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Gender and the environmental concerns of young farmers: Do young women farmers make a difference on family farms?

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ABSTRACT

Although the visibility of women farmers in agriculture is increasing, we have little knowledge about the impact this will have on the environmental management of family farms. Numerous studies have documented that young women farmers show high concern for environmentally friendly farming practices relative to young male farmers. However, family farms are still a prominent business form globally, and it is still unclear whether or not we can expect young women farmers in different employment statuses (manager, or full-time farm worker and spouse) and work schedules (full- or part-time) to show any differences in the adoption of environmental practices compared to young male farmers. This study investigates the question of how increasing the visibility of women on family farms, and young women's sensitivity to environmental concerns relative to male's, plays out in the dynamic of adopting Agri-Environment-Climate Measures (AECMs). Our results confirm gender differences in AECM adoption behavior when we investigate the employment statuses of young women farmers; however, for part-time family farms, gender differences in the adoption behavior disappears, while they emerge for environmental subsidies received. We argue that gender aspects of the adoption behavior of AECMs contain several overlapping issues, particularly gender differences in the spouse's involvement in farm work.

1. Introduction

In recent years, there has been a growing interest in the relationship between gender and environmental concerns among academic scholars. We particularly observe attention being given to the gender dimension of environmental concerns in environmental psychology (Tam 2013; Desrochers et al., 2019; Liu et al., 2019); political economics (e.g., behaviors towards climate change policies (Resurrección 2013; Mavisakalyan and Tarverdi 2019; Arbuckle and Mercer 2020)); energy research and policies (e.g., green and renewable energy consumption and production behavior (Allison et al., 2019; Li et al., 2019; Standal et al., 2020)); and behavioral economics (e.g., gender dimensions of pro-environmental behaviors among youth (Vicente-Molina et al., 2018; Hansmann et al., 2020)).

The finding that women have more environmental concerns relative to men is one of the most robust outcomes in some of this research, and there is ongoing research attempting to understand and theorize the potential argumentation and causality in gender and environmental approaches (MacGregor 2017).

If we turn our attention to the farming sector, we can ask the

question: do women farmers involved in farming decision making exert tendencies towards more environmental farming practices than male farmers? This question has been investigated in the past with both quantitative and qualitative studies that have provided mixed results (Egri 1999; Borsotto et al., 2008; Best, 2009; Burton 2014; Adinolfi et al., 2020).

However, recent review papers by Glazebrook et al. (2020), which includes global findings from both the global south and north, Dunne et al. (2020), covering interdisciplinary findings, and Ball (2020), focusing on women farmers in developed countries, provides a solid ground about the relationship between gender and environmental concerns in the farming sector. In summary, these studies conclude that women farmers show greater sensitivity towards environmental activities and are more involved with organic farming, sustainable agriculture practices, and alternative agriculture relative to male farmers.

For example, in comparison to male farmers, women farmers show a significantly higher intensity towards the adoption of organic horticulture technologies in the UK and the USA (Burton et al., 2003; Sachs 2006); the adoption of climate resilient seeds in India (Dar et al., 2020); the adoption of intense organic farming practices in Italy and Portugal

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(Dinis et al., 2015); and applying for government subsidies that are designed for agri-environmental and sustainable practices in Italy (Chiappini and De Rosa 2011). In Canada, an anthropological study by Hall and Mogyordy (2007) found that farms are more likely to switch from conventional to organic when women are involved with decision-making. Studies in the USA conducted by Sachs et al. (2016), Trauger (2004), and Wells and Gradwell (2001) show that women account for a greater portion of sustainable and organic farm operators than industrial farm operators, and women farmers show higher involvement with alternative agriculture initiatives.

In parallel to the discussions on the gender dimensions of environmental concerns, investigations of farmers' environmental behaviors often make note of the importance of another demographic characteristic: age. Several publications document a stronger predisposition of younger women farmers towards environmentally friendly farming practices relative to younger male farmers (Boon et al., 2010; Läßle 2012; Burton 2014; Briz et al., 2019; Chatzitheodoridis and Kontogeorgos 2020; Perez et al., 2020).

For example, a study by Chatzitheodoridis and Kontogeorgos (2020) in Greece found that, most of the time, urban youth that immigrate to rural regions show pro-environmental behaviors in their entrepreneurship initiatives and involvement with organic farming. The authors mention that these new entrants into farming are mainly the new young women farmers who hadn't had any farming experience before. Likewise, a study by Läßle (2012) investigating the characteristics of organic and conventional farmers in Ireland reports that organic farmers are younger and more likely to be women relative to conventional farmers. Research by Perez et al. (2020) on young farmers in the livestock sector of Spain documents a high number of young women farmers on agro-ecological farms relative to traditional farms. Moreover, research on Danish forest owners' willingness to undertake conservation activities shows that young and women farmers are more likely to participate in agri-environmental programs (Boon et al., 2010).

In the literature, several theories have attempted to explain the gender dimensions of environmental concerns. Feminist Agrifood Systems Theory (FAST) conceptualizes women's ways of knowing and working in agriculture, and highlights a greater concern among women for environmental quality, nutrition, and health, leading to greater attention and concern for sustainability. FAST explores how women shape new food and farming systems by integrating economic, environmental, and social values (Sachs et al., 2016). A study by used ecofeminist theory with the argumentation for dualism (the dualistic nature of Western thought and dualism occurring in conceptual systems, such as the dualism between nature and culture, reason and culture, male and female) to explain the involvement of women in sustainable farming. An interesting approach has also been put forward in recent literature on lesbian and queer sustainable farmers. Using rural queer theory, the importance of considering not only gender but also sexual relations in sustainable farming and offering a "relational agriculture" approach to achieve the reorientation of gender and sexual relations on farms for sustainability priorities in the farming sector has been highlighted (Wypler 2019; Leslie et al., 2019).

1.1. Study focus: environmental concerns of young women farmers

Although previous literature has indicated the age and gender dimensions of environmental concerns, there are still some interesting and relevant questions to be addressed towards young women farmers.

Even though the number of women farmers has increased in recent years, with the share of women farm managers in both the EU and the USA comprising a total of 30% (Francic and Kovacek 2019; Sachs et al., 2016; Whitley and Brasier 2021), most improvements have been achieved by switching from traditional decision-making approaches in family farming businesses (Contzen and Forney 2017), especially on the women-managed farms (Černič Istenič 2015). In our study we label this trend as "increasing visibility" of women farmers on family farms.

However, little is known about how young women's differing levels of on-farm involvement (increasing visibility) may impact those farms, especially from a sustainability standpoint.

What we know is that family farms continue to remain as a dominant business form globally, and in parallel there is growing evidence on women's changing roles within agriculture: more and more young women are entering agriculture by choice; women farmers increasingly create equal gender relations on family farms; and they're able to construct a modern and professional farming identity and shape new food and farming systems by integrating economic, environmental, and social values (Černič Istenič 2015; Černič Istenič and Charatsari 2017; Brandth 2002, 2021; Adro and Franco 2020; Perez et al., 2020; Sachs et al., 2016; Carter 2017; Tsiaousi and Partalidou 2020).

