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Transition to Organic Farming: A Case from Hungary

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Abstract: Sustainable agricultural solutions have emerged as feasible options for mitigating the negative environmental impacts created by agricultural production or adapting to inevitable climate change. Organic food production has become one of the most popular sustainable solutions among these. There is also a clear scientific consensus that transformative changes in agricultural systems and practice are needed as a response to the effects of climate change. A great variety of factors that influence the transition to organic farming have been found and identified over time. To understand the dynamics that lead farmers to move to organic farming, it is necessary to examine the relationship between these factors. In this study, we investigated the impacts of certain factors on the possibility of Hungarian farmers' conversion to organic production in the context of climate change adaptation. This dynamic was studied using descriptive and exploratory techniques on a cross-sectional sample. While the study supported certain well-established facts, it also yielded some surprising findings. One of our findings is that the transition to organic farming does not seem to be motivated by the perception of bad weather events, which is somewhat surprising. This outcome contradicts the frequently claimed idea that organic farming may be a successful adaptation strategy.

Keywords: organic farming; climate change adaptation; Hungary; FADN

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1. Introduction

Agriculture has always been about more than just food production. Over the centuries, agricultural practices have shaped the environmental landscape, local communities, economies, and cultures [1,2]. Indeed, whereas in the past, the agricultural system was characterized by the presence of small farms that offered local and seasonal products while having a minimal impact on the territory in which they operated [3], in the last seventy years, agricultural food production has increasingly evolved from a local activity to a global industry, aimed at feeding increasingly large populations with globalized tastes in Europe and around the world [4].

In an increasingly urbanized and globalized world, increased competition has necessitated the intensification of agricultural production, which primarily benefits larger enterprises, which often specialize in growing or breeding a small number of plant or animal varieties over large areas and have guaranteed access to markets around the world [5]. Furthermore, intensive farming makes food cheaper in relation to the size of the land, which helps feed the world's growing population [6]. However, agricultural intensification depends on the use of fertilizers, pesticides, and mechanical energy [7], which are major causes of increased GHG emissions [8], soil acidification, increases in reactive nitrogen over-supply, and biodiversity loss [9,10].

For these reasons, intensive agriculture is a major contributor to global climate change [11]. Indeed, Kotschi and Muller-Sämann claimed that agriculture was responsible for 15% of global greenhouse gas emissions, accounting for one-quarter of carbon dioxide emissions, two-thirds of methane emissions, and nearly all nitrous oxide emissions [12]. From this perspective, intensive agriculture has become the biggest threat to the environment when it comes to global warming, also leading to the emergence of new pests and being responsible for much of the world's deforestation [13].

Considering the high contribution of agriculture to greenhouse gas emissions, a reversal has become necessary and the implementation of sustainable agricultural innovations has emerged as a viable alternative to mitigate the environmental impacts generated by agricultural production [14]. Ikerd [15] defines sustainable agriculture as "*capable of maintaining its productivity and usefulness to society over the long run ... it must be environmentally sound, resource-conserving, economically viable and socially supportive, commercially competitive, and environmentally sound*" (p. 30). Keeping this in mind, sustainable agriculture and food systems must provide enough healthy food for everyone while minimizing damage to the environment and giving farmers a good living. Eyhorn et al. [16] say that agriculture and food systems need to change quickly if we want to make progress toward the Sustainable Development Goals (SDGs) set by the United Nations for 2030 and care for the planet. The sustainable agriculture agenda includes many different options, such as agroecology, conservation agriculture and forestry practices, crop and forest species diversity, appropriate crop and forest rotations, integrated pest management, pollinator conservation, rainwater harvesting, range and pasture management, and precision agriculture systems [17]. Among these solutions, organic food production has become one of the most popular sustainable options [18,19]. Organic agriculture is unique in that it promotes tight energy and short supply chains, resulting in a full system of agriculture based on ecological principles [20]. The potential of organic agriculture in mitigating climate change is mostly supported based on assumptions regarding the soil carbon sequestration potential of organic management [21,22]. Organic agriculture also offers a unique combination of environmentally friendly practices with low external inputs while contributing to food availability [23]. It refrains from using synthetic chemical fertilizers and pesticides, promotes crop rotations, and soil fertility is promoted [24]. The positive performance of organic agriculture as measured against a range of environmental indicators has been widely reported [25].

