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A TYPOLOGY TO EXPLAIN FACTORS AFFECTING THE ADOPTION OF AGRI-ENVIRONMENTAL PRACTICES: A CASE STUDY IN JAPAN

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Abstract: Like the governments of many other countries, the Japanese government is encouraging transitions to more environmentally sustainable agricultural schemes. However, there have been numerous debates around the world about what kind of farmers are willing to participate in agri-environmental practices, and no clear consensus has yet to emerge. Towards that end, some studies have used quantitative analysis to identify the demographic characteristics that affect the adoption of conservation practices, while others have used qualitative analysis to clarify the cognitive values farmers employ in their daily lives as social beings. In this study, to investigate farmers' motivational heterogeneity from the viewpoints of values and demographic characteristics, quantitative research was conducted in a rural community in the North-eastern region of Japan, where environmentally friendly agricultural practices have been used for more than 15 years. In this survey, 81 rice farmers responded to a variety of questions regarding their intentions to grow environmentally friendly rice and related demographic characteristics. Examining this data using factor analysis revealed that farmers were motivated to continue conservation practices due to three primary factors: stewardship, self-interest, and social networks. Contrary to previous studies, the stewardship factor was correlated with the self-interest factor, that indicates the emergence of a new type of environmentally friendly farmers. Also, as opposed to other studies that emphasized the importance of the stewardship and the self-interest, this study showed by cluster analysis that some farmers continued their practice solely due to the social networks. In addition, this study bridged the gap between previous qualitative and quantitative approach by indicating the relation between farmers value orientation and their demographic characteristics. To further encourage transitions to agri-environmental systems, policies that deal with farmer heterogeneity will need to be implemented.

Keywords: Environmentally friendly agriculture; Farmer decision making; Heterogeneity; Factor analysis; Cluster analysis

1. Introduction

The Japanese government formulated the "Measures for Achievement of Decarbonization and Resilience with Innovation (MeaDRI)" and embarked on a full-scale promotion of sustainable agriculture in 2021. The primary goals of this policy are a 50% reduction in the risk-weighted use of chemical pesticides by 2050, which will be achieved by the dissemination of the Integrated Pest Management (IPM) and other newly developed alternatives. Additional mandates include a 30% reduction in chemical fertilizer use, an increase in organic farming to 1 Mha (equivalent to 25% of farmland), and zero carbon dioxide (CO_2) emissions from fossil fuel combustion in agriculture, forestry, and fishery enterprises. In outlining to rationale behind these objectives, the government clearly states that the key to transitioning to more environmentally sustainable agricultural schemes is to create innovations, especially those centering on developing smart technologies (MAFF, 2021).

However, some social science studies (Weber-Blaschke et al., 2004; Karami and Keshavarz, 2010) have indicated that it would be unreasonable to conclude that technological progress will naturally lead to developing agri-environmental schemes. Those studies emphasized that whether farmers adopt new practices or not depends largely on social dimensions, thereby suggesting that farmer attitudes and behavior must be analyzed from sociological or social psychological approaches (Karami and Keshavarz, 2010; Grover and Gruver, 2017; Dessart et al., 2019). Similarly, studies conducted in Japan also support the idea that social factors can be effective to encourage the adoption of sustainable agriculture (Fujie et al., 2010; Nishimura, 2011).

Among the various social dimensions explored, some studies (e.g., Ruto and Garrod, 2009; Brown et al., 2019; Poltimäe and Peterson, 2021) indicate that the demographic characteristics of farmers can describe their behavior in relation to environmentally friendly agricultural practices. Those studies based on quantitative methods focus on farm size, years of education, and age as the main factors motivating farmer transitions. One strength of this approach is that it allows for the participation of large numbers of respondents, which means the data can be analyzed statistically, and model-based recommendations can be made regarding demographic characteristics that stimulate farmers to adopt new behavior. However, to date, the various models used in those studies have shown inconsistent findings and have not converged to form a unified perspective (Knowler and Bradshaw, 2007; Burton, 2014). This study provides insight into resolving the inconsistency by explaining why certain demographic characteristics can drive the adoption of environmentally friendly farming practices.

Other studies have tried to explain decision-making in terms of socio-cultural factors by focusing on the fact that farmers are not only economic individuals but also social beings belonging to their respective communities (Welch and Marc-Aurele, 2001; Pannell et al., 2006; Burton and Paragahawewa, 2011; Burton et al., 2021). Some of those studies addressed farmer values using qualitative methods such as in-depth interviews to describe their lifestyles and social contexts and provide results that show how cultural and social capital can work together to shape farmer values and thus encourage or discourage the adoption of agri-environmental schemes (Sutherland, 2013; Lawang, 2019; Lavoie and Wardropper, 2021). However, most of these studies have focused solely on social capital as a contributing factor of the adoption, and have not examined whether other reasons can coexist with social capital or are inversely proportional to it.