Based on the presented evidence on this changing social and cultural agrarian context, this study is focused on answering the following questions: "To what extent does increasing the visibility of women on family farms and women's consideration of the environment relative to male's play out in the dynamic of adopting environmental farming practices? Furthermore, what impact does their type of farm employment (manager, farm worker and spouse) and their work schedule (full- or part-time) have on their adoption of environmental farming practices?"

These research questions were addressed through an empirical analysis in Slovenia, a country where women farmers account for a higher-than-average percentage of the agricultural workforce (41.1%, which is above the EU-28 average of 35.1%) (Eurostat 2017). This study used panel data from the Slovenia Farm Accountancy Data Network (FADN) for the years 2014–2017 (N = 1454 young farmers, age < 40). The dynamics of the adoption of agri-environmental practices were investigated by classifying the study sample based on the young farmers' work statuses (manager, farm worker and spouse) and their work schedules (full- or part-time).

This research investigates the environmental concerns of young women farmers via their involvement with the Agri-Environment-Climate Measures (AECMs) that are implemented under the Slovenian Rural Development Programme (2014–2020).

As payments, these AECMs are a key policy tool for the integration of environmental concerns into the EU's Common Agricultural Policy (CAP). AECMs are designed to encourage farmers to protect and enhance their farmland's environment on a voluntary basis by paying them for the provision of environmental services (e.g., organic agriculture, payments for environmentally favorable farming extensification, the management of low-intensity pasture systems and/or integrated farm management, etc.).

In addition to the scientific and theoretical point of view, as highlighted in studies by Bock and Shortall (2006) and Sachs et al. (2021), gender differences on farms is an important future rural development management topic. More specifically, it is important to better understand how gender influences decision making and on which farm types for designing future eco-schemes (environment and climate schemes), especially within the scope of "green architecture" under the EU's CAP, which was proposed by the EU Commission in its CAP Strategic Plan Regulation in June 2018 (Matthews and Röder 2021).

Thus, this paper further investigates the gender dimensions of environmental concerns with a focus on young women farmers' agricultural (on-farm) employment statuses and work schedules. The following section provides a review of studies framing the relationship between gender and the environment in agrarian literature. The third and fourth sections provide an overview of this research's methodology and dataset, respectively, while the fifth section provides descriptive statistics. The sixth section presents empirical findings, and the final two sections are devoted to the discussion of the results and conclusion, respectively.

2. Literature review: the gender dimension of environmental farming practices

The literature that delves into the relationship between gender and environmental concerns brings about several findings that we have summarized within four overlapping perspectives: the *agri-entrepreneurship perspective*, the *personality perspective*, *ideological factors*, and a *farm's structural condition*. However, a number of critical discussions on the gender differences in the environmental concerns of farmers remains to be explored (Burton 2014; MacGregor 2017).

2.1. Agri-entrepreneurship perspective

Studies focused on the *agri-entrepreneurship perspective* mainly highlight the gender-specific differences in the entrepreneurship strategies in rural contexts. Studies from different countries show that women farmers, especially farm wives, play an important role in the development of new farming income (Boch 2004). It's been found that the agri-entrepreneurship skills of women farmers can lead to the successful creation of new income via multifunctional activities, such as organically processed products, agri-tourism, and direct sales (Seuneke and Bock 2013; Dias et al., 2019). Multi-tasking among women farmers requires them to maintain a balance between family, childcare, and farm work activities (Boch 2004). Shortall and Sutherland (2017) argue that the success of the creation of women farmers' multifunctional activities (e.g., specialty sheep breeding and agricultural environmental schemes) is because of women's ability to "think outside the box". Boch (2004) also argues that women's multi-tasking activities are based on a "feminine" approach that is more balance oriented between family and work rather than growth and profit orientation (which is more commonly observed in a masculine approach). Furthermore, Hoppe and Korb (2013) argue that the agri-entrepreneurship strategies of women farmers show some particularities in the case of negative economic returns. The authors found that women who continue farming practices under non-profit conditions aim to prioritize socio-environmental values such as environmental protection, maintaining farms for future successors, and keeping a farming lifestyle.

2.2. Personality perspective

Researchers approaching the topic from the *personality perspective* investigate new farm identity mechanisms within humanistic, social cognitive points of view, and present important findings that contribute to our understanding on the participation of women in sustainable farming. Studies that investigate the particular interests of women farmers in alternative agriculture (Carter 2017, 2021); sustainable agriculture (Trauger 2004; Trauger et al., 2010); and value-added production (Wright and Annes 2016) highlight the transformative power of these farming communities in terms of (i) self-identity (enabling switching identities from farm wife to farmer); (ii) the creation of the "changemaker" character (enabling refusing to fit in with the expectations of placeholders/communities); and (iii) women's empowerment (enabling the process of business success). However, the empowerment of women in sustainable networks has been observed to a limited degree (Hall and Mogyorody 2007; Wright and Annes 2016; Gidarakou et al., 2008). As found by Pilgeram (2019), the open space for women in sustainable agriculture is available to a particular group of women: white, well-educated, heterosexual, and married. Overall, the reported transformative power of sustainable farming communities highlights that characteristics that are more emphasized in females than in males exist in farm identity construction mechanisms.

2.3. Ideological factors

Ideological factors used to frame the participation of women in environmentally friendly farming practices have been documented by

several authors who have looked at women farmers' views on the use of land, labor, and capital. For example, as studied by Beus and Dunlap (1990), ecological sustainable agriculture is supported by ideology and superstructure paradigms that include several dimensions, such as centralization vs. decentralization; dependence vs. independence; competition vs. community; domination of nature vs. harmony with nature; specialization vs. diversity; and exploitation vs. restraint. Based on in-depth interviews with women farmers in alternative agriculture, the research results of Chiappe and Flora (1998) report the importance of further dimensions, such as a quality family life (making life less stressful) and spirituality (a desire to honor nature). Another approach has been proposed by Pedersen and Kjaergard (2004), who suggest that practicing organic farming creates conditions that give life to female values in agriculture, which include healthy food, living in a sound environment with contact to nature and animals, practicing spiritual principles, and a balanced family life. Furthermore, as documented by Hambleton (2008), women farmers are more involved with niche and personalized products and doing farming for personal fulfillment. Moreover, Perez et al. (2020) argue that agri-ecological livestock farming is not just an economic activity, but it also represents a lifestyle based on harmony between humans and nature among women farmers.

2.4. Farm's structural condition

Under *farm structural conditions*, the relationship between gender and environmental concerns can explain the differences in the farm structural characteristics between male- and female-managed farms. As reported by several studies, women farmers are mostly represented on small-sized farms, resulting in clear structural size differences between male and female farmers and leading to women's involvement in alternative farming and value-added production (Ball 2020; Dunne et al., 2020; Zimmerer et al., 2015). In addition to farm size, a study by Hall and Mogyorody (2007) indicates that women farmers are more involved in less mechanized farm types (such as vegetable, mixed livestock, or cash crop farms) rather than field-crop farms with high levels of mechanization and capital-intensive production, making it easier for them to transition to organic farming. Other structural conditions under sustainable production, such as diversified farming incomes/diversified production, combining agricultural activities with other activities, and using short marketing channels, give women a greater role in the promotion and administration of sustainable projects (Gongolra et al., 2019). In a study by Trauger (2004), this role of women in sustainable farming practices was investigated via their involvement with value-added production, such as processed goods, organic, local, or other certified production. The authors observe that more involvement with value-added production was related to the ability of the women, i. e., whether they were able to "do the work" that is associated with these production types. The fact that value-added production provides working conditions under which women are more likely to be represented is also supported by the findings of Sumner and Llewelyn (2011) and Wright and Annes (2016).