However, despite the benefits of organic practices in the agricultural sector being widely recognized, their adoption rate still remains very low, as many farmers are reluctant to adopt this innovation [26]. To help organic farming grow, it is important to look at why farmers are or are not switching to organic farming and what the main reasons are for farmers to switch to organic farming. Hence, this study's research question is: "What are the main reasons for farmers to switch to organic farming in the context of climate change adaptation?" In order to find an answer to the predetermined question, this study considers a sample of Hungarian farmers and develops multiple research hypotheses. We chose to carry out this study in Hungary because, despite the fact that the European "Farm to Fork" strategy aims to allocate at least 25% of each country's agricultural area to organic production by 2030 [27], Hungary is still well below the established threshold, as, in the country, organic farming remains a niche market [28]. The willingness of farmers to establish organic farms is much lower than in Western European countries [29]. The results of this study could have both theoretical and policy implications. From a theoretical perspective, understanding the factors influencing the adoption of organic farming would enrich current knowledge. In terms of policy, a clear picture of the factors that farmers use to decide whether or not to use organic practices could help policymakers come up with the right steps to take to encourage organic farming in the agricultural sector.

The study is structured as follows. The theoretical framework presents the concepts that define the scope of this inquiry. The Materials and Methods section reviews the research design, the context of data collection, and the details of of data analysis. The results come next, and then there is a section about how the results fit into a bigger picture of organic farming.

2. Theoretical Framework

The fundamental activities of agriculture, such as ploughing and fossil fuel combustion, contribute to climate change. Globally, 17% of GHG emissions can be attrbuted to agricultural activities [30]. This is why ethical and sustainable agriculture—farming practices that adhere to organic principles—is essential to our future. Therefore, we shed light on the theoretical considerations of three different angles. First, we briefly overview the most fundamental aspects of organic farming research. We then explore the link between organic farming and climate change adaptation from the perspective of farmers' decision-making. Based on these insights, we formulate our research questions and hypotheses.

2.1. Aspects of Organic Agriculture

Discussions on the benefits and costs of organic farming represent a key subfield in the literature [31]. Among these, yield and yield stability are the most widely discussed themes. Synthetized reviews of studies comparing the yields of conventional and organic farming suggest an average of 8% to 25% lower yields in organic systems [32–34]. However, under adverse circumstances such as severe droughts, organic management has been shown to produce higher yields than can be explained by the higher water-holding capacity of organically farmed soils [35]. The greater resilience of organic farming can be associated with the positive experience of diversity in crop rotations. However, pest outbreaks, weed pressure, and variable nitrogen supply may cause a counter-effect on yield stability [31]. Biodiversity is another frequently measured dimension when assessing the benefits of organic farming. In the review of Bengtsson et al. [36], results suggest that organic land management is often beneficial for the biodiversity of wildlife on farms and landscapes. As one of the most common criticisms of conventional agriculture is that it contributes to soil degradation and soil erosion, soil health has become a key element of organic management. There is empirical evidence confirming that organically managed soils are less vulnerable to erosion and have more organic content due to organic matter inputs [37]. These favorable conditions lead to improving fertility parameters. Results of a meta-analysis claim that organic farming is more profitable than conventional farming due to the premium prices of organic products [38]. This clearly positive impact on organic farmers' livelihoods can be further strengthened with mixed farming systems [31]. Mentioning premium prices for organic agriculture points to the recent trends indicating that the demand for organic products has been continuously growing, making it one of the fastest growing food sectors both in North America and Europe [39]. Both organic farming and organic markets are two of the most regulated sectors in farming and in retail sales. Organic regulations strictly codify principles and practices, directing farmers on what rules to follow when producing organically [32]. In most countries, organic products can only be sold under legally-defined labelling schemes that inform consumers [40]. Organic management can be an ideal strategy for agricultural production to strengthen climate change mitigation efforts. Reganold and Wachter [41] claim that significantly lower energy consumption and higher soil organic matter are key factors to consider when looking for arguments in favor of organic conversion. Seufert and Ramankutty [31] and Gattinger [42]) looked at case studies to find that GHG emissions are lower per unit area in organic management. However, when they looked at emissions per unit of output, the results were very different.

