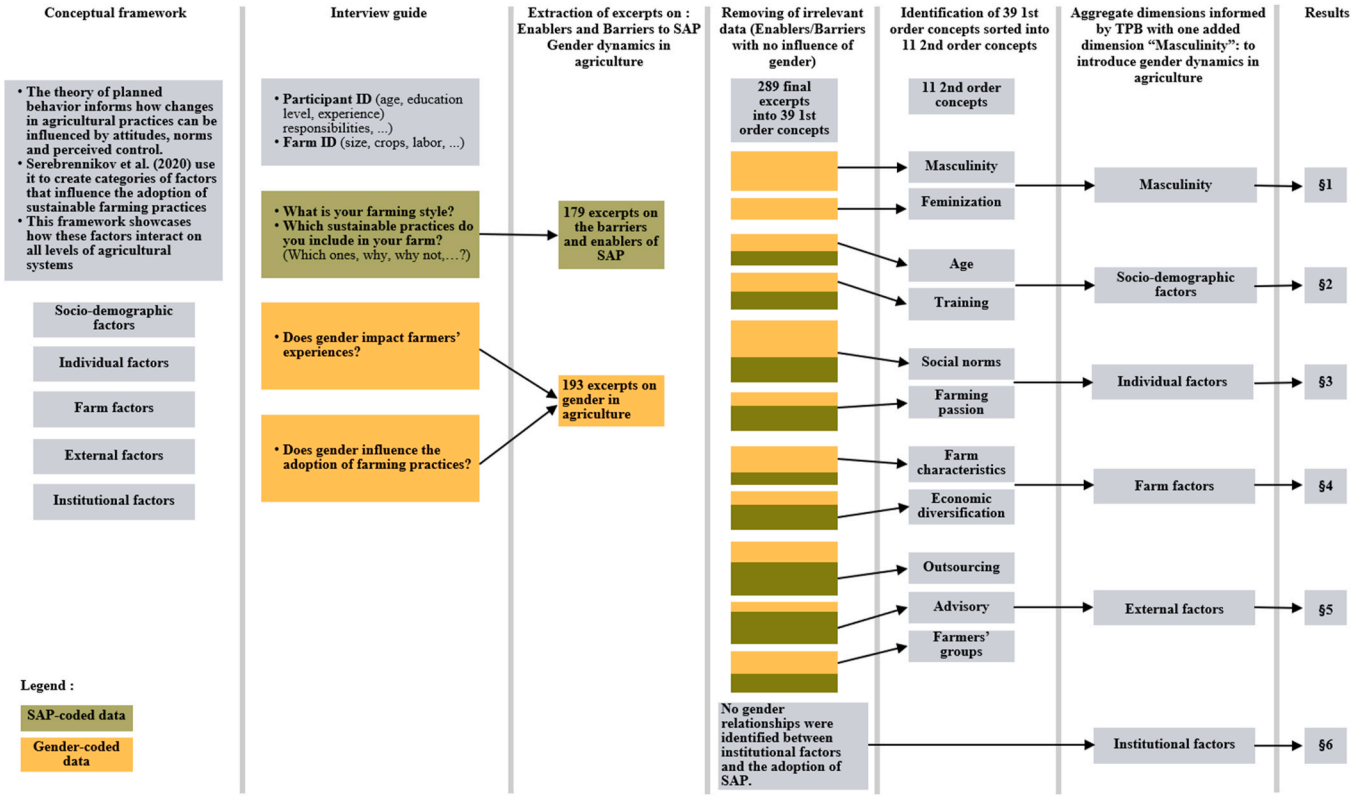

Figure A3. Methodological process.