In addition to these structural opportunities, several authors also highlight the important role played by *farm structural barriers* observed historically in farming sectors, such as gender discrimination in regards to farm management rights, access to credit (Saugeres 2002; Ong and Lioa 2020), and farmland (Pilgeram and Amos 2015). As concluded by Ball (2020) and Perez et al. (2020), these structural barriers are the reasons that more sustainable, alternative farming is more attractive to women.

This study aims to contribute to the literature that provides insights on the role of farm structural conditions in explaining gender differences in environmental concerns, and investigates the labor aspect of farm characteristics, particularly the work statuses and work schedules of young women farmers.

3. Methodology: the choice of the three study samples

Based on previous economic and sociological studies from the Slovenian rural context, three main assumptions were used to define study samples: 1) decision-making towards environmental farming practices likely differs across farm types (Unay-Gailhard and Bojnec 2015, 2016); 2) women managers are considered land owners and highly involved in the decision-making processes of family farm businesses (Čerňič Istenič 2015; Čerňič Istenič and Charatsari 2017); and 3) the interests of women farmers in acquiring new agricultural knowledge (in our case a willingness to learn environmentally friendly farming practices) depends on their position on a farm (Čerňič Istenič 2015; Čerňič Istenič and Charatsari 2017).

Furthermore, to provide insights on the gender dimensions of the environmental farming practices among younger generations, apart from a sample that represents full-time farmers, this study also looked at part-time farms. This is due to the importance of part-time farming among the younger generation as a second career option (Unay-Gailhard and Simões, 2021). As suggested by Guarín et al. (2020), the consideration of the new emerging farm typologies of small farms in Europe, such as part-time farms, which highly involve younger farmers, is important for gaining a better understanding of the changing dynamics of the farming sector.

Finally, the selection of subsamples among the entire sample of young farm managers was based on two criteria: 1) statistical sampling that allows us to use data from a sample to make conclusions that are representative in terms of number of observations, and 2) sampling that allows us to assume the strategic decision-making power of farm manager in terms of hours spent on farm work.

Therefore, different farm typologies are investigated with different objectives and comparison categories. Fig. 1 details the different statuses of young women farmers we analyzed in the three study samples.

As shown in Fig. 1, the environmental concerns of young women farmers were explored within different samples to investigate young women farmers as farm managers (entire sample), farm workers (subsample-I), and as part-time farm managers on family farms (subsample-II).

Entire sample: Farms managed by young managers. This sample includes Slovenian farms managed by young managers (age < 40).

Subsample-I: Family farms managed by young male managers. The farm structure in Slovenia has been marked by the involvement of women as

farm workers and spouses with a wide spectrum of hours spent on the farm. In order to capture the effect of this spectrum (number of on-farm hours worked) on agri-environmental concerns, subsample-I aims to provide insights on farms where we observed full-time women farm workers and spouses.

Subsample-II: Part-time family farms managed by young managers. Different than the entire sample, this study aims to provide further insights into the family farms that are run part-time by both family members. The objective of this is to capture the role played by female-managed farms in terms of a combination of work statuses and work schedules. Respectively, farms for which we did not observe any hours spent on the farm by the manager and/or the spouse of the manager were dropped from the sample.

This study is interested in the gender-specific changes towards voluntary based agri-environmental subsidies in each study sample. Therefore, regression models were used to see whether gender has a significant effect on changes in the adoption behavior of agri-environmental subsidies (logistic regressions models, Model-I and Model-II) and changes in received agri-environmental subsidies (between effect model, Model III).

Additional to the independent variable of gender, numerical control variables (land, labor, capital and the entrepreneurship characteristics of farms) were used in each model. This study estimated all models using statistical software Stata 14.1.

4. Data

The study used panel dataset from Slovenia's Farm Accountancy Data Network (FADN) for the years 2014–2017. Table 1 provides information about the variables used, including descriptions and units.

This analysis was based on farm-level data from the Slovenian FADN datasets. FADN data is collected for each EU-member state for a sample of professional farms exceeding the specific minimum threshold in terms of their size. FADN is annual data based on national surveys and covers only agricultural holdings that are considered commercial due to their size.

The overall purpose of the FADN methodology is to provide representative annual economic farming data at EU level and by country according to three farm categories: region, economic size, and type of farming (EC 2020). It also provides microeconomic farm-level data for farms and rural areas as an instrument for monitoring and evaluating the

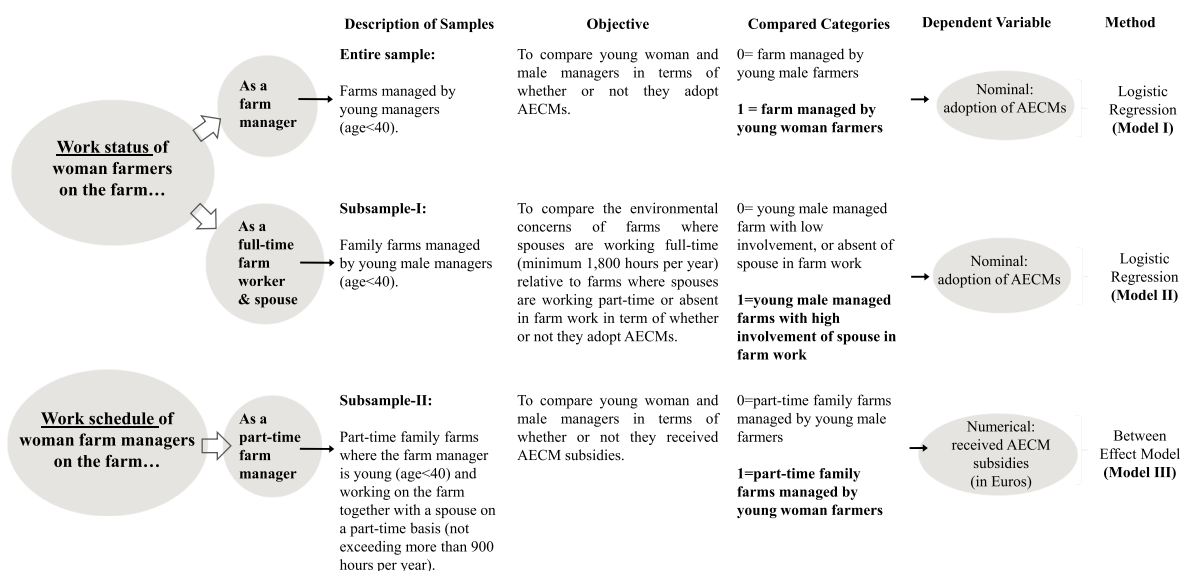


Fig. 1. Description of the three study samples for the analysis of the adoption of Agri-Environment-Climate Measures (AECMs) by young farmers within different work statuses and schedules of young women farmers.