Based on the idea that focusing on heterogeneity can help identify the triggers that encourage the conversion of a variety of farmers in agricultural communities (Darnhofer et al., 2005; Rolfe and Harvey, 2017), this study attempts to identify the characteristics that motivate farmers to adopt or continue conservational practices by classifying them from the farmers' diverse values. This is based on the understanding that, in general, farmers living in the same or nearby areas may share some of the same characteristics but may have diverse attitudes and values toward a particular case.

Hence, in order to understand how environmentally friendly farming practices came to be implemented over an entire community, it is important to take into consideration the heterogeneity of farmers and landowners and to identify the factors that contributed to their decision-making (Emtage et al., 2007; Ahnström et al., 2009; Daxini et al., 2019). Here, it should be noted that previous studies have shown that the fewer participants are involved in conserving local environmental values, the less effective those measures will be, and that for stronger conservation effects, scale economics should be drawn on by encouraging the participation of larger numbers of farmers (OECD, 2012, 2013).

Numerous researchers have also noted that farmers can be divided into several distinctive value types and that each type has different reasons for adopting ecologically sound practices. Not only does this imply differences, such as those between environmentally friendly and conventional farmers, but it also suggests that there is a diversity of values involved in decision-making – even among farmers who have already adopted conservational practices (Fairweather, 1999; Darnhofer et al., 2005; Grover and Gruver, 2017). It is also clear that differences in farmers' values and/or

adoption behavior among the classified groups are related to their demographic characteristics (Zhang et al., 2016; Niskanen et al., 2021). However, still here, it remains controversial as to what demographic characteristics influence farmers and whether these influences are positive or negative. This study explains why certain demographic characteristics motivate farmers by using both quantitative data and qualitative findings.

In the next section, an overview of the methodology of this study and some characteristics of case study areas will be presented, after which data from the quantitative survey conducted with farmers will show the diversity of their values and the demographic characteristics of each farmer type. In the Discussion section, the identified farmer values are characterized in comparison to previous studies. Finally, in the Conclusions, the findings of this study are summarized, and then the limitations of this study and some future perspectives are presented.

2. Materials and Methods

2.1. Quantitative research based on qualitative research

This study's findings draw extensively on a mixed-method approach. First, to better understand how conservational practices were diffused into the study area and why the farmers adopted those production methods over an extended period, in-depth interviews were conducted with 28 people, including farmers and staff members of a local agricultural cooperative. Additionally, since it is generally accepted that conducting exploratory qualitative research prior to quantitative surveys can enhance the validity of research findings (Betancourt et al., 2011; Creswell, 2015), those procedures were implemented in this study as well.

Next, questionnaires were distributed to farmers who had already been engaged in environmentally friendly farming practices for periods of up to 15 years. As will be explained later, since most farmers in this area have been utilizing eco-friendly farming practices for an extended period, this survey did not make comparisons between farmers who had adopted ecological conservation practices and those who had not. The data, which was collected in February 2017 with the assistance of agricultural cooperative staff members, involved 312 farmers. Of these, 81 were accepted as valid responses. Farmers were asked about their reasons for initiating conservation practices and their motives for maintaining them, in addition to demographic items such as gender, age, farm income as a percentage of household income, experience, farm size, and level of

education. These questions and the options within these items were selected based on information selected from the interview results.

2.2. Overview of the case study area

The case study area (Tome City, Miyagi Prefecture) is an area in Japan where the adoption rate of eco-friendly agricultural practices is remarkably high (Figure 1). In Japan, products grown using at most 50% pesticides and chemical fertilizers relative to the local standard are certified as "Tokubetsu-Saibai", which means "especially cultivated agricultural products". Of particular interest here is that although just 2.6% of the nation's total arable land area has received this certification (MAFF, 2019), fully 83.8% of the Tome City rice fields were so certificated from 2008 to 2015, the year with the highest percentage, a rate of 91.1% was achieved.