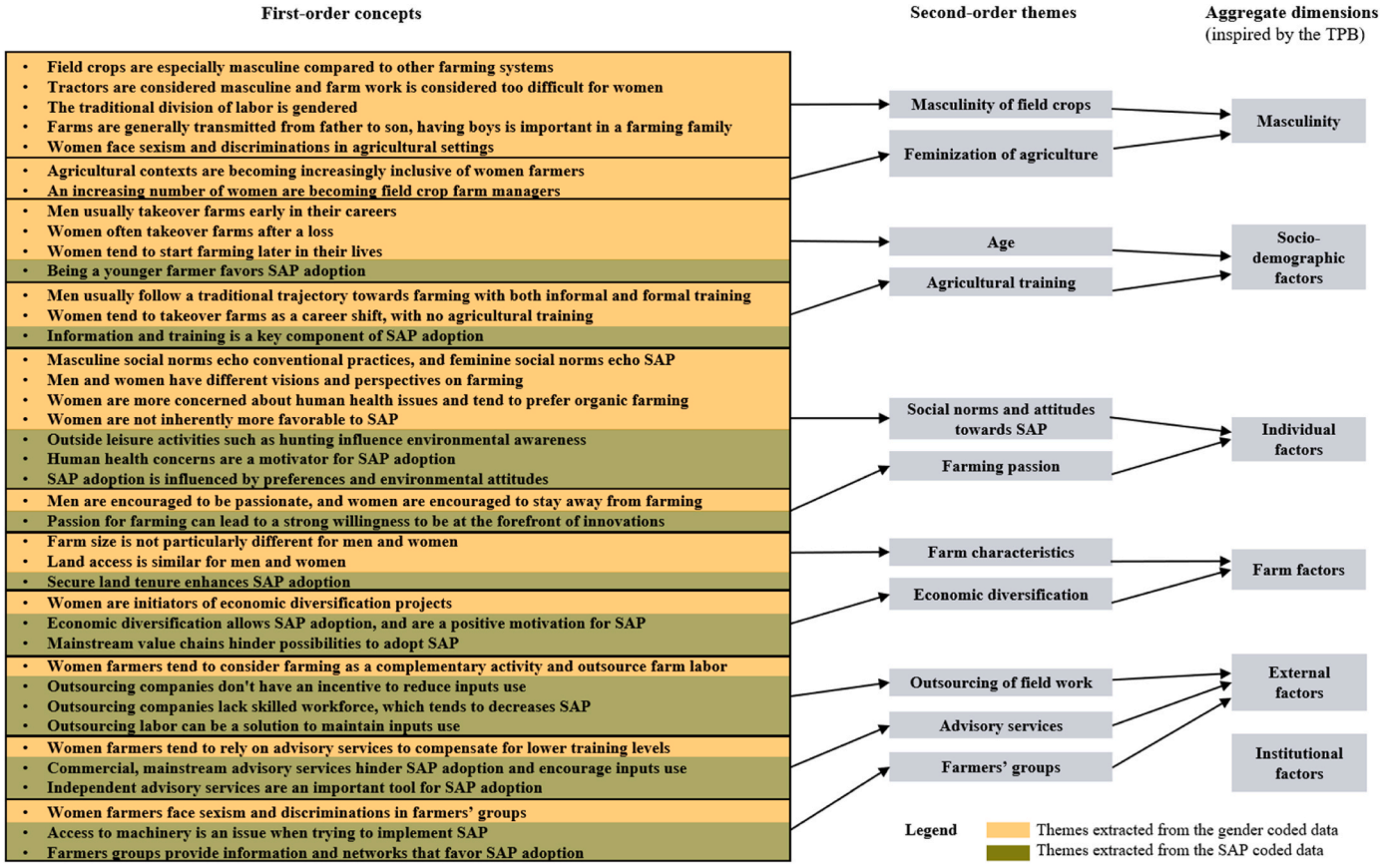

Figure A4. Codebook describing the thematic analysis process.

Data availability

The data that has been used is confidential.

References

Alvesson, M., 2003. Beyond neopositivists, romantics, and localists : a reflexive approach to interviews in organizational research. Acad. Manag. Rev. 28 (1), 13. https://doi.org/10.2307/30040687.

Alvi, M., Barooah, P., Gupta, S., Saini, S., 2021. Women's access to agriculture extension amidst COVID-19: insights from Gujarat, India and Dang, Nepal. Agric. Syst. 188. https://doi.org/10.1016/j.agsy.2020.103035. Scopus.

Azima, S., Lepage, F., Afif, K., Greene, J., 2024. Navigating a gendered ecosystem : the role of entrepreneurial capital in the business strategies of single-owner women farmers. Agric. Hum. Val. 42, 1121–1137. https://doi.org/10.1007/s10460-024-10663-3.

Azima, S., Mundler, P., 2022. The gendered motives and experiences of Canadian women farmers in short food supply chains : work satisfaction, values of care, and the potential for empowerment. J. Rural Stud. 96, 19–31. https://doi.org/10.1016/j.jrurstud.2022.10.007.

Ball, J.A., 2020. Women farmers in developed countries : a literature review. Agric. Hum. Val. 37 (1), 147–160. https://doi.org/10.1007/s10460-019-09978-3.