2.2. Factors Associated with Climate Change Adaptation and the Adoption of Organic Farming

This section reviews the factors that have been shown to influence adaptation decisions. There is also a clearly articulated scientific consensus that there is a need for transformative changes in agricultural systems as responses to climate change impacts [43]. Due to the scientific recognition that climate change adaptation in agriculture systems is an urgent need, research in agricultural climate change adaptation has been a pivotal field of inquiry in multiple disciplines [44]. A large part of this discourse has been devoted to understanding farmers' adaptive behavior. Farmers are the sole agents turning policies, measures, incentives, and no less importantly, their perceptions into actual practices on the ground. Studies on farmers' adaptive behavior have tried to figure out what factors affect farmers' decisions about how to deal with climate change [45].

For quite a long time, the dominant and influential view has been that farmers show rationally expected, optimization-led, and profit-maximizing behavior [46]. This canonical theory has been exposed to a large amount of empirical evidence, resulting in a psychologically more realistic interpretation of economic behavior [47,48]. The current consensus in that sense, has been formed on results suggesting that individuals' ability to adapt to climate change is dependent on their perception of climate hazards as well as their values and objectives [49]. The most important thing to take away from these results is that values, cognitive biases, mental shortcuts, emotions, social experiences, social relationships, norms, peer validation, learning, and other contextual factors [50–52] have a big impact on how people make decisions when there is risk or uncertainty.

Vulturius et al. [53] identified two subfields of climate change adaptation research. In the structural approach, the success of adaptation largely depends on individuals' access to resources and skills. Among these, objective factors associated with adaptation, education, knowledge, cultural preferences, technology use, and economic constraint have been discussed and studied [49]. The other approach is based on the argument that draws attention to other factors that have explanatory power for individuals' adaptive actions. Regarding cognitive, affective, and behavioral factors, they are often called subjective factors in the literature. Multiple subjective factors have been identified as a result of studies from diverse disciplines over the last decades. Grothmann and Patt [54] proposed an analytical model that addresses two key cognitive processes of climate change adaptation. Climate change risk appraisal is the result of the perceived probability and severity of any climate change related threat. Perceived adaptive capacity refers to beliefs in adaptation actions. Risk appraisal and perceived adaptive capacity are positively correlated with adaptation intention. Individual adaptation has been shown to be influenced by whether or not a person believes in climate change [55–59]. These results suggest that believing that climate change is occurring has a positive impact on adaptation attitude. Other studies have drawn attention to the importance of climate change communication, including climate change science, implying that adaptation intentions and actions are affected by how effectively scientific facts are communicated towards a wider audience [60–62]. Adaptive decision making is informed by the temporal perspective of climate change risk [63]. Studies on proximizing climate change focus on the extent of the impact of psychological distance on individuals' engagement with climate change issues. Brugger et al. [64] suggest that temporal and spatial proximal consequences can trigger positive and negative responses but can cause no visible actions in individuals' decision making. Extreme events experienced on own assets, such as land or yield, have been shown to have an impact on farmers' adaptive decisions. The more serious these events are, the more likely it is that people will change their behavior to avoid harm in the future.

The other subject area covered by this study is organic farming. Conversion to organic farming is a complex practice and can be influenced by a variety of socio-demographic, psycho-attitudinal, and contextual factors [65]. Among the socio-demographic characteristics of the farmer, variables such as age and gender are among the most investigated. However, the literature shows mixed results, so it is still quite problematic to understand the real impact of these personal characteristics on the adoption process of organic farming [66]. Indeed, regarding age, some studies have shown that younger farmers are more interested and ready to convert to organic farming, as they have more open minds than older farmers [67,68], who are generally less educated [69,70] and more risk-averse [71,72]. In contrast, other studies have shown that older farmers are more likely to convert because they are characterized as having more experience in the field, which enables them to change [69,73]. Similarly, considering the gender variable, some research has revealed that being female increases the likelihood of adopting organic farming compared to the male gender because women are more predisposed to collaboration with the farm team [74] and, at the same time, they show more concern about the health effects of synthetic chemical pesticides [75]. On the other hand, Thorsøe et al. [76] found that men are more supportive of adopting sustainable innovation because they are more self-confident.

Another important socio-demographic variable is education. In fact, most studies on the topic show that as years of education increase, the likelihood that the farmer will decide to convert to organic farming also increases [77,78]. This is likely because farmers with more education have the tools they need to understand and carry out the change [77].