The local agricultural cooperative in this area, which has been promoting especially cultivated agricultural products since 2003, is marketing their rice under the name *"Kankyo-Hozenmai"* which means "environmentally friendly rice", as part of its unique marketing strategy. Note that under the current Japanese agri-environmental policy, *Tokubetsu-Saibai* products are not eligible for subsidies unless farmers implement some additional environmental measures (MAFF, 2022). However, the local agricultural cooperative in the case study area provides additional payments for farmers adopting the required production methods, which makes it easier for them to benefit financially than farmers in other areas.

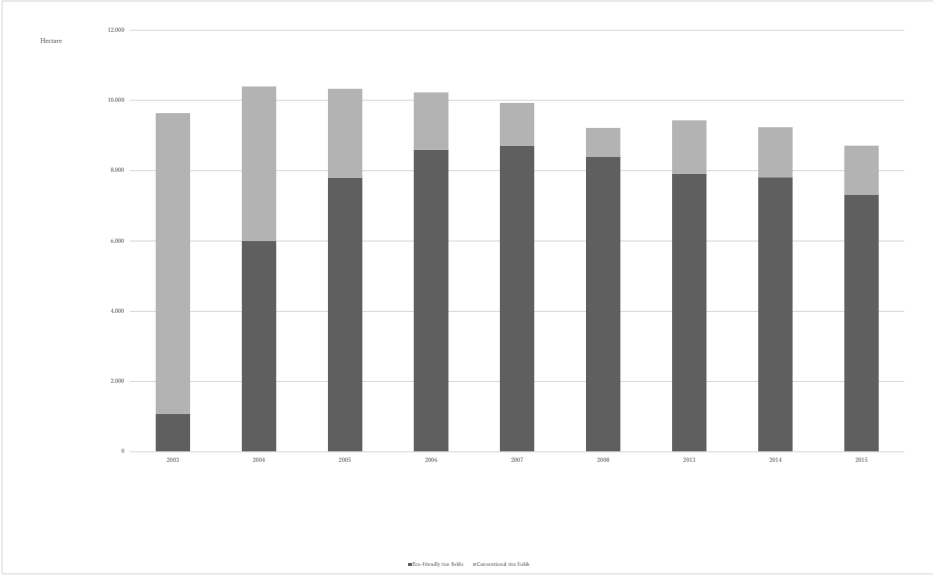

Figure 1: Proportion of eco-friendly rice fields in study area

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The north-eastern part of Japan, where the case study area is located, is famous for its rice monoculture, and Miyagi Prefecture has a particularly strong historical background as a region that built up a huge fortune in the 17th century through the transportation and sale of rice to the capital city under the policies of the feudal lord of the period. Tome City, where the survey was conducted, is also blessed with vast plains and abundant water resources, which is why rice production remains one of its primary industries.

Due to historical reasons, there are numerous small-scale Japanese farmers who cultivate less than one hectare of rice. However, in the case study area, most farms are larger (Figures 2, 3). Nevertheless, compared to countries in Europe and North America, where industrial-level agricultural production is more prominent, most Japanese farms are small and are typically operated as family businesses. Furthermore, in many cases, the farming family members in this area are engaged in side-jobs other than cultivating and selling agricultural products.

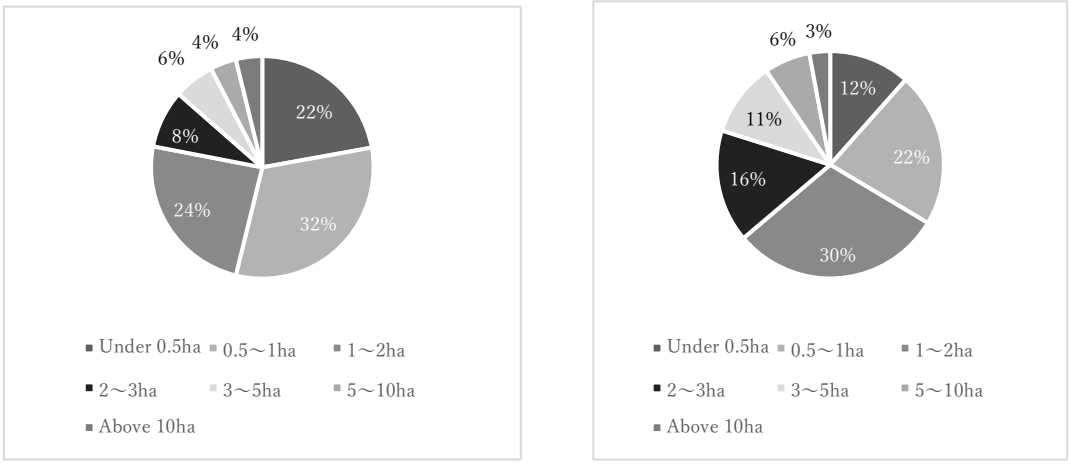

Figure 2: Average farmland size in Nationwide proportion (left) and case study area (right)