Barbercheck, M., Brasier, K., Kiernan, N.E., Sachs, C., Trauger, A., 2014. Use of conservation practices by women farmers in the Northeastern United States. Renew. Agric. Food Syst. 29 (1), 65–82. https://doi.org/10.1017/S1742170512000348. Scopus.

Buraud, L., Legein, L., Guieu, A., 2023. Défricher le genre dans l'agriculture wallonne. Oxfam. https://oxfambelgie.be/sites/default/files/2023-12/OXFAM-Rapport%20agriculture%20Wallonie%202023%20v4.pdf.

Burton, R.J.F., 2004. Reconceptualising the 'behavioural approach' in agricultural studies : a socio-psychological perspective. J. Rural Stud. 20 (3), 359–371. https://doi.org/10.1016/j.jrurstud.2003.12.001.

Burton, R.J.F., 2014. The influence of farmer demographic characteristics on environmental behaviour : a review. J. Environ. Manag. 135, 19–26. https://doi.org/10.1016/j.jenvman.2013.12.005.

Candel, J., 2022. EU food-system transition requires innovative policy analysis methods. Nat. Food 3 (5), 296–298. https://doi.org/10.1038/s43016-022-00518-7.

Canessa, C., Ait-Sidhoum, A., Wunder, S., Sauer, J., 2024. What matters most in determining European farmers' participation in agri-environmental measures? A systematic review of the quantitative literature. Land Use Policy 140. https://doi.org/10.1016/j.landusepol.2024.107094. Scopus.

Carrola, S., Lievens, E., Janssens, E., Bragard, C., 2014. Estimation quantitative des utilisations de produits phytopharmaceutiques par les différents secteurs d'activité en Wallonie. http://etat.environnement.wallonie.be/files/Studies/CRP_4_Carola_et_al_2012_2014.pdf.

Castleberrya, A., Nolen, A., 2018. Thematic analysis of qualitative research data : is it as easy as it sounds? https://doi.org/10.1016/j.cptl.2018.03.019.

Chiappe, M.B., Butler Flora, C., 1998. Gendered elements of the alternative agriculture paradigm. Rural Sociol. 63 (3), 372–393. https://doi.org/10.1111/j.1549-0831.1998.tb00684.x.

Coldwell, I., 2007. New farming masculinities : « more than just shit-kickers », we're « switched-on » farmers wanting to « balance lifestyle, sustainability and coin ». J. Sociol. 43 (1), 87–103. https://doi.org/10.1177/1440783307073936. Scopus.

Coulibaly, T.P., Du, J., Diakité, D., 2021. Sustainable agricultural practices adoption. Agriculture' 67 (4), 166–176. https://doi.org/10.2478/agri-2021-0015.

Dessart, F., Barreiro-Hurlé, J., Van Bavel, R., 2019. Behavioural factors affecting the adoption of sustainable farming practices : a policy-oriented review. Eur. Rev. Agric. Econ. 46, 417–471. https://doi.org/10.1093/erae/jbz019.

Doss, C., 2013. Intrahousehold bargaining and resource allocation in developing countries. World Bank Res. Obs. 28 (1), 52–78. https://doi.org/10.1093/wbro/lkt001.

Doss, C., Meinzen-Dick, R., Quisumbing, A., Theis, S., 2018. Women in agriculture : four myths. Global Food Secur. 16, 69–74. https://doi.org/10.1016/j.gfs.2017.10.001.

Enthoven, L., Van den Broeck, G., 2021. Local food systems : reviewing two decades of research. Agric. Syst. 193. https://doi.org/10.1016/j.agsy.2021.103226, 103226.

European Environment Agency, 2023. Agricultural area under organic farming in Europe. European Environment Agency. https://www.eea.europa.eu/en/analysis/indicators/agricultural-area-used-for-organic.

European Environment Agency, 2024. Percentage of reported monitoring sites with pesticides exceeding thresholds in a) surface waters and b) groundwater in Europe weighted by country area [Jeu de données]. https://www.eea.europa.eu/en/analysis/indicators/pesticides-in-rivers-lakes-and/percentage-of-reported-monitoring-sites.

Eurostat, 2021. Land cover statistics. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Land_cover_statistics.

Eurostat, 2024. Agri-environmental indicator—Mineral fertiliser consumption. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_mineral_fertiliser_consumption.

Eurostat, 2025. Main agricultural labour force by age and sex of the farm manager, farm type of the agricultural holding and NUTS 2 region [Jeu de données]. Eurostat. https://doi.org/10.2908/EF_LF_MAIN.