Finally, income is also a key component. Pradhan et al. [79] say that when the economy is more stable, farmers are more likely to take care of more farmland and buy new tools and supplies for organic farming. Consequently, if farmers have extra income from off-farm sources, participation in organic farming is more likely to increase [80], as farmers are more confident that they can cope with hypothetical economic contingencies. In the same way, if more family members help out on the farm, the farmer will be more likely to change, since he or she does not have to pay for extra workers [81].

Delving into psycho-attitudinal factors, variables such as attitude, perception of the importance of organic farming, social norms, and risk perception deserve special attention. In more detail, the inherent literature has shown that, generally, the likelihood of converting to organic farming increases when farmers take a positive attitude towards the management of organic practices, towards the environment or health, or towards social influences [82,83]. Similarly, perception is also a determinant of adoption [84]. If farmers perceive that organic farming is easily applicable on their farm and results in increased income, then they are more likely to want to convert [85]. Conversely, more risk-averse farmers will be less willing to bear the risk of a situation that includes higher input costs, fluctuating market prices, and market demand [86]. In addition, it is possible that farmers feel the need to protect their family's health and worry about society's judgement regarding their farm management. In this way, social norms can also affect how farmers act when it comes to organic farming [86].

Finally, conversion to organic farming is influenced by contextual factors. Among other things, these include farm size and characteristics, membership in agricultural associations, and the possibility of technical and economic support. Some studies highlight that larger farms are more difficult to manage, resulting in farmers' having less motivation to initiate conversion [71,79]. Therefore, organic farming is more likely to be adopted on small family-run farms [87]. In contrast, other studies have argued that large farms are more likely to adopt organic production because they are more involved in obtaining financial subsidies [88] and technical support [72]. For similar reasons, the literature shows that farms that are part of an agricultural association are more likely to adopt organic farming. This could be because farmers can easily get information and solve problems related to group certification and group marketing when they work in groups and share information with other organic farmers [81].

All of the above factors affect each other and the farmer's decision-making process. To understand the dynamics that lead farmers to switch to organic farming, it is important to look at each of these factors and how they affect each other [89].

2.3. Research Questions and Hypothesis

The central topic of the study is: what are the primary reasons for farmers to transition to organic production? In order to properly address this question, five hypotheses were formulated and tested. The greening measure was a significant novelty of the Common Agricultural Policy in the 2015–2020 programming period. The overall objective of this new payment structure is to support agricultural practices that are beneficial to the climate and the environment. The objective was to be achieved by arable crop diversification, and maintenance of permanent grassland ecological focus areas as a mandatory component within the framework of direct payments [90]. The introduction of the measure has been surrounded by political debates, with the EU in particular accused of keeping Pillar 1 payments alive and failing to efficiently integrate environmental objectives into agricultural policies [91–95]. By now, a number of impact studies have assessed the actual effect of greening measures from various perspectives [96]. In this discourse, organic farming is usually mentioned in the contexts of eligibility and exemptions because certified farms are ipso facto entitled to greening payments with an exception to the obligations [97]. This legal recognition is a strong political signal from EU policymakers [98], on the one hand, but it may also result in greening measures that have not been expected to contribute to organic farming conversion [99], or have not been seen as an effective incentive to promote sustainability transition [100]. It is therefore worth looking at whether there is a relationship between greening and the adoption of organic farming through the following hypotheses: (H1) Greening support positively influences organic production.

The comparisons between conventional and organic farming have been a prominent topic in the discourse on sustainability transition in agriculture [11]. Globally, intensive agriculture has been practiced for many years and is now a fundamental way of life. Intensive agriculture increases the quantities of hazardous chemicals in our water and greenhouse gas emissions in the atmosphere. The world's woods and woodlands have decreased by around two percent as a result of intensive agriculture. Intensive agricultural land use restricts gene flow and fragments habitats. Where insecticides are routinely employed, local extinctions are commonplace [101]. These comparisons often highlight lower yields produced by organic farms, but emphasize that they provide more profit, more environmental benefits, more nutritious food. Another perspective, often applied in these comparisons, looks at the barriers that hinder the adoption of organic farming. Inequalities around the distribution of public and private fundings, access to infrastructures and knowledge on the one hand and the insufficiencies of legal and financial instruments on the other hand are the main drivers keeping the conventional intensive agro-industrial model in current food systems at the expense of widespread conversion to organic farming [41]. This finding leads us to the second hypothesis to assess in this study: (H2) Intense agriculture hinders organic production