3. Results and Discussion

3.1. Characteristics of demographic items

The characteristics of the survey population are shown in Table 1, where it can be seen that 92.6% of respondents were male, and only 4.9% were female. This is because most of the farms in the study area are family-owned, and most male farmers answered this survey as the family patriarch. In terms of age, while the average age of Japanese

farmers in the survey year (2017) was 66.6 years, the average of respondents were 58.8 years. Additionally, 74.1% of the respondents were high school and vocational school graduates, and 50.6% reported that agricultural income accounted for more than three-fourths of their household income. Furthermore, although more farmers in the study area reported having side jobs than the national average, the survey population was more likely to be full-time farmers with a high dependence on agricultural income. Finally, 59.3% of the respondents stated that they had more than 30 years of farming experience.

The correlation coefficients between these demographic items were (in descending order) age and experience (.739**), farm area and percentage of farm income (.426**), age and education (-.240*), gender (Male=1, Female=2), and farm income percentage (-.228*).

Table 1 Demographic characteristics of respondents

	n (%)
Total	81 (100.0)
Gender	
Male	75 (92.6)
Female	4 (4.9)
Not stated	2 (2.5)
Age	
Under 30 years old	0 (0.0)
30-39 years old	3 (3.7)
40-49 years old	13 (16.0)
50-59 years old	19 (23.5)
60-69 years old	35 (43.2)
70-79 years old	9 (11.1)
Over 79 years old	0 (0.0)
Not stated	2 (2.5)
Education level	
College degree and above	4 (4.9)
Pre-university (associate degrees, technical college)	9 (11.1)
Vocational school	60 (74.1)
Junior high school	6 (7.4)
Not stated	2 (2.5)
Ratio of agricultural income to household income	
Over three-quarter	41 (50.6)
Over half	12 (14.8)
Less than half, more than a quarter	17 (21.0)
Less than a quarter	9 (11.1)
Not stated	2 (2.5)

Experience	
Less than 10 years	8 (9.9)
Less than 20 years, more than 10 years	12 (14.8)
Less than 30 years, more than 20 years	10 (12.3)
Less than 40 years, more than 30 years	22 (27.2)
Over 40 years	26 (32.1)
Not stated	3 (3.7)
Scale (rice fields only)	
1-50 acres	47 (58.0)
51-100 acres	14 (17.3)
1.1 hectare +	13 (16.0)
Not stated	7 (8.6)

3.1. Why did they start producing environmentally friendly rice?

The respondents were asked about their motivation for starting eco-friendly farming in relation to two aspects: information pathways and purposes (Table 2, multiple answers). In terms of information pathways, most respondents stated their decision to adopt the practices was motivated by encouragement from the local agricultural cooperative (37.0%). In this area the local agricultural cooperative has been actively supporting farmers since well before starting the conservation production. This bond helped farmers listen to what the cooperative says. Moreover, discussions within their local farmer groups (33.3%) were also one of the main reasons for the adoption, which means that farmers in this area influence the decision-making processes of each other.

On the other hand, since many farmers in this area converted to ecological farm practices at the same time, it can be said that relatively few respondents (13.6%) started those practices by following the examples of other farmers in their neighborhood. Additionally, as is the case nationally, there are few young farmers in this area, so relatively few respondents (16.0%) had recently inherited the ecological friendly practices from their parents.

As for their purposes, many respondents reported that they wanted to create a unique agricultural product as a local brand (39.5%) and to reduce pesticide use as a cost-saving measure (33.3%). Some respondents also answered that they were concerned about declines in living things in the rice fields (23.5%), but expectations for personal economic added value, at 18.5% of the total, were not particularly high.

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Table 2 Reasons for adopting the conservation practices

Information pathways	n(%)
Because our agricultural cooperative proposed the policies	30 (37.0)
Because I followed the discussion results in the neighbor farmers group	27 (33.3)
Because I inherited the practices from my parents	13 (16.0)
Because other farmers in my area had already adopted them.	11 (13.6)
Purposes	
Because I wanted to create a unique agricultural product as a local brand	32 (39.5)
Because I wanted to reduce pesticide use to cut costs	27 (33.3)
Because I felt that the number of living things in the rice fields was decreasing	19 (23.5)
Because I wanted to sell rice at a higher price.	15 (18.5)
Other	5 (6.2)

3.3. Why did they choose to produce environmentally friendly rice?

In order to clarify what motivates farmers who have been engaged in ecological rice production, respondents were presented with a choice of 12 reasons, and rated their responses on a four-point scale ("I don't think so" = 1, "Not very much" = 2, "Somewhat" = 3, and "Definitely" = 4), as shown in Table 3. Since most respondents had been producing environmentally friendly rice for about 15 years, the mean values for all reasons were generally high. Nevertheless, since diversities were found in some of their responses, a factor analysis of the 12 reasons was conducted to identify which latent factors were responsible for their production methods.