Table 1

Description of the Slovenian FADN dataset (2014–2017) used for samples of young farmers.

Variables	Description and Unit
Dependent variables	
Agri-Environment-Climate Measures (AECMs) e.g., organic farming, integrated production, preservation of crop rotation	Nominal: Farms adoption of voluntary based AECMs in the current year; 0 = No, 1 = Yes Numerical: Farms received voluntary based subsidies for AECMs in the current year; unit in Euros
Independent variables	
LABOR	
Gender	Gender of farm manager: 0 = Male, 1 = Female
Age	Age of farm manager
Education	Farm manager's education: 1 = Practical agricultural experience, 2 = Basic agricultural training, 3 = Degree in agriculture
Hours spent on farm by farm manager	Total work covering the agricultural work for the farm manager directly related to the farm (Annual Work Units (AWU); one AWU corresponds to 1800 h per year)
Hours spent on the farm by the manager's spouse	Total work covering the agricultural work for the spouse of the farm manager directly related to the farm (AWU)
Full-time farmer	Minimum hours required by the relevant national provisions governing contracts of full-time employment. In the case of Slovenia, 1 AWU = 1800 h per year.
Part-time farmer	Maximum hours required by the relevant national provisions governing contracts of part-time employment. In the case of our study, it corresponds to the maximum half full-time working hours (1800 h per year/2 = maximum 900 h per year).
LAND	
Farm size	Total Utilized Agricultural Area (UAA) in hectares (ha)
Share of rented land	Rented area as a percentage of the total UAA (Unit: percentage; (rented UAA/Total UAA) *100)
Less Favored Area (LFA) location	Farms that received LFA subsidies in the current year: 0 = No, 1 = Yes
CAPITAL & ENTREPRENEURSHIP	
Land productivity	Total output to total land (Euros/hectares (ha)) (Unit: ratio; total output, Euros/total land as UAA in ha)
Share of non-agricultural income	Share of income coming from non-agricultural activities such as forestry products, contract work for others, hiring out of equipment, or agri-tourism. (Unit: percentage; (non-agricultural income/total agricultural income) *100)
Participation in young farmer payments	Farms that received young farmers' start-up payments at a minimum of 18,000 Euros (Rural Development Policy (2014–2017), Measure 6.1): 0 = No, 1 = Yes,

incomes of agricultural holdings and farm businesses and for better understanding the impacts of the CAP measures. It aims to cover viable farms that represent the future of the EU's farming structure (EC 2020).

The average farm size by sector – crop farms, livestock farms, and mixed crop and livestock farms – in the FADN sample is usually bigger than national farm averages. This could also mean that the FADN sample includes more innovative and entrepreneurial farms that are able to manage their bookkeeping/accountancy. The FADN dataset contains data on farms' incomes and farm business activities as an important informative source of microeconomic data based on harmonized book-keeping principles for understanding the impact of the measures taken under the CAP. The farm-level FADN data as used in our study is confidential while the FADN public database includes aggregate (after validation), individual data in standard results. The FADN publishes

summary data reports available to the public.

5. Descriptive statistics

The descriptive statistics shown in Table 2 and in Table A1 (Appendix) summarize the labor, land, capital, and entrepreneurship

Table 2

Descriptive statistics-I: Farm characteristics of each study sample, Slovenian FADN dataset, average from 2014 to 2017.

FARM CHARACTERISTICS	Unit of measurement or used statistics	Entire Sample	Subsample-I	Subsample-II
		Farms managed by young managers N = 1454	Family farms managed by young male managers N = 1217	Part-time family farms managed by young managers N = 342
LABOUR				
Gender: female-managed farms	% (N)	16 (237)	–	21 (75)
Age of farm manager	Mean years (Std)	34 (0.12)	33 (0.13)	33 (0.24)
Education of farm manager: Degree in agriculture	% of yes	12.59	13.39	11.11
Basic level agricultural training	% of yes	42.78	43.63	42.98
Practical agricultural experience	% of yes	44.64	42.97	45.91
Hours spent on the farm by the farm manager	Mean in hours (Std)	1170.33 (16.37)	1216.51 (17.58)	518.00 (9.77)
Hours spent on the farm by the spouse of the manager	Mean in hours (Std)	390.48 (14.45)	328.17 (15.05)	163.77 (11.66)
LAND				
Farm size	Mean in ha (Std)	13.68 (0.31)	14.16 (0.36)	10.00 (0.42)
Share of rented farmland (UAA)	Mean % (Std)	25.30 (0.74)	26.47 (.83)	22.46 (1.41)
Location of farm in Less Favored Area (LFA)	% (Std)	87 (0.91)	87 (0.10)	86.82 (1.85)
Farm types: Field crops	% of yes	11.71	12.08	17.37
Horticulture	% of yes	1.32	1.33	0.30
Wine	% of yes	3.41	3.50	5.39
Other	% of yes	4.60	4.67	6.59
permanent crops	% of yes	16.86	16.67	5.69
Milk	% of yes	44.04	43.58	46.71
Other grazing livestock	% of yes	3.21	3.33	2.69
Granivores	% of yes	14.84	14.83	15.27
Mixed farms	% of yes			
CAPITAL & ENTREPRENEURSHIP				
Land productivity	Mean in Euros/ha (Std)	2509.85 (73.88)	2558.17 (84.15)	1686.15 (81.34)
Share of non-agricultural income	% (Std)	17.73 (1.60)	16.81 (1.89)	17.66 (1.37)
Participation in rural development subsidies:				
Agri-Environment-Climate Measures (AECMs)	% of yes	60.73	58.02	54.49
Young farmer payments	% of yes	6.12	4.4	1.19

characteristics of the entire sample and two sub-samples.

5.1. The profile of young farmers

Entire Sample: Farms managed by young managers. The entire panel sample covered a total of 1454 farm observations, with young women managers representing 16% of the sample (Table 2). The levels of practical agricultural experience (44%) and basic agricultural training (42%) for the sampled farmers are about the same, who are involved mainly with grazing livestock (44%), milk (16%), and mixed farming (14%). The entire sample significantly differs in the involvement of managers by gender, as well as the involvement of spouses of the manager in terms of hours spent on the farm. There is a significant higher number of farms that have adopted AECM measures managed by women managers (Table A1).

Beside the FADN data, discussions on the characteristics of young farmers in Slovenia with institutional level actors (national and regional level government officials at Ministry of Agriculture, Forestry and Food and advisory services), it is confirmed as the largest number of young farm managers are involved mainly with cattle breeding (53%), mixed farming -animal and plant production- (13, 5%), and crop production (9.1%); and 19% of the beneficiaries of the young farmer payments in the Pillar II, CAP are female (based on the published Rural Development Programme, 2014–2020).

Subsample-I: Family farms managed by young male managers. As shown in Table 2, the involvement of women as full-time farm workers and spouses represents 14% of the whole sample. There is a significant higher number of farms that have adopted AECM measures that are managed by male managers with the full-time involvement of their spouse (Table A1). Interestingly, for farms with full-time women workers and spouses, the hours spent on the farm is higher for women farm workers and spouses with 1933 AWU compared to 1403 AWU for male managers.