Ferdinand, M.S., Baret, P.V., 2024. A method to account for diversity of practices in conservation agriculture. Agron. Sustain. Dev. 44 (3), 31. https://doi.org/10.1007/s13593-024-00961-9.

Ferto, I., Bojnec, S., 2025. Sustainable development gender equality and green entrepreneurship in farms. Sustain. Dev. 1–24. https://doi.org/10.1002/sd.3337.

Finger, R., 2024. Europe's ambitious pesticide policy and its impact on agriculture and food systems. Agric. Econ. 55 (2), 265–269. https://doi.org/10.1111/agec.12817. Scopus.

Finger, R., Fabry, A., Kammer, M., Candel, J., Dalhaus, T., Meemken, E.M., 2024. Farmer protests in Europe 2023–2024. EuroChoices 23 (3), 59–63. https://doi.org/10.1111/1746-692X.12452. Scopus.

Finger, R., Möhring, N., 2022. The adoption of pesticide-free wheat production and farmers' perceptions of its environmental and health effects. Ecol. Econ. 198. https://doi.org/10.1016/j.ecolecon.2022.107463. Scopus.

Foguesatto, C.R., Borges, J.A.R., Machado, J.A.D., 2020. A review and some reflections on farmers' adoption of sustainable agricultural practices worldwide. Sci. Total Environ. 729. https://doi.org/10.1016/j.scitotenv.2020.138831. Scopus.

Gerrard, C., Smith, L., Padel, S., Hitchings, R., Measures, M., Cooper, N., 2011. OCIS Public Goods Tool Development.

Gioia, D., 2021. A systematic methodology for doing qualitative research. J. Appl. Behav. Sci. 57 (1), 20–29. https://doi.org/10.1177/0021886320982715.

Gioia, D.A., Corley, K.G., Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research : notes on the gioia methodology. Organ. Res. Methods 16 (1), 15–31. https://doi.org/10.1177/1094428112452151.

Gioia, D., Corley, K., Eisenhardt, K., Feldman, M., Langley, A., Lê, J., Golden-Biddle, K., Locke, K., Mees-Buss, J., Piekkari, R., Ravasi, D., Rerup, C., Schmid, T., Silverman, D., Welch, C., 2022. A curated debate : on using "Templates" in qualitative research. J. Manag. Inq. 31 (3), 231–252. https://doi.org/10.1177/10564926221098955.

Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C., 2010. Food security : the challenge of feeding 9 billion people. Science 327 (5967), 812–818. https://doi.org/10.1126/science.1185383. Scopus.

Guyomard, H., Soler, L.-G., Détang-Dessendre, C., Réquillart, V., 2023. The European green deal improves the sustainability of food systems but has uneven economic impacts on consumers and farmers. Commun. Earth Environ. 4. https://doi.org/10.1038/s43247-023-01019-6.

Hoffelmeyer, M., Wypler, J., Leslie, I.S., 2023. Surveying queer farmers : how heteropatriarchy affects farm viability and farmer well-being in U.S. agriculture. J. Agri. Food Syst. Commun. Dev. 12 (3), 111–125. https://doi.org/10.5304/jafscd.2023.123.005. Scopus.

Jain, C., Saxena, D., Sen, S., Sanan, D., 2023. Women's land ownership in India : evidence from digital land records. Land Use Policy 133. https://doi.org/10.1016/j.landusepol.2023.106835. Scopus.

Knowler, D., Bradshaw, B., 2007. Farmers' adoption of conservation agriculture : a review and synthesis of recent research. Food Policy 32 (1), 25–48. https://doi.org/10.1016/j.foodpol.2006.01.003.

Lagrave, R.-M., 1983. Bilan critique des recherches sur les agricultrices en France. Études Rural. 92 (1), 9–40. https://doi.org/10.3406/rural.1983.2932.

Lagrave, R.-M., Lemarchant, C., Seiller, P., 2021. Retour sur les « agricultrices » : des oubliées de la recherche et du féminisme. Travail, Genre Soc. 45 (1), 31–38. https://doi.org/10.3917/tgs.045.0031.

Leslie, I.S., 2017. Queer farmers : sexuality and the transition to sustainable agriculture. Rural Sociol. 82 (4), 747–771. https://doi.org/10.1111/ruso.12153.

Leslie, I.S., 2019. Queer farmland : land access strategies for small-scale agriculture. Soc. Nat. Resour. 32 (8), 928–946. https://doi.org/10.1080/08941920.2018.1561964.