Climate change is expected to result in severe impacts on food production worldwide [102], due to high temperatures and reduced water availability, which lead to reduced crop yields. In addition, climate-induced changes in the population dynamics and invasiveness of insect pests, pathogens, and weeds could exacerbate these effects [103]. The potential influence of climate change on future crop productivity is a serious social concern. Present forecast results for the twenty-first century indicate significantly more negative yield responses for maize, soybean, and rice than the original models. While estimates of future yields remain unknown, these findings show that important breadbasket regions will confront unique anthropogenic climatic hazards sooner than anticipated [104]. As such, adaptation is considered a key factor that should shape the future severity of climate change impacts on food production [105]. The greatest benefits are likely to come from more radical agro-ecological measures that strengthen the resilience of farmers and rural communities [106]. Among these, the development of organic practices could be a solution, as organic is now a concrete response with respect to mitigation and adaptation policies [21]. In fact, organic agriculture includes, in addition to the reduction of the use of synthetic chemicals, the diversification of agroecosystems and the general enhancement of agrobiodiversity. When compared to the industrial agricultural model, organic agriculture that is based on the improvement of soil fertility and biological diversity within the farm and that bases its innovative capacity on personal experience, the ability of observation and intuition, and traditional knowledge has greater resilience to water scarcity, pathogen impact, and the presence of extreme weather events such as drought and floods [107]. The following hypothesis is derived: (H3) The negative economic effects of climate change have an impact on becoming an organic producer.

The literature suggests that the likelihood of adopting sustainable innovations to mitigate climate change is supported by increased awareness of the importance of implementing sustainable practices and solid guidance on how to make the change [108]. With this in mind, lack of information can be a barrier to converting to organic agriculture, especially as farmers feel insecure about what rules might be imposed on them in the near future [109]. In fact, some authors have recognized that simple knowledge transfer is generally insufficient to achieve sustainable behavioral changes [110]. Farmers need information that they feel is reliable and that they can rely on [111]. Studies of the adoption of innovations related to organic or generally sustainable agriculture [112] have found that climate change information must be made relevant to local contexts in order for farmers to find it useful in guiding the implementation of sustainable practices [113,114]. Additionally, Schattman et al. [115] emphasize the importance of considering farmers' perspectives and explain that personal experiences with climate-related events decrease risk perception and help determine adaptation actions among farmers. Again, Arbuckle et al. [116] found that farmers who are informed about the behaviors that lead to climate change are more susceptible to adaptation and mitigation actions than farmers who do not accept the human cause of climate change. Furthermore, the advancement of information and communication technologies has resulted in major changes in farmers' knowledge and information consumption patterns. These technologies have the potential to motivate and drive farmers' innovation activities, including adaptation actions [117,118]. Based on these factors, the following hypothesis has been formulated: (H4) The information sources of climate change practices have an influence on becoming an organic producer.

Several studies have concluded that organic farming can be an effective adaptation strategy in the face of increasing climate change [21,119]. Considering that more care is typically taken to increase soil organic matter and conserve biodiversity, and produce less water pollution, organic farming may have a significant role to play in increasing the resilience of agriculture [31,120]. This evidence suggests that the dynamics of the transition towards organic farming may be also associated and driven by the need to use more adaptation practices. This line of thought contradicts existing literature evidence, but it may be worth investigating further because the inevitable need for adaptation may eventually lead farmers to transition to organic farming. Based on these factors, the following hypothesis has been formulated: (H5) More adaptation practices have an influence on the willingness to convert to organic farming.

3. Materials and Methods

3.1. Framework for Sampling

Our study aims to demonstrate how local agricultural commodity producers are responding to climate change in the context of conversion to organic farming. We used Woods and colleagues' [121] approach in our study, adapting it to the scope of our research and the domestic environment. We employed a four-element analytical framework to investigate the subject of agricultural adaptation, and then included components of that framework into the model we created to describe farmers' adaptation behavior. The following points of analysis are included in the analytical framework:

- Belief in the effects of climate change. According to relevant research, the more one believes in the theory of climate change, the more likely one is to adjust one's own activities to the projected consequences.
- Producers' perceptions of climate change impacts the extent to which they are affected by it. According to the decision theory literature on climate change, the producer's perception of change is the most crucial element determining adaptation, aside from belief. We also addressed questions about perceptions in relation to producer actions. We wanted to find out how changes in the weather affect farmers' profits, crop quality, crop yields, and investment decisions.
- The ways in which producers adjust. Farmers are constantly under pressure to change due to the nature of their business. One of the study's main goals was to find out what steps farmers have taken or plan to take to make their operations more climate resilient. The list of possible answers to the questionnaire was made on the basis of professional conversations and interviews with experts, with the idea that respondents could come from many different fields.

