Farmers' responses to social impact indicators for agricultural and community practices: a case study of organic rice production in Japan

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Abstract: *Farmers' perceptions of the social impacts of organic agriculture were measured using social impact indicators and were compared with their perceptions of conventional agriculture. A rice production area in the northern part of Japan was analyzed as a typical example. The results indicate that although abstract concepts may be difficult for farmers to respond to, organic farmers tend to be interested in the implications of agricultural and community practices and in social values. These results imply that organic farmers may have higher social values in their agricultural and community practices and that this study will be useful in discussing the applicability of social life cycle assessment (LCA) and life cycle sustainability assessment to organic agriculture.*

Keywords: *social impact indicators; organic agriculture; rice production; social values*

Introduction

With the establishment of the Law for the Promotion of Organic Agriculture and the policy framework of Model Towns for Organic Agriculture, the number of organic farms in Japan has increased. Although the legal definition of organic agriculture, which contains both certified and non-certified organic production, has caused some confusion on the subject, attention has been paid to the transition from conventional agriculture to organic agriculture. National and prefectural governments have instigated policy support for organic agriculture and some national research projects on organic agriculture have been set up. Consequently, comparative studies on the environmental and economic performance of organic and conventional agriculture have been conducted (Hokazono et al., 2009).

The results of these comparisons, however, do not necessarily favour organic agriculture. Although they are consistent with previous life cycle assessment (LCA) studies on agriculture and food in Europe (Nemecek et al., 2005; Williams et al., 2006), they differ from peoples' ideas that organic agriculture is more environmentally friendly than conventional agriculture. Further, because of the lack of premiums for organic products, especially for organic vegetables, the economic performance of organic agriculture is not necessarily higher than that of conventional agriculture. These facts sometimes cast doubts on organic agriculture and result in scepticism regarding its potentiality.

Here, we present an approach to measure farmers' perceptions of the social impacts of organic agriculture. One reason for doing so is that social indicators are an important pillar in sustainability, which consists of environmental, economic, and social pillars. In other words, the pros and cons of organic and conventional agriculture have to be judged using the sustainability framework and not merely environmental and economic criteria. The other reason is that understanding farmers' perceptions while paying attention to cultural biases and geographical differences is imperative for understanding the social sustainability of agricultural and community practices and will be the first step in measuring the social performance of organic agriculture by using, for example, social LCA (UNEP, 2009), which is still in development.

In this paper, we first explain the survey method and structure of the questionnaire; then, we clarify the differences in farmer responses according to the indicator categories and between organic and conventional farmers. On the basis of the results, the implications and limitations of the study as well as future research directions are discussed.

Method

In this study, one framework of social impact assessment is used to clarify farmers' perceptions of social activities and phenomena. Instead of measuring the social impacts of organic agriculture, we employ the list of indicators to measure farmers' responses to social impact indicators.

Study region

The area of study is located in the northern part of Japan and the main crop in the area is paddy rice. Due to the introduction of the policy framework of 'Model Towns for Organic Agriculture', the important characteristics in the area are active community practices based on the close relationship between producers and consumers.

Questionnaire

Table 1. Structure of the questionnaire.