Table 3 Reasons for continuing the conservation practices

	Mean	SD
Because they are appealing to consumers	3.70	0.55
Because they take into consideration other living things in the rice fields	3.54	0.64
Because many farmers in my area are implementing them	2.97	1.00
Because they are relatively easy to implement	3.16	0.90
Because I can sell rice at a higher price	3.24	0.76
Because I feel reluctant to use excessive pesticides	3.51	0.70
Because it is the policy of our agricultural cooperative	2.78	0.98
Because they lead to cost reductions	2.90	1.01
Because they can help protect the health of myself and my family	3.40	0.76
Because I want to provide safer rice to consumers	3.76	0.43
Because I take pride in growing rice more conscientiously than in other regions	2.84	0.83
Because I have no particular reason to quit	3.18	0.90

As can be seen in Table 4, all 12 reasons could be traced to three factors. First, the statements that had high loadings for Factor 1 were mainly associated with health and environmental issues such as "Because I want to provide safer rice to consumers", "Because they (production methods) take into consideration other living things in the rice fields", "Because they are appealing to consumers", "Because I take pride in growing rice more conscientiously than in other regions" and "Because I feel reluctant to use excessive pesticides" all of which are encompassed by Factor 1. Hence, this factor variable was labeled as "Stewardship". This label was chosen because this factor focuses on care for consumers and other species. In a previous study, stewardship is defined as "the responsible use (including conservation) of natural resources in a manner that provides important accountability to society, taking into account not only private needs but also the interests of society, future generations, and other species in a full and balanced way" (Worrell and Appleby 2000).

The statements that had high Factor 2 importance were related to farm management and the farmers' personal and family health concerns. Example statements include: "Because they are relatively easy to implement", "Because they lead to cost reductions", and "Because I can sell rice at a higher price ", as well as "Because they can help protect the health of myself and my family". Since these statements are related to labor productivity and family health, this factor variable was labeled as "self-interest".

The final factor reflects passive acceptance of the ecological production methods. This factor is influenced by the statements "Because it is the policy of our agricultural cooperative", "Because many farmers in the area are implementing them", and "Because I have no particular reason to quit". Since these statements relate to social relationships among the agricultural cooperative and local farmers, the variable was labeled as "social networks". The fact that Factor 3 includes the statement "Because I have no particular reason to quit" implies the influence of external factors is felt more strongly than the other two factors, which are primarily associated with internal motivations.

Furthermore, since the factor analysis adopted an oblique rotation, a significant positive correlation between "stewardship" and "self-interest" was found (0.515). This correlation is examined in comparison with other studies in the Discussion section.

Table 4: Results of factor analysis

	1	2	3	Communality
Because I want to provide safer rice to consumers	0.747	-0.112	0.041	0.408
Because they take into consideration other living things in the rice fields	0.683	0.133	-0.010	0.451
Because they are appealing to consumers	0.561	0.05	0.001	0.513

Because I take pride in growing rice more conscientiously than in other regions	0.518	-0.224	0.340	0.440
Because I feel reluctant to use excessive pesticides	0.414	0.272	-0.120	0.478
Because they are relatively easy to implement	-0.041	0.707	0.019	0.284
Because they lead to cost reductions	-0.052	0.692	0.119	0.339
Because I can sell rice at a higher price	0.06	0.632	0.119	0.515
Because they can help protect the health of myself and my family	0.385	0.464	-0.194	0.456
Because it is the policy of our agricultural cooperative	-0.018	-0.032	0.610	0.411
Because many farmers in the area are implementing them	-0.123	0.311	0.570	0.270
Because I have no particular reason to quit	0.154	0.058	0.522	0.354
Eigenvalue	3.643	1.654	1.384	
Contribution ratio (%)	30.355	13.784	11.531	
Factor correlation	1	2	3	
1		0.515	0.157	
2			0.277	
Note: The factor loadings are based on principal axis factoring and promax rotation with Kaiser normalization (rotation converged in eight iterations).				