Subsample-II: Part-time family farms managed by young managers.

Subsample-II includes family farms that are managed by young farm managers together with their spouses involved with farm work on a part-time basis. Part-time family farms represent around 1/3 of the entire sample and the share of women managers is higher (21%) relative to the entire sample (16%) (Table A1). For part-time family farms, triple the amount of hours are spent on the farms by managers (518 AWU) compared to their spouses (163 AWU). Compared to the entire sample, part-time farms are more involved with field crops (17%) and less with milk (5%) production, probably due to the higher labor requirements of dairy farming.

A focus on young women farmers. Descriptive statistics (Tables 2 and 3, A1, and A2) suggest five important patterns on young women farmers. First, the involvement of young women managers with farm work is undeniable. As we know from the literature, in some countries, in the scope of young farmer payment applications, young women may register as the manager of the farm (e.g., due to their spouses not meeting certain requirements, or being registered solely for administrative purposes), and are not necessary involved with farm work (Gidarakou et al., 2018). This is not the case in our study, and on both full-time and part-time farms, young women managers show a stronger involvement with farm work compared to their spouses.

Second, we observe gender differences in the farm structure in terms of involvement of spouses with farm work. In our entire sample, and subsample-II, young women who pursue management roles are more likely to farm with a spouse. However, on average, young male managed farms show a one-person led farm structure with significantly low involvement from their spouses (Table 2).

Third, another gender difference has been observed regarding the agricultural education. The results of the Pearson chi2 test show that the relationship between education level and gender is significant (Table A2). The percentage of young farm managers that an educational degree in agriculture and/or basic level agricultural training is higher for male farm managers relative to females. The percentage of female managers (53%) that have practical agricultural experience is slightly

Table 3

Results of the regression models, Agri-Environment-Climate Measures (AECMs) adoption models, Slovenian FADN dataset (2014–2017).

FARM CHARACTERISTICS	Logistic regression Model-I		Logistic regression Model-II		Between effect model Model-III	
	Entire Sample: Farms managed by young managers N = 1435		Subsample-I: Family farms managed by young males N = 1200		Subsample-II: Part-time family farms managed by young managers N = 334	
	Coef.	Std.	Coef.	Std.	Coef.	Std.
LABOR						
Gender: women as a farm manager	0.37**	0.15	NC	NC	1060.66***	408.04
Farms with high female involvement as a full-time worker & spouse	NC	NC	0.38**	0.17	NC	NC
Age of farm manager	0.01	0.01	0.01	0.01	–26.97	33.21
Education of farm manager	0.21**	0.08	0.21**	0.09	323.29*	178.12
LAND						
Farm size	0.03***	0.00	0.03***	0.00	198.06***	18.99
Share of rented farmland	–0.00	0.00	–0.00	0.00	–5.55	6.69
Less Favored Area (LFA) location	0.00*	0.00	0.00	0.00	–0.36*	0.31
CAPITAL & ENTREPRENEURSHIP						
Land productivity	–0.00	0.00	–0.00	0.00	0.01	0.06
Share of non-agricultural income	0.00*	0.00	0.00**	0.00	1.89	2.89
Participation in young farmer payments	0.29	0.28	0.29	0.31	–154.51	816.97
Constant	–1.31***	0.51	–0.62	0.56	–822.46	1395.40
LR chi ² (9)	61.33		58.72		–	
Prob > chi ²	0.000		0.000		0.00	
Pseudo R ²	0.031		0.03			
Number of groups					177	
Wald chi ² (9)					143.16	

Notes.

1) Legend NC: Not Considered in the presented model.

2) ***, **, * represent significance at the 1%, 5%, 10% levels, respectively.

3) Model-I: Are farms managed by young women managers more likely to adopt AECMs? Model-II: Are farms with full-time women farm workers & spouses more likely to adopt AECMs? Model-III: Do part-time family farms managed by women managers receive more AECM subsidies?

higher than male managers (42%).

Fourth, consistent with the previous literature, we observe that the mean farm size is significantly low for the female-managed farms relative to male managed farms, which is also observed for part-time farms: on average, for the entire sample, young female-managed farms have 11 ha, while young male-managed farms have a farm size of 14 ha. For the subsample-II (part-time farms), young female-managed farms represent 8 ha, while for male-managed farms this amount is 10 ha.

Finally, as provided by the results of the two-way *t*-test (Table A1), on farms where we observe high involvement of young women farmers (as a farm manager, or as a full-time worker and spouse), there is a significantly higher number of AECM adoption. In the following sections we cover the robustness of these results.

6. Econometric results

To distinguish the effect of work statuses (manager, or farm worker and spouse) and work schedules (full- or part-time) of young women farmers on the adoption of environmental practices, this study used regression models.

With the regression models, we sought to compare categories such as, “farms managed by young women farmers vs. young male farmers” (Model-I), “farms managed by young males with a high involvement of spouses vs. a low involvement or absent spouses” (Model-II), and “part-time farms managed by young women farmers vs. young male farmers” (Model-III). We wanted to explore the farm typologies in which young women involvement makes a difference in terms of environmental concern.

In the logistic regression model, Model-I, we assessed the link between farm managers' gender and the adoption behavior of AECMs on the farms by considering control variables divided under labor, land, capital, and entrepreneurship. The independent variable of “gender of farm manager” was expected to give an indication as to whether or not farms managed by young women farm managers are more likely to adopt environmental farming practices relative to farms managed by young male farm managers.

In the logistic regression model, Model-II, the reference variable of “full-time women farm worker and spouse” is intended to give an indication as to whether or not farms managed by male managers with the involvement of their spouse as a full-time worker are more likely to adopt environmental farming practices relative to farms managed by males with low involvement of spouses (part-time not involved with farm work).

In the between effect model, Model-III, using similar control variables, we examined the role of gender in accessing the agri-environmental subsidies on the part-time family farms.

The econometric findings are presented in Table 3.

6.1. Do young women farmers make a difference in the adoption of AECMs?

As shown in Table 3, in both the logistic regression models (Model-I and II), the results for the tested **gender** variable have positive and significant coefficient signs.

Model-I and II: For the young farmers sample, being a young women farm manager, and for the male young farmers sample, having a full-time women farm worker and spouse shows a significant positive effect on the adoption of environmental subsidies (Table 3). The positive and significant coefficient signs for the tested gender variables show that farms managed by young women managers are more likely to adopt AECMs (relative to farms managed by young male managers), and farms where women workers and spouses work full-time on the farm are more likely to adopt AECMs (relative to farms where women workers and spouses work part-time or are absent). However, these gender differences for the adoption of AECMs disappears when we run the logistic regression model for part-time family farms.

Model-III: Nevertheless, our findings highlight the gender differences of received AECMs for part-time farms. The parameter estimates in the between effect model show that the role of the farm manager's gender on received agri-environmental subsidies is statistically significant (Table 3). Being a woman farm manager is found to have a positive effect on the increase of received agri-environmental subsidies at the 5% significance level for part-time family farms. This indicates that farms managed as a part-time family business with a woman manager are more likely to adopt agri-environmental farming practices relative to part-time family business farms managed by a male manager.