Category	Social impact (abbreviation)
A. Health and social well-being	A1. Gain in longevity of family members and myself (longevity) A2. Nutrition condition of family members and myself (nutrition) A3. Mental health of family members and myself (mental health) A4. Economic independence and self-determination (independence)
B. Quality of the living environment	B1. Leisure and recreation (recreation) B2. Rural landscape (landscape) B3. Liveability of housing facilities (housing) B4. Adequacy of electricity and water facility (physical infrastructure) B5. Adequacy of health and medical services (social infrastructure) B6. Crime and violence (crime)
C. Culture	C1. Regional identity (cultural identity) C2. Cultural isolation of family members (cultural isolation) C3. Neglect of the region (regional neglect) C4. Extinction of the dialect (dialect) C5. Cultural heritage (cultural heritage)
D. Family and community	D1. Decrease in family members (family decrease) D2. Nurture of family members (family nurture) D3. Commemoration of ancestors (ancestors) D4. Domestic violence (domestic violence) D5. Community connections (connections) D6. Community cohesion (cohesion) D7. Social differentiation and inequity (inequity) D8. Social tension and violence (tension)
E. institutions, legality, politics, and equity	E1. Functioning of government agencies (government functioning) E2. Integrity of government agencies (government integrity) E3. Citizen participation (participation) E4. Human rights (human rights)
F. Relations between the different and diverse groups of people	F1. Status of women (women's status) F2. Independence of women (women's independence) F3. Fair division of production-oriented labour (production labour) F4. Fair division of household labour (household labour) F5. Fair division of reproductive labour (reproductive labour) F6. Fair division of social labour (social labour) F7. Employment of disabled people (disabled employment)

Indicators

The indicators used for the questionnaire are illustrated in Table 1. They are based on the list for social impact assessment (van Schooten et al., 2003; Hunkeler et al., 2008) and classified into the following six categories: A. health and social well-being; B. quality of the living environment; C. culture; D. family and community; E. institutions, legality, politics, and equity; and F. relations

between the different and diverse groups of people. Due to the cultural and institutional differences between the western world and Japan, we modified the list and adapted it to Japan.

Response measurement

A five-point Likert scale was used to measure the responses of farmers to social impact indicators. The expression 'degree of interest' was employed in order to elicit the following responses: 'very interested' for 5, 'somewhat interested' for 4, 'neither interested nor uninterested' for 3, 'not so interested' for 2, and 'not interested' for 1. In addition, sections for free descriptions were introduced into the questionnaire, in order to clarify farmers' perceptions of alternatives to improve the performance measured by each indicator.

Classification of farmers

We surveyed farmers who cultivate 'environmentally friendly' rice in the studied area, in which agricultural cooperatives play an important role. On the basis of the information provided by the fact sheets of the questionnaire, we can classify the farmers into three types: (1) farmers who practice organic farming congruent with the Japanese Agricultural Standard (JAS) for Organic Plants (Notification No. 1605 of the Ministry of Agriculture, Forestry, and Fisheries of 27 October, 2005), (2) farmers who practice 'environmentally friendly' farming with no application of chemical fertilizers and pesticides, and (3) farmers who practice 'environmentally friendly' farming with reduced application of chemical fertilizers and pesticides. A farmer who practices both (2) and (3) is recognized as type (2). This classification can be changed into organic farmers [(1) + (2)] and conventional farmers [(3)].

Distribution of questionnaire

We obtained support from a farmer who leads the agricultural and community practices in the study area. After interviews with him were conducted regarding the social impacts of organic agriculture and after revisions to a preliminary questionnaire were made on the basis of his comments, we sent the questionnaires to him. With the help of the agricultural cooperative, he distributed them to 40 rice farmers. The total number of usable questionnaires for the analysis is 21.

Data analysis

Calculation of scores and ranks

We calculated the scores and ranks for each category and for each social impact under the following assumptions: (1) response '5' of Farmer A is the same as response '5' of Farmer B and (2) the intervals between '3' and '4' and between '4' and '5' are the same. In calculating the scores for each social impact, assumptions (1) and (2) are made, and in calculating the ranks, assumption (1) is made. After making comparisons among categories and among types of farmers using all of the farmers' data, the differences in responses between organic and conventional farmers were compared among categories and social impacts. Since the data collection was not based on statistical sampling, as already illustrated, statistical tests were not conducted.

Biplots based on principal component analysis

In order to get the overall configuration of the data, we conducted principal component analysis (PCA) and made a biplot that illustrates the relationships between social impact indicators (variables) and farms (samples). The variables for the types of farmers are also included in the analysis. In calculating PCA, the above strong assumptions on data were relaxed and each variable was assumed to be categorical (factorial). In the calculation, variables that contained missing values (C2, C5, D4, D8, and E2) were excluded from the analysis. TIBCO Spotfire S+® 8.1 was used for the calculation and the

covariance matrix was selected because the original observations are on a common scale; that is, all data are categorical (factorial).