3.4. Characteristics of the three clusters

As shown in Table 5, respondents were clustered using the three factor scores extracted from the factor analysis, from which the existence of the three clusters was derived. The characteristics of each cluster were summarized based on demographic characteristics and adoption reasons. Cluster 1 has a more balanced proportion of persons under 60 and over 60 years old than the other two clusters, and it can be seen that most respondents in that cluster earned more than half of their household income from agriculture. Additionally, Cluster 1 farm sizes were the largest among these three clusters. In terms of the reasons for their ecological practices, the responses related to increasing profits were more prominent than in the other two clusters, such as "Because I want to reduce pesticides as a cost-saving measure" and "Because I want to create a unique agricultural product as a local brand", both of which were cited positively by 42.9% of the respondents in Cluster 1.

Turning to Cluster 2, it can be seen that, compared to the other two clusters, this cluster had the highest percentage of respondents under 59, a more moderate percentage of farm income, and more restrained farm sizes. Additionally, in terms of the reasons for the ecological practices, these respondents cited information pathways more often than the other two clusters by giving reasons such as "Because it is the policy of our agricultural cooperative" (59.1% of respondents in Cluster 2) and "Because I inherited the practices from my parents" (36.4% of respondents in Cluster 2).

Compared to the other two clusters, Cluster 3 had the highest percentage of respondents in their 60s or older, the highest percentage of respondents for which agriculture accounted for less than half of their household income, and the smallest farm sizes. In terms of the reasons for their ecological practices, more respondents in Cluster 3 reported "Because I found that environmentally friendly rice is resistant to cold damage" (answered by 12.1% of Cluster 3 respondents) and "Because other farmers in my neighborhood had already adopted them" (answered by 21.2% of Cluster 3 respondents), which means they were followers rather than early adopters.

Table 6 reported the results of an analysis of variance (ANOVA) based on the factor scores. Cluster 1 had extremely low scores for "social networks" but high scores for "stewardship" and "self-interest". In contrast, Cluster 2 showed an opposite trend, with low scores for "stewardship" and "self-interest" but high scores for "social networks". Meanwhile, Cluster 3 had higher scores for all factors than Clusters 1 and 2.

In summary, Cluster 1 was a mostly middle-aged group with high business-oriented motivations, whose respondents did not place much importance on information pathways or social networks, and who made independent decisions from their own management perspectives. Cluster 2 was a group of younger farmers with moderate business-oriented motivations who were not so much interested in stewardship attitudes or the economic benefits derived from conservation practices but had adopted the practices due to social influences such as their relationships with the local agricultural cooperative and neighboring farmers. Cluster 3 was a group consisting of older small-scale farmers, the majority of whom have been producing eco-friendly rice since the conservation strategy started. Therefore, they have a strong attachment to the practices, which is reflected in their favorable responses to all factors.

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Table 5 Characteristics of each cluster

		Cluster 1	Cluster 2	Cluster 3	n	
	Total	14 (20.3%)	22 (31.9%)	33 (47.8%)	69	
Gender	Male	14 (100.0%)	21 (95.5%)	31 (93.9%)	66	n.s.
	Female	0 (0%)	1 (4.5%)	2 (6.1%)	3	
Age	Younger than 59 years	6 (42.9%)	16 (72.7%)	11 (33.3%)	33	$\chi 2=8.383$*
	Older than 60 years	8 (57.1%)	6 (27.3%)	22 (66.7%)	36	
Ratio of agricultural income in household	Less than half	1 (7.1%)	6 (27.3%)	15 (45.5%)	22	$\chi 2=6.960$*
	More than half	13 (92.9%)	16 (72.7%)	18 (54.5%)	47	
Farm size (Median)		58 ha	46 ha	35 ha		F=3.103(2)+
Reasons for adopting the conservation practices	**Information pathways**					
	Because our agricultural cooperative proposed the policy	5 (35.7%)	13 (59.1%)	8 (24.2%)	26	
	Because I followed the results of the discussion in the neighbor farmers group	4 (28.6%)	7 (31.8%)	11 (33.3%)	22	
	Because I inherited the practices from my parents	1 (7.1%)	8 (36.4%)	3 (9.1%)	12	
	Because other farmers in my neighborhood had already adopted them	0 (0%)	1 (4.5%)	7 (21.2%)	8	
	Purposes					
	Because I wanted to create a unique agricultural product as a local brand	6 (42.9%)	8 (36.4%)	12 (36.4%)	26	
	Because I wanted to reduce pesticide use to cut costs	6 (42.9%)	4 (18.2%)	12 (36.4%)	22	