Leslie, I.S., Wypler, J., Bell, M.M., 2019. Relational agriculture : gender, sexuality, and sustainability in U.S. Farming. Soc. Nat. Resourc. 32 (8), 853–874. https://doi.org/10.1080/08941920.2019.1610626.

Mazoyer, M., Roudart, L., 1997. Histoire des agricultures du monde. Du néolithique à la crise contemporaine. https://www.persee.fr/doc/reae_0755-9208_1998_num_48_1_1591.

Meinzen-Dick, R., Kovarik, C., Quisumbing, A.R., 2014. Gender and sustainability. Annu. Rev. Environ. Resour. 39 (1), 29–55. https://doi.org/10.1146/annurev-environ-101813-013240.

Meinzen-Dick, R., Quisumbing, A., Doss, C., Theis, S., 2019. Women's land rights as a pathway to poverty reduction : framework and review of available evidence. Agric. Syst. 172, 72–82. https://doi.org/10.1016/j.agsy.2017.10.009. Scopus.

Nisbet, E.K., Zelenski, J.M., Murphy, S.A., 2009. The nature relatedness scale : linking individuals' connection with nature to environmental concern and behavior. Environ. Behav. 41 (5), 715–740. https://doi.org/10.1177/0013916508318748.

Palmberg, I.E., Kuru, J., 2000. Outdoor activities as a basis for environmental responsibility. J. Environ. Educ. 31 (4), 32–36. https://doi.org/10.1080/00958960009598649.

Peter, G., Bell, M.M., Jarnagin, S., Bauer, D., 2000. Coming back across the fence : masculinity and the transition to sustainable agriculture*. Rural Sociol. 65 (2), 215–233. https://doi.org/10.1111/j.1549-0831.2000.tb00026.x.

Pfammatter, P., Jongerden, J., 2023. Beyond farming women: queering gender, work and family farms. Agric. Hum. Val. https://doi.org/10.1007/s10460-023-10449-z. Scopus.

Pilgeram, R., Amos, B., 2015. Beyond "Inherit It or Marry It" : exploring how women engaged in sustainable agriculture access farmland. Rural Sociol. 80 (1), 16–38. https://doi.org/10.1111/ruso.12054.

Pilgeram, R., Dentzman, K., Lewin, P., 2022. Women, race and place in US agriculture. Agri. Human Value. 39 (4), 1341–1355. https://doi.org/10.1007/s10460-022-10324-3. Scopus.

Pilgeram, R., Dentzman, K., Lewin, P., Conley, K., 2020. How the USDA changed the way women farmers are counted in the census of agriculture. Choices 35, 1–10.