6.2. Young farm managers, agricultural education and AECM adoption

Another significant variable in addition to gender is the **agricultural education level** of farm managers. In the logistic regression models (Model-I and II), the results show that young farmers with a high level of agricultural education are more likely to adopt AECMs. Findings from the between effect model (Model-III) show that each level of education increases the received agri-environmental subsidies for the part-time family farms. According to FADN data, the results of the logistic regression models (Model I and II) show that young farmers with a high level of agricultural education are more likely to adopt AECMs. However, the impact of gender is greater than education: the coefficient (0.37) of “gender of farm manager” is higher than the coefficient (0.21) of “education background of farm manager” (Table 3).

When we further estimate the relationship between agricultural education and received agri-environmental subsidies with Ordinary Least Squares (OLS) regression and logistic models (with similar independent variables by considering AECM adoption as a dichotomous dependent variable), the effect of agricultural education on the adoption of AECM shows positive and significant results for part-time farm managers. This confirms the evidence that even in the case of part-time farming careers, the education level of the manager positively affects the willingness as well as the accessibility of agri-environmental subsidies.

Going one step further, this study investigated the relationship between education and agri-environmental concerns using the Kruskal-Wallis H test to identify statistically significant differences of farmers' received environmental subsidies and their educational backgrounds (Table A3). Results show that there are differences regarding the received AECM subsidies among young farmers who have practical experience, basic training, and a degree in agriculture, with agricultural degree holders significantly receiving more AECM subsidies in most cases.

6.3. Young farm managers, farm size, and AECM adoption

Another control variable linked to farm structural characteristics is **farm size**, which has positive and significant coefficient signs on AECM adoption. In both logit regression models (Model-I and II), the logit estimates for the effects of farm size on AECM adoption is positive and significant (Table 3). Larger farms, in turn, were more likely to adopt agri-environmental farming practices both among the young farmers sampled and the young male managers sampled. This result shows a robust effect in the between effect model (Model-III). This study found that part-time farms with larger farm sizes are more likely to adopt AECMs: rises in farmland size increase received agri-environmental subsidies for part-time family farms.

7. Discussion

Our study investigated the agri-environmental concerns of young farmers via their adoption of voluntary based AECMs (e.g., subsidies for organic farming, integrated production, and preservation of crop rotation) that aim to encourage farm management that reduces the negative effects of farming on the environment. The central focus of the paper is to explore the agri-environmental concerns of young women farmers of

different farm types. Three farm typologies were classified according to the young women farmers' work statuses: (1) as a manager; (2) as a full-time farm worker and spouse; and (3) as a manager on a part-time family farm. The discussion of the empirical results about young farmers in Slovenia reveals four main insightful points on the gender dimensions of agri-environmental farming practices.

First, this study confirms that, when we investigate the work status of young women farmers as farm managers, gender differences concerning the adoption of agri-environmental farming practices exist. Our findings show that young women-managed farms are more likely to adopt AECMs compared to young male-managed farms (Model I). Based on the presented descriptive statistics and the previous literature, these findings are interpreted with: *gender differences (I) in the spouse's involvement in farm work; (II) in farm size characteristics, and (III) in agri-entrepreneurship strategies.*

7.1. Gender differences in the spouse's involvement in farm work

In our study, descriptive statistics on the farms managed by youth provide a different trend in terms of the involvement of spouses in farm work on young female- and male-managed farms. The active involvement of farming spouses on young female-managed farms is significantly higher (in terms of working hours of farm work) than on young male-managed farms. In other words, young women farmers who pursue management roles are more likely to farm with their spouse. However, on average, young male-managed farms show a one-person dominant farm structure. This pattern was also observed in other EU rural contexts (Bjørkhaug and Blekesaune 2007), and this result supports an ongoing masculine form of farm structure, even among younger generations.

Apart from this gender difference of the involvement of spouses, most of the time, young female-operated farms have more equal farm working structures between couples and show a higher involvement with AECMs relative to young-male operated farms. A study by Hall and Mogyoródy (2007) in Canada gives some insights into the link between the "equal gender division of labor on farms" and "environmental concerns". The authors found that most of the studied organic farms had a "traditional" gendered division of labor except for the organic farmers who were involved with alternative farming (less profit orientated). These alternative oriented organic farms appear to be more interested in a more equal gender division of labor on the farm. In our case, the link between "equal gender division of labor on the farm" and "environmental concerns" was partly captured through the labor division differences on female-managed farms in Slovenia. A study by Čerňič Istenič (2015) in Slovenia supports our finding in terms of labor division aspects on female-managed farms, reporting that on female-managed farms, work, decision-making, and responsibilities are more evenly distributed among genders relative to male-managed farms.

7.2. Gender differences and farm size characteristics

For several authors, sustainable agriculture consists of smaller and less capital-intensive farms, which makes switching to agri-environmental practices easier for women who work on smaller sized farms (Pilgeram and Amos 2015; Perez et al., 2020; Ball 2020). In line with that view, the approach of feminist political ecology considers the increasing recognition of women farmers with smaller sized farms, and calls for the consideration of gender as a group for political ecology (Zimmerer et al., 2015). In our case, we did not observe significant mean differences in terms of farm types between young female- and male-managed farms, but in terms of farm size (on average, young female-managed farms represent 11 ha, and young male-managed farms 14 ha). Due to farm size differences being relatively small, further investigations need to frame the gender differences in AECM adoption in consideration of women's smaller farm sizes.

7.3. Gender differences in agri-entrepreneurship strategies

Previous studies that have framed the gender dimension of environmental farming practices via the agri-entrepreneurship strategies of women show differences relative to males. For example, women agri-entrepreneurship is based on a "feminine" approach that represents a search for a balance between farm work and farming family life (Boch 2004); women farmers show an ability to "think outside the box" due to their responsibilities, which are different from males in the rural context (Shortall and Sutherland 2017); under negative returns, women may maintain farming practices by prioritizing non-profit values (Hoppe and Korb 2013), a phenomenon defined as an "emotional attachment" in family-farm literature (Glover and Reay 2015); the business strategies of women are mainly driven by an interest in nature, allowing them to combine their job with their passion (Sörensson and Dalborg 2017); women's involvement in agriculture leadership positions in a male-dominated occupation of farming were described as "a third sex" (Pini 2005) and to perform within different forms of femininity (Annes et al., 2021).

In the case of Slovenia, studies investigating women farmers' agri-entrepreneurship strategies highlight that the interests of women in attaining agricultural education and acquiring new knowledge depend significantly on their position on a farm (Čerňič Istenič 2015). Women farm managers (who are mainly landowners in the case of Slovenia) are more likely to show an openness to innovation, show interests in new knowledge, and show a higher willingness to gain access to government subsidies (Čerňič Istenič 2015; Čerňič Istenič and Charatsari 2017). Under documented characteristics, we can interpret gender differences in AECM adoption via the "eager character" of women who are in management positions. Looking at things from an agri-business perspective, this "eager character" of women could be taking form due to the highly dependent nature of small-sized female-managed farms on subsidies or due to the unequal access of other economic resources between genders, which remains a topic for future research.