- Adaptation impediments. According to the literature review, there are a variety of reasons why a producer may be unable to adopt the adaptation approach that he or she believes is necessary, in addition to weed difficulties. Our survey found barriers to economic capital, knowledge and skills, tendering prospects, the regulatory environment, technology, labor, and lack of cooperation were all addressed in our survey.

The study was based on the Hungarian records of Farm Accounting Data Network (FADN). Face-to-face data collection consisted of survey administrators asking questions and recording responses in person on a paper-based questionnaire. Later, paper-based responses were entered via an online interface, resulting in a standardized database of responses. It was the responsibility of domestic FADN partners' survey administrators to collect data from farms selected to participate in regular and thematic FADN surveys. The Hungarian component of the Farm Accounting Data Network (FADN) is up-to-date and compliant. The network has the accrual accounts of 1900 Hungarian holdings, which is a representative sample of 106 thousand agricultural holdings (including individual and commercial partnerships) with an STE of over 4000.

3.2. Data Collection

The study was built around a questionnaire survey of a domestic sample of farms that was part of the Hungarian component of the Farm Accounting Data Network (FADN). The questionnaire, which was used to collect data, was made available to the FADN network's seven accountancy offices for farmers to fill out both online and on paper. Therefore, staff members of FADN partners worked as survey administrators. The survey sample was not chosen using probability purposive or expert sampling approaches. According to Etikan [122], the researcher makes a conscious judgement about the participant's selection based on the participant's attributes in this approach. As a result, the researcher determines which traits qualify potential volunteers for participation in the study. However, the individuals' availability and willingness to participate are also important elements. The accountancy firms in the national FADN network were required to fill out a predetermined number of questionnaires for this study. At the end of the survey, the total number of completed items had to exceed 300. For the selection of participants, the accountancy firms were not provided with any pre-defined criteria. The only guiding assumption was that producers must be willing to fill out the survey. The data was collected between September and December 2017.

3.3. Applied Methods

To analyze the combined effects of the hypothesized factors, we applied multivariate regression using data from our cross-sectional sample. Cross-sectional studies are observational research projects that look at data from a population at a particular point in time. Cross-sectional studies do not follow subjects over time, in contrast to other kinds of observational research. They are often simple and inexpensive to perform. When preparing for future advanced research, they are helpful for producing preliminary evidence [123]. A two-sample *t*-test was used to compare the means. This method was necessary in two cases: (1) to determine whether farmers perceive the impact of climate change on the weather or on their farm business position to be greater, and (2) to find out whether they use positive or negative information sources more often when identifying adaptation tools.

3.4. Descriptive Statistics

First of all, we need to know the characteristics of our sample and the variables in our models. This is summarized in Table 1.

Table 1. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Becoming bio producer [1]	300	1.08	0.433	1	4
Greening support (log of greening support, 1000 HUF)	287	7.16	1.34	3.63	11.54
Intensity of production (log of NPK fertilizer kg/ha)	260	4.72	0.80	1.65	8.14
Negative WEATHER effects of climate change					
Weather became more volatile [2]	300	3.35	1.31	1	5
Average temperature has risen [2]	300	3.37	1.27	1	5
Annual rainfall has decreased [2]	300	3.55	0.97	1	5
Negative ECONOMIC effects of climate change					
Reduced profitability of my farm [2]	300	2.93	0.89	1	5
Quality deterioration of my crops [2]	300	2.68	0.85	1	5
Yields decrease on my farm [2]	300	2.86	0.94	1	5
Level of investment has decreased [2]	300	2.79	1.35	1	5
AVERAGE negative weather effects of climate change [2]	300	3.42	0.89	1.33	5
AVERAGE negative economic effects of climate change [2]	300	2.82	0.75	1	5
POSITIVE information sources					
Professional journals [3]	300	0.64	0.48	0	1
Professional organizations [3]	300	0.17	0.38	0	1
National Agricultural Chamber [3]	300	0.41	0.49	0	1
Other farmers [3]	300	0.66	0.48	0	1
Independent Consultant [3]	300	0.27	0.45	0	1
Exhibition/fair [3]	300	0.37	0.48	0	1
Educational institution [3]	300	0.05	0.23	0	1
NEGATIVE information sources					
Internet [3]	300	0.67	0.47	0	1
Radio, TV, media [3]	300	0.59	0.49	0	1
Input supplier/Integrator [3]	300	0.27	0.44	0	1
Professional training [3]	300	0.42	0.49	0	1
Average **POSITIVE** information sources [3]	300	0.368	0.185	0	1
Average **NEGATIVE** information sources [3]	300	0.485	0.246	0	1