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	Because I felt that the number of living things in the rice fields was decreasing	5 (35.7%)	3 (13.6%)	8 (24.2%)	16
	Because I thought the extra income was attractive	3 (21.4%)	1 (4.5%)	8 (24.2%)	12
	Other	1 (7.1%)	0 (0%)	3 (9.1%)	4

Table 6 Characteristics of factor scores by each cluster

	Cluster 1	Cluster 2	Cluster 3
n	14	22	33
Stewardship			
Mean	.252	-.930	.513
SD	.426	.912	.438
Self-interest			
Mean	-.104	-.909	.650
SD	.813	.627	.136
Social networks			
Mean	-1.150	-.072	.536
SD	.538	.558	.478
F（df)	36.346**(2)	47.830**(2)	53.045**(2)
Note. **p<.01			
Multiple comparisons using the Bonferroni method showed significant differences between Clusters 1 and 2 and between Clusters 2 and 3 for the			

4. Discussion

This study analyzed farmers' motivations for converting to ecologically friendly farming practices and demonstrated the heterogeneity of the study area farmers by showing their diversity in relation to demographic characteristics and values. Based on factor analysis, three value orientations of "stewardship", "self-interest", and "social networks" were found in the farmers' attitudes. Additionally, based on the cluster analysis results, the farmers were classified into three groups. The obtained data indicates the heterogeneity of farmers and suggests that preparing multiple incentives that recognize the diversity of their motivations is important for promoting conservation measures.

Additionally, although numerous studies have examined the relationships between farmer demographic characteristics and environmental behavior, the causal pathways are complicated by generational, social and cultural factors, which means that clarifying the causal reasons for those relationships is more important than attempting to determine linear relationships between particular demographic characteristics and environmental behavior (Burton, 2014). This study reinforced Burton’s idea by showing the data that explains the causal relationship between the demographic characteristics and the agri-environmental adoption behavior.

Some previous studies found that larger farms were more willing to participate in agri-environmental schemes (Prokopy et al., 2008; Liu et al., 2018), and while the same

tendency was confirmed in Japan (Inoue et al., 2014; Nagai, 2021), the present case study showed that the group with the smallest farm sizes (Cluster 3) placed the highest value on eco-friendly farming practices. This result probably relates to the cohort effect noted by Burton (2014), because the smallest farm size group was also the oldest group, and their members were the first generation to accept the need for environmentally sound measures in the case study area. In fact, they had been discussing and negotiating such measures with the agricultural cooperative for several years before they decided to implement them. Because of their experiences, they tend to view agri-environmental schemes more favorably. Other studies, such as the classification study by Niskanen et al. (2021), in which they investigated older farmers with small organic farms, showed similar results. In addition, in Barnes et al. (2022), the farmers most likely to participate in agri-environmental schemes felt they were supported by the supply chain and belonged to the farmer community, so they also had strong environmental outlooks. Similarly, Cluster 3 were supported by the agricultural cooperative and belonged to the farmer community, so they also had strong environmental awareness.

The youngest group (Cluster 2) adopted conservation practices primarily due to encouragement by social networks in their farm communities, which is consistent with the results of several previous studies on farmers embracing agri-environmental schemes (Welch and Marc-Aurele, 2001; Pannell et al., 2006; Burton and Paragahawewa, 2011; Burton et al., 2021). Additionally, in the Japanese case as well, Fujie et al. (2010) confirmed that the presence of early adopters among neighboring farmers encouraged the diffusion of such practices. In addition to those previous results, the present study emphasizes that social network-based participation stimulates farmer motivation levels even if they do not have much genuine interest in eco-friendly agricultural schemes, in contrast to some studies that highlighted the importance of a high level of environmental conservation awareness (Prokopy et al. 2008; Arbuckle et al., 2013). Furthermore, while some studies emphasized the importance of economic benefits (Rolfe and Harvey 2017; Liu et al. 2018), others pointed out their inadequacy, as in the present study (Lohr and Salomonsson, 2000; Läpple and Kelley, 2013). While these personal motivations such as environmental awareness and economic benefits can provide a powerful impetus for adoption, a weak point of highlighting these factors is that it tends to exclude farmers who do not have personal incentives to adopt agri-environmental measures. This weakness is countered, to a certain degree, by social factors that encourage all farmers to adopt environmentally friendly practices regardless of their personal motivation levels. However, if there is incompatibility with social and

cultural beliefs, social networks become an impediment to adoption (Ejembi and Obekpa, 2017). Therefore, as discussed below, social networks are effective only when a certain technology or attitude is recognized as "good" within the group to which one belongs.