Second, our study confirms the importance of family farm configuration differences for the adoption of AECMs when we investigate the work status of young women farmers as full-time workers and spouses. Young male-managed farms with high involvement from their spouse have a significant positive effect on the adoption of AECMs relative to young male-managed farms with low involvement of their spouse (Model II).

A limitation of our data on the strategic decision-making actors does not allow us to make a point on the changing nature of farming family configuration in terms of the power of full-time women farm workers and spouses in decision making. Research by Rappaport (1995) is one of the few studies that investigates the decision-making power of women farmers as full-time workers and spouses, finding that they report not having sole responsibility for farm decisions.

Apart from that knowledge, our findings can be discussed in light of the previous studies on (IV) *the labor-intensive nature of environmental farming practices*; (V) *the ability of women on family farms to "do the work" associated with sustainable agriculture*; and (VI) *changing practices as a result of embodied work in agriculture*.

7.4. The labor-intensive nature of environmental farming practices

Literature to-date on organic farming shows that, depending on the farm type, a switch to organic farming or maintaining organic practices may require higher labor demands (Unay-Gailhard and Bojnec 2019; Briz et al., 2019; Bruce 2019; Heinrichs et al., 2021). Agri-ecological farming shows a higher labor intensity relative to conventional farming, and environmental investments require significantly more time (e.g., building organic matter in the soil) (Bruce 2019). Depending on the farm type and size, the adoption of agri-environmental measures may also increase family or hired labor use. A study by Unay-Gailhard and Bojnec (2019) in Slovenia found that, while for large field crop

farms an increase in hired labor was observed, for large dairy farms the increase was family labor (i.e., involvement of women farm workers and spouses in organic cheese making). These studies may indicate that on farms where there is a high involvement of women farm workers and spouses, environmental farming practices may be more attractive due to existing potential labor. However, this result needs careful consideration based on the case study region. Findings of McGurk et al. (2020) show that increases in total farm labor (the number of hours utilized in farm management) has a significant negative impact on the likelihood of participation in agri-environmental farming practices in Ireland.

7.5. The ability of women to “do the work” associated with sustainable agriculture

As suggested by Trauger (2004) and Anthopoulos (2010), this potential family labor input that is provided by women may be used for sustainable models of production (e.g., value-added products or local food production). This is due to women’s ability to “do the work” associated with these sustainable models of production (Trauger 2004), and these models include “traditionally female skills” and bringing “motherhood” knowledge into commodification (Anthopoulos 2010).

7.6. Changing practices as a result of embodied work in agriculture

It is also interesting to discuss our results within the literature about embodied work in agriculture, which draws attention to the emerging new demands on the men and women involved with farm work with new possibilities (Brandt 2021). A study by Brandt and Haugen (2014), shows how new income possibilities in the agro-tourism sector create new demands on men (e.g., to be sensitive to the needs and requirements of agri-tourists during their farm visits), which may be in contrast to their previous practices. What we know from the literature is that women farmers are highly represented in new income possibilities, such as organic, local, direct-marketing, and agri-tourism (Ball 2020). A high involvement of women in these service sectors may be expected to have different demands on men, requiring them to change their previous agricultural practices. Further research from a body perspective may help to further understand how farming practices are being changed by women’s involvement with farm work with new possibilities in environmental farming practices, and how this influences farm-men bodies.

Third, gender differences between the adoption of AECMs disappear for part-time family farms that are managed by young farmers. For part-time family farms, the gender of the manager is not a significant factor explaining the adoption behavior, but there are gender differences between the received environmental subsidies. Farms managed as a part-time family business by a young woman versus a male increases the probability of receiving Agri-Environmental Subsidies (AECMs) (Model III). The lack of support for the gender dimension of received AECMs on part-time family farms merits some discussion that may explain and provide knowledge about the (VIII) key characteristics of part-time farms in Europe.

7.7. Key characteristics of part-time farms in the EU

As observed within the new emerging farm typology in Europe, farms run with weak market orientation show different patterns of behavior, even among themselves. In a study by Guarín et al. (2020), these weak market-oriented farms were classified into two types (“part-time farms” and “peasant farms”) depending on their farmer profile, land, labor, income, market linkage, and accessed subsidies. Therefore, captured part-time farms in our study may include a non-homogenous characteristic as opposed to the full-time farms.

In our paper, compared to other studied farm types, part-time family farms managed by younger farmers are represented by a relatively high percentage of women farmers, the lowest average of farm size, and the lowest percentage with access to government subsidies, such as agri-

environmental subsidies and young farmer payments. This trend in our sample is consistent with the “part-time farms” typology rather than the “peasant farms” as presented by Guarín et al. (2020) and fits with the “non-commercial farming” typology of Sutherland et al. (2019) in terms of a high representativeness of women.

What we know further from the literature is that part-time farms (i) may identify within several forms, including survival, capital accumulation, and hobby farming in the UK (Munton et al., 1989); (ii) show difficulties in enlarging their land to switch to full-time farming businesses in Eastern Europe (Chaplin et al., 2007); (iii) are more likely to be organic or be in conversion to organic farming compared to commercial farms, and that part-time farmers may prefer to stay part-time either as a lifestyle or with a complementary off-farm income in Scotland (Sutherland et al., 2019); and (iv) may be perceived as a career objective among youth as a “planned part-time career path” on the EU islands (Unay-Gailhard and Simões, 2021).

In terms of the gender dimensions of part-time farms, we have little knowledge on female-managed part-time farms. Sutherland et al. (2019) found that on these non-commercial farms, without gender division, both men and women feel trapped in an unprofitable situation, and women show an interest in management roles but with a disproportional amount of behavior to do so recreationally.

Returning back to our findings, it could be the case that certain part-time family farms may find AECMs attractive for specific sustainable production methods (e.g., organic products requiring processing), and for these kinds of farms gender differences disappear. In that case, gender differences for accessing AECMs no longer exist, but the farmers’ potential to provision those kinds of production methods rises as an important factor in decision-making. In the literature, a finding that may support this possibility is provided by Guarín et al. (2020). The authors report key characteristics of European part-time farms, with a very high percentage of on-farm food processing as an important source of revenue.

Finally, even if it is out of the scope of this study’s objectives, we found a robust result for the positive and significant effects of agricultural education and farm size on the adoption of agri-environmental farming practices. In the entire study sample of young farmers, a larger farm size and higher level of agricultural education increases the likelihood of the adoption of AECMs. This is in line with previous studies focused on the role of farm characteristics on adoption behavior (see Unay-Gailhard and Bojnec (2015) for farm size and Pavlis et al. (2017) for a review on agricultural education). The contribution of our research to these studies provides insights on the ongoing positive effect among farms managed by young farmers.

8. Conclusion

Our study findings are in line with previous studies documenting the stronger tendency of young women farmers towards environmentally friendly farming activities (Boon et al., 2010; Läßle 2012; Chatzitheodoridis and Kontogeorgos 2020; Perez et al., 2020). No matter whether we compare farms managed by young males and women, or farms with a high and low involvement of young women workers and spouses, the combination of work statuses (manager, or full-time worker and spouse) and schedules (full- or part-time) of young women farmers emerges as an important factor for understanding the gender dimension of environmental concerns, and particularly the adoption of AECMs.