[1] 1 = not bio at all, 2 = changing to bio in progress, 3 = besides traditional bio also, 4 = exclusively bio; [2] 1 = fully disagree, 5 = fully agree; [3] 0 = No, 1 = Yes.

4. Results

Table 2 presents the results of three regression models. In all cases, our dependent variable was the degree of transition from conventional to organic production, measured on a scale of 1–4. Thirteen farmers who did not receive greening support were not included in our analysis. In the first model, each source of information that farmers use to learn about how to adapt was still looked at separately. In the second model, only those information sources that were found to be significant in the first model were retained. Finally, in the third model, the negative and positive sources from the first model were averaged and these two variables were included in the model. Our aim with this multifaceted approach was to demonstrate the robustness of our theoretical considerations. As can be seen, we have been successful in this endeavor.

Table 2. Multivariate regression results.

	(1)	**(2)**	**(3)**
Greening support	0.0469 ***	0.0437 ***	0.0491 ***
	(2.67)	(2.77)	(3.01)
Intensity of production	−0.111 ***	−0.108 ***	−0.104 ***
	(−4.49)	(−4.64)	(−4.46)
Negative effects of climate change—weather	0.0138	0.0171	0.0253
	(0.59)	(0.76)	(1.12)
Negative effects of climate change—economy	−0.0696 **	−0.0730 ***	−0.0665 **
	(−2.43)	(−2.63)	(−2.36)

Table 2. *Cont.*

	(1)	(2)	(3)
Number of applied adaptation practices	−0.0128 ***	−0.00873 **	−0.0130 ***
	(−2.76)	(−2.21)	(−3.10)
Professional journals	0.0122		
	(0.33)		
Internet	−0.00913		
	(−0.24)		
Radio, TV, media	−0.115 ***	−0.0979 ***	
	(−3.06)	(−2.77)	
Professional organizations	0.0337		
	(0.65)		
National Agricultural Chamber	0.0163		
	(0.46)		
Independent consultant	0.0202		
	(0.49)		
Exhibition, fair	0.0348		
	(0.98)		
Educational institute	0.165 **	0.163 **	
	(2.23)	(2.33)	
Other farmers	0.0338		
	(0.87)		
Input supplier/Integrator	−0.0350		
	(−0.86)		
Professional training	−0.0559		
	(−1.38)		
Average POSITIVE information sources			0.207 **
			(2.20)
Average NEGATIVE information sources			−0.196 ***
			(−2.72)
_cons	1.507 ***	1.490 ***	1.393 ***
	(8.41)	(8.63)	(8.15)
N	203	203	203
R^2	0.257	0.230	0.212
adj. R^2	0.193	0.202	0.184

t statistics in parentheses. ** $p < 0.05$, *** $p < 0.010$.

Table 3 presents the results of the two-sample *t*-test. The purpose of this is to highlight the fact that there is a significant difference in farmers' perceptions of the negative impacts of climate change, depending on whether they are weather or business impacts. There is also a significant difference in the frequency of use of positive and negative information sources.

Table 3. Comparison of two means.

	obs.	dif. [1]	*p* Value
Negative weather effects-Negative economic effects	300	0.598	0.000
Positive info sources-Negative info sources	300	−0.117	0.000

[1] Measured on 5 point Likert scale.

5. Discussion

The results of this study enrich knowledge about the dynamics that drive farmers to make a conversion to organic farming. Moreover, when compared with other papers on the topic, they support some findings already known in the literature. For example, as in this research in which greening support was found to positively influence organic production, Bertoni et al. [96] and Bertoni et al. [97] in their studies also came to similar conclusions. The greening measure aims to support agricultural practices that are beneficial to the climate and environment. It follows that organic farming is perfectly compatible with greening measures, and these could be a valuable incentive to promote the transition to sustainability.