In contrast to Cluster 2, the group with the highest farm management motivation (Cluster 1) adopted conservation practices based primarily on stewardship attitudes and self-interest. Some research has shown that stewardship values have similarities to the principles of the organic farming movement in terms of health, ecology, fairness, and care (Bennett et al., 2018; West et al., 2018; IFOAM, 2020). Although some studies have explained that the core principles of organic farming are in opposition to current pragmatic profit-based agricultural trends (Constance et al., 2008; Campbell and Rosin, 2011), in this study there was a correlation between stewardship attitudes and self-interest. The reason why the correlation was found is that most of the respondents in this study was the “second generation”. They began eco-friendly farming around 2000s, which means there is a generation gap between those farmers and the “first generation” organic farmers who started organic farming in 1970s for philosophical reasons (Moen, 1997; Fomsgaard, 2017). The newer organic farmers that emerged sometime prior to the 1990s were more pragmatic (Darnhofer et al., 2010; Campbell and Rosin, 2011) as shifts in political, marketing, and social dimensions made the phenomenon of eco-friendly farming more attractive in terms of economic benefits. In other words, whereas the "first generation" tried to realize their ideals by disregarding the profit motive to some extent, current eco-friendly farmers are more eager to earn money by implementing such practices.

Among the reasons for that shift is that governments have gradually expanded financial support for farmers who have embraced ecological agricultural measures, and another is that demand for "quality products" from consumers has expanded since the "quality turn" (Goodman, 2004; Murdoch et al., 2017) that occurred several decades ago. In line with these socioeconomic transitions, the agriculture sector's understanding of what constitutes "good" practices, which was previously dominated by productivism, has expanded to include environmental values (Sutherland and Darnhofer, 2012; Sutherland, 2013; Tachikawa and Sakamoto, 2017). The participants in the present study are members of a generation who began farming after a social transition had taken place that considered that "what is good for the environment is also good for our livelihoods," and thus the data shows the correlation between two values that considered to be in conflict with each other in previous studies.

5. Conclusions

This study revealed the heterogeneity of farmers in the community in terms of both value orientation and demographic characteristics. Previous studies have adopted either a quantitative approach or a qualitative approach, and these two groups with different methodologies had little interaction. However, this study bridged the gap that existed between these two currents by using both approaches and explained why certain farmers value orientations were related with certain demographic characteristics.

The analysis revealed that stewardship, self-interest, and social networks were the three factors that motivated farmers to continue their environmentally friendly practices. Farmers were divided into three groups depending on how committed they were to these factors. While previous research has assumed that the stewardship and self-interest factors were in conflict, this study found that the conflict does not always exist, and these two factors can coexist in the mind of a single farmer.

In addition, this study clarified how farmers in a community have different value orientations and presented the possibility that the diffusion depended one single reason might end up being insufficient. In other words, this study demonstrated that diverse value orientations can coexist in the minds of farmers and that the combination of diverse reasons can encourage more farmers to convert their practices. These findings indicate that adopting flexible measures that suits multiple values can be effective in preserving the local environment and local agriculture.

The results also indicate that support for social dimensions can motivate many farmers to accept agri-environment schemes, particularly when offered in tandem with economic incentives for individual farmers. Although current agri-environmental policies in Japan are aimed only at providing financial support to individual farmers, it is also important to focus on the local farmers bond and social support. While the results of the present suggest that social networks within a community can work to stimulate participation in ecological friendly farming, Japanese agri-environmental policies are not focused on local communities where farmers live, except for a former one ("Measures to Conserve and Improve Land, Water, and Environment"), which is already terminated (MAFF, 2015 and 2022). Taken together, the results of this study clearly show that establishing measures based on (farmer) communities can advance the dissemination of sustainably ecological agriculture practices (OECD, 2013; Burton et al., 2021).

There are some limitations of this study. Firstly, due to the way of distributing the survey, this study might have the selection bias that it has collected most answers from

farmers who are enthusiastically engaged in environmentally friendly farming. If more farmers who perceive farming to be entirely a side business responded, it is likely to happen that the ratio of the number of people assigned to the three groups change. Secondly, because most of the respondents were engaged in reduced pesticide farming, different results might be obtained if the survey subject were completely pesticide-free organic farmers. This possibility will be the subject of further studies.

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