Results

Difference between indicator categories

The first result is the difference in the responses between indicator categories (Table 2). From the averages of social impact scores within the category and the average ranks of those scores within the category, we noticed that farmers tend to give higher scores to category A, 'health and social well-being', and category B, 'quality of the living environment'. The same tendency was found in the scores and ranks, although the latter had a distinct tendency. When we examined the averages of the number of free descriptions within the category, we realized that farmers added further explanations about categories A and B. These results indicate that although we modified the questionnaires for use in the Japanese situation, the farmers experienced difficulty in answering the questions related to highly abstract concepts.

Table 2. Difference in responses to social impact indicators between indicator categories.

Category	Score[1)]	Rank[2)]	Free description[3)]
A. Health and social well-being	3.9	7.6	6.3
B. Quality of the living environment	3.9	7.4	5.3
C. Culture	3.4	7.8	2.4
D. Family and community	3.8	7.6	4.0
E. institutions, legality, politics, and equity	3.9	8.2	1.5
F. Gender and disabilities	3.5	8.3	0.9

1) The average of social impact scores within the category
2) The average rank of social impact scores within the category
3) The average number of free descriptions within the category (Descriptions such as 'nothing special' were not counted.)

Difference between types of farmers

The second result comes from the comparison between organic and conventional agriculture (Table 3). Since the number of farmers who practice 'Organic JAS' was limited, we paid attention to the comparison between 'Organic' and 'Conventional'; that is, the comparison of scores and ranks between farmers who practice 'Organic JAS' or 'Environmentally Friendly (no application)' and farmers who practice 'Environmentally Friendly (reduced application)' and not 'Organic'.

Table 3 illustrates that in general the average scores and ranks of organic farmers are greater than those of conventional farmers. This result implies that organic farmers tend to be interested in the implications of agricultural and community practices.

Table 3. Difference in responses to social impact indicators between types of farmers.

Type of farmers	Number of farmers	Score[1)]	Rank[2)]
(1) Organic JAS[3)]	3	3.7	11.7
(2) Environmentally Friendly (no application)[4)]	5	3.9	8.2
(3) Environmentally Friendly (reduced application)[5)]	16	3.7	11.7
Organic[6)] [(1) or (2)]	7	3.8	9.7
Conventional[7)] [(3) neither (1) nor (2)]	14	3.6	11.5

1) The average social impact score for the type of farmers
2) The average rank of social impact scores for the type of farmers
3) Farmers who practice organic farming congruent with Japan's Agricultural Standards (JAS)
4) Farmers who practice 'environmentally friendly' farming with no application of chemical fertilizers and pesticides
5) Farmers who practice 'environmentally friendly' farming with reduced application of chemical fertilizers and pesticides
6) Farmers who practice 'Organic JAS' or 'Environmentally Friendly (no application)'
7) Farmers who practice 'Environmentally Friendly (reduced application)' and who are not 'Organic'

Difference between types of farmers for each indicator group

The third result concerns which indicators distinguish between organic and conventional farmers (Table 4). As shown in the table, if we looked at the ratios of scores and ranks for organic farmers to those for conventional farmers ('Organic'/'Conventional'), the ratios for categories F ('gender and disabilities') and C ('culture') are higher than those for the other categories, although not all indicators favour organic agriculture. Although this result is based on an exploratory survey, it implies that organic farmers tend to be more interested in topics related to social values.

Table 4. Difference in responses to social impact indicators between 'Organic' and 'Conventional'.