Qu, S.Q., Dumay, J., 2011. The qualitative research interview. Qual. Res. Account. Manag. 8 (3), 238–264. https://doi.org/10.1108/11766091111162070.
Rizzo, G., Migliore, G., Schifani, G., Vecchio, R., 2023. Key factors influencing farmers' adoption of sustainable innovations : a systematic literature review and research agenda. Org. Agri. https://doi.org/10.1007/s13165-023-00440-7. Scopus.
Roy, P., Hočevar, D.K., 2019. Listening to a silent crisis : men's suicide in rural and farming communities in Slovenia. Revija Socijalnu Politiku 26 (2), 241–254. https://doi.org/10.3935/rsp.v26i2.1593. Scopus.
Sachs, 2023. Gender, women and agriculture in agriculture and human values. Agric. Hum. Val. 40 (1), 19–24. https://doi.org/10.1007/s10460-022-10391-6. Scopus.
Saugeres, L., 2002. Of tractors and men : masculinity, technology and power in a French farming community. Sociol. Rural. 42 (2), 143–159. https://doi.org/10.1111/1467-9523.00207.
Schmidt, C., Goetz, S.J., Tian, Z., 2021. Female farmers in the United States : research needs and policy questions. Food Policy 101. https://doi.org/10.1016/j.foodpol.2021.102039, 102039.
Scialabba, N.E.-H., 2014. (avec Organisation des Nations Unies pour l'alimentation et l'agriculture). SAFA guidelines: Sustainability assessment of food and agriculture systems version 3.0. FAO.
Serebrennikov, D., Thorne, F., Kallas, Z., McCarthy, S.N., 2020. Factors influencing adoption of sustainable farming practices in Europe : a systemic review of empirical literature. Sustainability 12 (22), 9719. https://doi.org/10.3390/su12229719.
Seuneke, P., Bock, B.B., 2015. Exploring the roles of women in the development of multifunctional entrepreneurship on family farms : an entrepreneurial learning approach. NJAS - Wageningen J. Life Sci. 74, 41–50. https://doi.org/10.1016/j.njas.2015.07.001, 75 Scopus.
Statbel, 2020. Chiffres agricoles 2020 [Jeu de données]. https://statbel.fgov.be/fr/themes/agriculture-peche/exploitations-agricoles-et-horticoles#figures.
Statbel, 2022a. Chiffres agricoles 2022. https://statbel.fgov.be/fr/themes/agriculture-peche/exploitations-agricoles-et-horticoles#figures.
Statbel, 2022b. Comptes macro-économiques de l'agriculture | Statbel. https://statbel.fgov.be/fr/themes/agriculture-peche/comptes-macro-economiques-de-lagriculture#documents.
Tchékémian, A., 2014. Women and farming in twenty-first century France : the recognition of women farmers. Études Rural. 193 (1), 61–77. https://doi.org/10.4000/etudesrurales.10017. Scopus.
Tey, Y.S., Brindal, M., 2012. Factors influencing the adoption of precision agricultural technologies : a review for policy implications. Precis. Agric. 13 (6), 713–730. https://doi.org/10.1007/s11119-012-9273-6. Scopus.
Tourtelier, C., Gorman, M., Tracy, S., 2023. Influence of gender on the development of sustainable agriculture in France. J. Rural Stud. 101. https://doi.org/10.1016/j.jrurstud.2023.103068, 103068.
Trauger, A., 2004. 'Because they can do the work' : women farmers in sustainable agriculture in Pennsylvania, USA. Gend. Place Cult. 11 (2), 289–307. https://doi.org/10.1080/0966369042000218491.
Trauger, A., Sachs, C., Barbercheck, M., Brasier, K., Kiernan, N.E., 2010. "Our market is our community" : women farmers and civic agriculture in Pennsylvania, USA. Agric. Hum. Val. 27 (1), 43–55. https://doi.org/10.1007/s10460-008-9190-5.
Unay-Gailhard, İ., Bojnec, Š., 2021. Gender and the environmental concerns of young farmers : do young women farmers make a difference on family farms? J. Rural Stud. 88, 71–82. https://doi.org/10.1016/j.jrurstud.2021.09.027.
Wauters, E., Mathijs, E., 2014. The adoption of farm level soil conservation practices in developed countries : a meta-analytic review. Int. J. Agric. Resour. Govern. Ecol. 10 (1), 78–102. https://doi.org/10.1504/IJARGE.2014.061058.
Webb, P., Benton, T.G., Beddington, J., Flynn, D., Kelly, N.M., Thomas, S.M., 2020. The urgency of food system transformation is now irrefutable. Nat. Food 1 (10), 584–585. https://doi.org/10.1038/s43016-020-00161-0. Scopus.
Wells, B.L., Gradwell, S., 2001. Gender and resource management : community supported agriculture as caring-practice. Agric. Hum. Val. 18 (1), 107–119. https://doi.org/10.1023/A:1007686617087.
Williams, T.G., Bürgi, M., Debonne, N., Diogo, V., Helfenstein, J., Levers, C., Mohr, F., Stratton, A.E., Verburg, P.H., 2024. Mapping lock-ins and enabling environments for agri-food sustainability transitions in Europe. Sustain. Sci. 19 (4), 1221–1242. https://doi.org/10.1007/s11625-024-01480-y. Scopus.
Zahm, F., Girard, S., 2023. La Méthode IDEA - Indicateurs De Durabilité Des Exploitations Agricoles. IDEA.
Nguyen, G., Purseigle, F., Brailly, J., & Marre, M. (2022). Agricultural Outsourcing in France : A Statistical Perspective on an Emerging Phenomenon. *Economie et Statistique / Economics and Statistics*, *532-33*, 89-110. https://doi.org/10.24187/ecostat.2022.532.2073.
Ajzen, I. (1991). The theory of planned behavior. In *Handbook of Theories of Social Psychology : Volume 1* (p. 438-459). Scopus. https://doi.org/10.4135/9781446249215.n22.
Schneider, K., Barreiro-Hurle, J., & Rodriguez-Cerezo, E. (2023). Pesticide reduction amidst food and feed security concerns in Europe. *Nature Food*, *4*(9), 746-750. Scopus. https://doi.org/10.1038/s43016-023-00834-6.