We argue that observed gender differences reflect several overlapping issues within the relationship between gender and environmental concerns, particularly gender differences in farm characteristics, agri-entrepreneurship strategies, labor aspects of environmental farming practices, and key characteristics of part-time farms. Based on the profile of young farmers in our study, the gender differences among spousal involvement on the farms draws attention to the labor-intensive nature of this topic, which could mediate the relationship between gender and decision-making towards the adoption of AECMs.

From a policy perspective, innovative policies for the climate and environment proposed through a set of policy initiatives under the European Green Deal are the main considerations of the European Commission for 2019–2024. Our study results show that farms managed by young women managers and farms with a high involvement of women in farm work are more likely to “follow the norm” and respond to environmental policy targets defined by institutions as a voluntary based subsidy. Therefore, if policies intend to focus on gender aspects to improve the adoption behavior of agri-environmental farming practices, they may likely be faced with less resistance by farms that are managed by young women farmers, although even these farms ongoingly show a masculine form with a high involvement of spouses in farm work.

The proposed gender-aware agri-environmental policy design for young farmer supports needs careful consideration. As suggested by Sutherland et al. (2013), in some contexts AECMs might be understood as agri-entrepreneurship opportunities rather than a chance to achieve environmental goals. Although environmentally friendly farming practices may serve as a policy driver to increase the agri-entrepreneurship intentions of young women, there is missing knowledge on how young women make economic decisions in farming careers in association with achieving the required environmental outcomes. This is an issue that requires further research. The theoretical, conceptual, and methodological explanations of gender-aware microeconomics that analyze the gender differences in economic decisions and its effect on the natural environment still needs to be explored (Pouw and Akram-Lodhi 2017).

As a concluding remark, we would like to point out the limitations of our study, which cover four main points. First, looking at the relationship between gender and environmental perspectives, it is important to note that the investigated AECM adoption behavior is not necessary indicative to understanding the agri-environmental behaviors of young women farmers. Other reasons, such as a high ability of women to be more easily involved with on-farm organic processing and food production compared to males, or unequal access to other financial resources other than subsidies, may play a role in AECM adoption. Second, based on previous knowledge in the study country context, women managers are considered landowners and active in the decision-making processes of family farm businesses (Čerňič Istenič 2015; Čerňič Istenič and Charatsari 2017). In other country contexts, the use of the “gender

of manager” among younger generations may represent a limit in the analysis in cases where young women are registered administratively as farm managers on behalf of their spouses but are not necessary involved with agriculture (e.g., for the case of Greece, see Tsiaousi and Partalidou 2020). Third, our study investigates the adoption behavior of AECMs without focusing on a specific measure, but as a whole. Studies that investigate distinctions among these measures may provide further details on gender and environmental perspectives in the farming sector. Finally, given that a primary focus of this paper is on young farmers, this analysis does not aim to compare different age categories (younger versus older farmers). A further study on the age specific models would be interesting for exploring how gender roles influence a range of behavior towards agri-environmental farming practices among different farming generations.

Credit author statement

İlkay Unay-Gailhard: Conceptualization, Methodology, Formal analysis, Writing- Original draft preparation, Visualization, Funding acquisition. Štefan Bojnec: Software, Data curation, Validation, Writing - Review & Editing, Funding acquisition.

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Appendix

Table A1

Descriptive statistics-II: results of the two-way *t*-test in each study sample, Slovenian FADN dataset, average from 2014 to 2017

FARM CHARACTERISTICS	Unit	Entire Sample: Farms managed by young managers			Subsample-I: Family farms managed by young male managers			Subsample-II: Part-time family farms managed by young managers		
		Mean differences	Female-managed farms	Male managed farms	Mean differences	Farms with high involvement of spouse	Farms with absent or low involvement of spouse	Mean differences	Female-managed farms	Male-managed farms
		p-value	N = 237 (18.9%)	N = 1216	p-value	N = 175 (16.7%)	N = 1042	p-value	N = 75 (28%)	N = 267
<i>Environmental concerns of young farm managers</i>										
Farms that adopted Agri-Environment-Climate Measures (AECMs)	%	0.0574	66.24	59.65	0.0235	67.42	58.34	0.0574	66.24	59.65
<i>Type of family farm configuration based on working hours of farm work</i>										
Hours spent on the farm by farm managers	AWU	0.0000	958.93	1216.73	0.0000	1403.53	1185.35	0.0000	427.64	540.93
Hours spent on the farm by the spouse of the farm manager	AWU	0.0000	692.76	327.76	0.0000	1933.92	263.02	0.0000	320.77	119.82

Table A2

Descriptive statistics-III: Pearson chi2 test for the entire sample, differences in education background regarding the gender of young farm managers, Slovenian FADN dataset, average from 2014 to 2017

FARM CHARACTERISTICS	Used statistics	Entire Sample: Young Farmers N = 1454		
		p-value	Female managers N = 237	Male managers N = 1217
Education of farm manager:		0.008		
Degree in agriculture	% (N)		8.44 (21)	13.39 (163)
Basic level agricultural training	% (N)		38.40 (91)	43.63 (531)
Practical agricultural experience	% (N)		53.16 (126)	42.97 (523)

Table A3

Results of the Kruskal-Wallis H test for the entire sample: differences in farm characteristics regarding the farmers' educational backgrounds, Slovenian FADN dataset, average from 2014 to 2017

FARM CHARACTERISTICS	Young farm managers with practical experience N = 649		Young farm managers with basic training in agriculture N = 622		Young farm managers with degree in agriculture N = 183		Kruskal-Wallis H test	
	Mean	Median	Mean	Median	Mean	Median	Chi-sq	p-value
LABOUR								
Share of family labor	98.76	100.00	97.97	100.00	95.78	100.00	40.58	0.0001
Hours spent by farm manager on the farm	1091.39	900.00	1225.76	1125	1296.67	1305.00	23.33	0.0001
Hours spent by the spouse of manager on the farm	457.02	315.00	345.80	0.00	310.42	0.00	34.54	0.0001
LAND								
Farm size	12.68	8.90	14.03	10.20	16.27	12.63	14.18	0.0008
Share of rented farm land (UAA)	21.81	12.07	27.38	21.41	29.55	24.31	23.95	0.0001
CAPITAL & ENTREPRENEURSHIP								
Land productivity	2068.07	1585.40	2633.72	1.958.38	3.503.77	2344.87	57.59	0.0001
Non-agricultural income (Euros)	5678.84	708.44	5327.26	607.90	7710.95	955.16	3.50	0.1732
Received environmental subsidies (Euros)	1578.62	436.02	1604.89	506.47	3215.99	1247.91	18.17	0.0001

Note: Kruskal-Wallis H test results show that there are differences regarding the received environmental subsidies among young farmers who have practical experience, basic training, and a degree in agriculture, with agricultural degree holders significantly receiving more subsidies in most cases.

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