Category	Social impact (abbreviated)	Ratio of score[1)]		Ratio of rank[2)]	
A. Health and social well-being	A1. longevity	0.96	1.01	0.85	1.06
	A2. nutrition	1.08		1.35	
	A3. mental health	0.98		0.94	
	A4. independence	1.00		1.09	
B. Quality of the living environment	B1. recreation	1.02	1.03	1.12	1.17
	B2. landscape	1.03		1.06	
	B3. housing	1.13		1.61	
	B4. physical infrastructure	1.02		1.23	
	B5. social infrastructure	0.95		0.81	
	B6. crime	1.04		1.21	
C. Culture	C1. cultural identity	1.06	1.09	1.48	1.28
	C2. cultural isolation	1.17		1.19	
	C3. regional neglect	1.13		1.27	
	C4. dialect	1.07		1.19	
	C5. cultural heritage	1.03		1.26	
D. Family and community	D1. family decrease	1.02	0.98	1.11	1.18
	D2. family nurture	1.05		1.18	
	D3. ancestors	1.04		1.35	
	D4. domestic violence	0.66		0.68	
	D5. connections	1.00		1.20	
	D6. cohesion	1.11		1.87	
	D7. inequity	1.06		1.22	
	D8. tension	0.91		0.80	
E. institutions, legality, politics, and equity	E1. government functioning	1.02	0.98	1.17	1.04
	E2. government integrity	1.00		1.03	
	E3. participation	0.88		0.81	
	E4. human rights	1.04		1.15	
F. Gender and disabilities	F1. women's status	1.11	1.13	1.19	1.40
	F2. women's independence	1.00		0.94	
	F3. production labour	1.14		1.50	
	F4. household labour	1.18		1.33	
	F5. reproductive labour	1.22		1.69	
	F6. social labour	1.18		1.91	
	F7. disabled employment	1.06		1.27	

1) The ratio of the average score for 'Organic' farmers to that for 'Conventional' farmers
2) The inverse ratio of the average rank of the score for 'Organic' farmers to that for 'Conventional' farmers

Visualization of farmers' responses using biplots

The result of PCA is illustrated in Table 5. The cumulative proportion of the first three principal components was 0.490, which means that about half of the information included in the data was summarized as principal components 1, 2, and 3. Each component can be interpreted using principal component loadings. Component 1 is related to gender and its direction is opposite to 'Organic'. This implies that organic farmers tend to pay attention to gender in their management, although the relationship is weak. Component 2 can be related to institutional aspects and its direction is the same as that of 'Organic'. Although these two components are main principal components, they cannot distinguish between organic and conventional farmers, as illustrated in a biplot for components 1 and 2 (Fig. 1). Component 3 distinguishes the difference between organic and conventional farmers, as shown in Fig. 2.

These three components are useful in understanding the configuration of farmers' responses: they help demonstrate how organic farmers' responses can be linked to social values. The interpretation of the axes, however, has to be recognized with caution, because there are many arrows that have almost the same directions as shown in Figs. 1 and 2.

Table 5. Main principal component loadings for the first three principal components.

	Component 1		Component 2		Component 3	
Proportion of the variance		0.218		0.187		0.084
Organic		0.061		0.020		0.321
Conventional		–0.061		–0.020		–0.321
Social impact indicator[1)]	F33 production labour '3'	–0.224	E14 government functioning '4'	0.214	A45 independence '5'	0.186
	F23 women's independence '3'	–0.202	E34 participation '4'	0.213	A14 longevity '4'	0.179
	F13 women's status '3'	–0.202	E44 human rights '4'	0.208	F24 women's independence '4'	0.172
	D13 family decrease '3'	–0.201	F44 household labour '4'	0.200	F22 family decrease '2'	0.171
	C33 regional neglect '3'	–0.186	D64 cohesion '4'	0.195	F65 social labour '5'	0.165
	F73 disabled employment '3'	–0.182	B54 social infrastructure '4'	0.194	F45 household labour '5'	0.159