Similarly, this study found that intensive agriculture hinders organic production. Part of the existing literature on the topic confirms the result of our hypothesis [41,124]. In fact, while intensive agriculture increases production quantities with the help of synthetic chemicals that, however, cause serious damage to the environment, organic agriculture bans these synthetic products and as a result, there will be lower yields produced (but more environmental benefits and healthier food). The comparison between the two situations goes against widespread conversion to organic farming [41].

Again, regarding the third hypothesis of this study, it was found that an increase in undesirable effects of climate change corresponds to a decrease in the likelihood of converting to organic. In contrast to the first two hypotheses that mostly go in agreement with the existing literature, this result is surprising. In fact, in general, the literature points out that organic practices should be a solution to climate change [21]. In fact, among other things, organic farming involves diversifying agroecosystems, improving soil fertility, and generally enhancing agrobiodiversity. These three conditions should make farmers more resilient to water shortages, pathogens, droughts, and floods, which will help them deal with the effects of climate change [107]. However, the fact that negative effects of climate change do not seem to make farmers more likely to adopt organic farming practices is likely because farmers still perceive the cost of transition is higher than the yield and revenue losses caused by climate change.

Our fourth hypothesis on information sources showed that there are several sources that have positive impacts and others that have negative impacts on conversion to organic farming. In particular, it was found that the most effective sources in facilitating organic transition were those from educational institutes. Having clear and accurate information from experts in the field can be valuable support, especially for those farmers who feel insecure about implementing an innovation [109,111]. Indeed, some authors have recognized that mere knowledge transfer is generally insufficient to achieve sustainable behavioral changes [110]. This may be why information from Radio, TV, and media has negatively influenced conversion to organic. Farmers need reassurance from figures they feel are competent and authoritative.

Lastly, the fifth hypothesis was formulated to test whether the number of adaptation practices had any impact on conversion to organic farming. This reverse thinking had never been documented in the literature, so it was intriguing to investigate the potential of this dynamic, because it might be possible that at some point in the future, farmers will be under so much pressure to adapt to climate change that this dynamic will culminate in a transition to organic production. The evidence resulting from this study did confirm this line of thinking partially. The model results show a connection between the adoption of adaption practices and the likelihood of converting to organic farming. The results, however, indicate a negative connection, so this reversed thinking did not lead to a new perspective on the well-studied link between organic farming and adaptation potential to climate change. Further research into this dynamic and understanding whether more adaptation practices may eventually lead to the transition to organic production can be a subject of future research.

6. Conclusions

Sustainable agricultural solutions have emerged as feasible options for mitigating the environmental impacts created by agricultural production or adapting to inevitable climate change. Organic food production has become one of the most popular sustainable solutions among these. The transition from conventional to organic farming has long been the focus of research from multiple disciplines. Numerous socio-demographic, psycho-attitudinal, and contextual elements have been identified as affecting and driving this transformation as a result of this extensive research. Climate change and the unavoidable necessity for producers to adapt will influence the conditions of the transition inevitably. The results of this study show that even though there has been a lot written about organic agriculture, it is still possible to find new evidence by looking at the context from a different perspective. The theoretical implication of this study is that it contributes with new research evidence to this diverse discourse. In this study, we investigated the impacts of certain factors on Hungarian farmers' conversion to organic production in the context of climate change adaptation. One of the findings of this study that stands out is that organic farming did not seem to be motivated by the perception of bad weather events. Given that organic farming is considered an established adaptive technique, this appears unexpected. This association was also not supported from another angle: in our sample, farmers who had previously implemented a large number of adaptation practices did not appear to be more likely to transition to organic produce. These results highlight the practical implications of this study. The weight of European organic production is expected to change significantly in the short term. As part of the Green Deal adopted by the EU Commission, the Farm to Fork strategy sets clear objectives regarding the share of organic production in EU agriculture. The target is that 25% of the EU's agricultural land should be under organic farming by 2030. Studies on the relationships between organic agriculture and climate change adaptation can undoubtedly help with the transition towards more organic production, given that some sort of adaptation in agricultural production is unavoidable due to climate change impacts.

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Limitations: The sampling method is where the limitation of this study is rooted. Although using the Hungarian FADN sample guaranteed that professional farmers were involved in data collection, no systematic sampling procedure was followed in choosing the subsample to guarantee representativeness. As a result of that, we were unable to deliver findings that can be generalized to the entire farming population.

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