1) The first six loadings other than the types of farmers

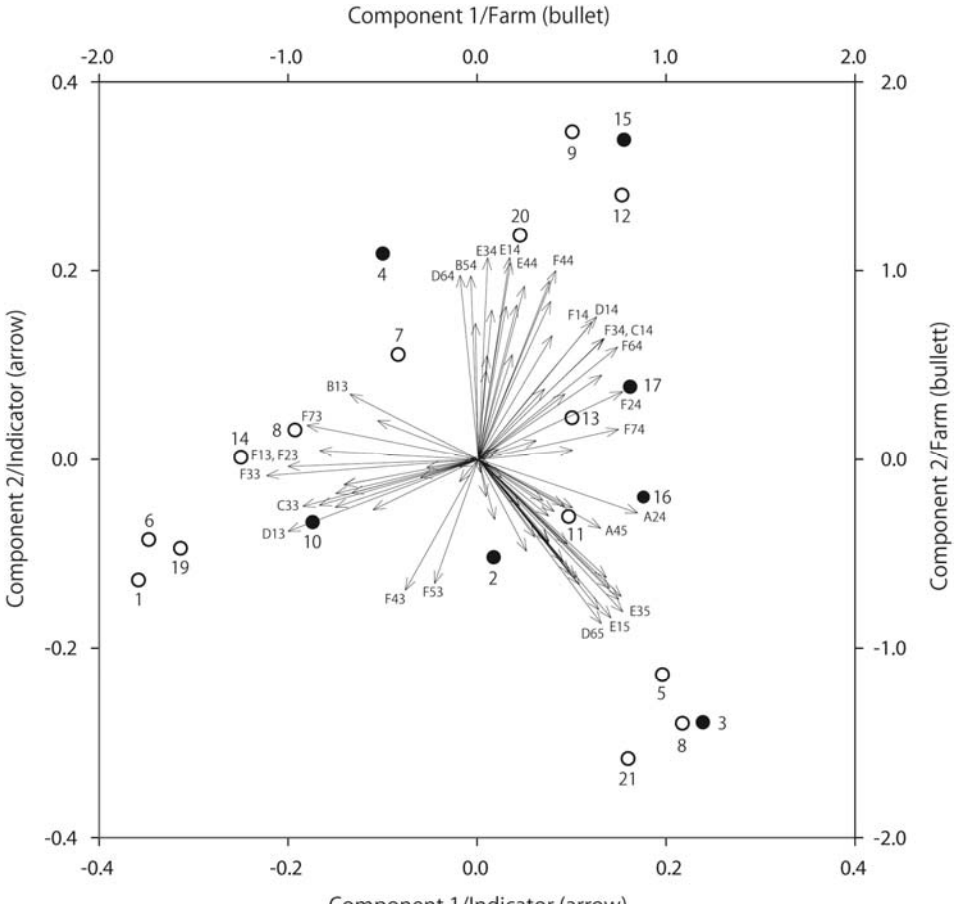

Figure 1. Biplot for components 1 and 2; closed bullet = 'Organic' and open bullet = 'Conventional'.

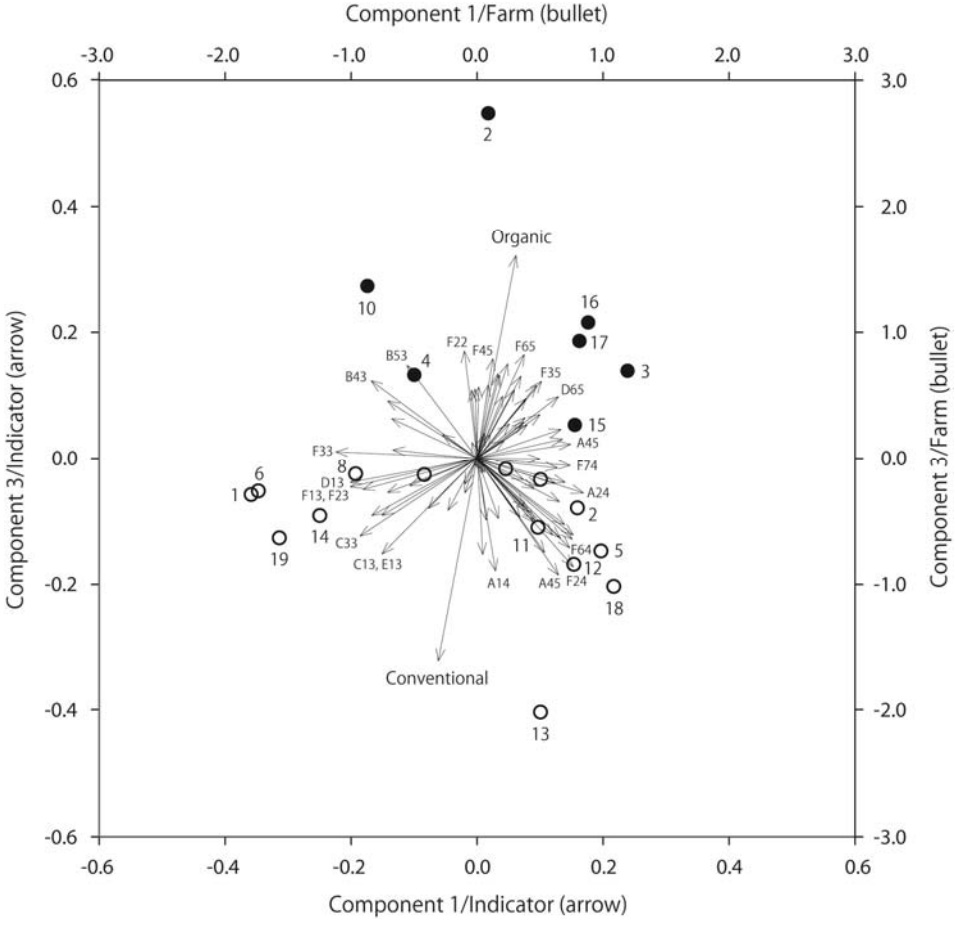

Figure 2. Biplot for components 1 and 3; closed bullet = 'Organic' and open bullet = 'Conventional'.

Discussion on the limitations and results

In this section, we will provide a brief discussion on the survey method and data analysis and will then discuss the implications of the relatively good performance of the indicators related to social values for 'Organic' farmers.

Concerning the survey and data analysis, we raise two points. First, although this survey was made possible with the support of a farmer who leads community practices, including interaction with consumer groups, it could contain some biases. A larger survey may be informative for the purpose of generalizing the results. Second, there may be difficulties in conducting statistical sampling in these study topics. The refinement of the framework based on case study methods will be useful for constructing practical theories.

Higher social values in organic farmers can indicate that they have organic values (De Wit and Verhoog, 2007). In other words, they tend to appreciate social responsibility in organic agriculture (Pyburn et al., 2006). Although the types of farmers studied in this paper are restricted to those who practice 'environmentally friendly' agriculture, the results indicate that there are at least two stakeholders; these can be simplified into proselfs and prosocials, if we use the terminology of social dilemmas (Van Dijk et al., 2010). Indeed, since agriculture can be considered a manner of common resource management, attitudes of organic farmers are necessary to resolve social dilemmas. When uncertainty exists about the participants in a society (environmental uncertainty), the behaviour of prosocials tends to restrict their harvests in resource dilemmas (*ibid.*). This will be an important perspective in revitalizing rural areas and in making the transition to sustainability.

Concluding remarks

The results of this exploratory study can be summarized as follows: (1) highly abstract concepts may be difficult for farmers to respond to; (2) organic farmers tend to be interested in the implications of agricultural and community practices upon social issues; and (3) organic farmers tend to be interested in social values.

The results of this study relate to the trends in farmers' responses when asked about the social impact that they believe organic practices deliver. This is a way of tackling farmers' perceptions of social issues. What are, in particular, the ones that they consider as important or unimportant. The study will be useful in discussing the applicability of social LCA and life cycle sustainability assessment to organic agriculture. In order to evaluate the overall sustainability performance of organic agriculture, further studies on the tradeoffs among indicators are needed.

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