

【論文】

## Rice Production and the Natural Farming Movement in Japan: A Study of Farm Management Issues and Approaches

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### ABSTRACT

This study utilizes factor analysis to evaluate the performance of natural farming in paddy rice fields in Japan. The findings cover four performance dimensions, namely operational efficiency, human relationships, ingenuity, and open-mindedness. Given a relatively weak theoretical basis, including hypotheses and constraints on the relation between factors and observations in preceding studies, it was decided to use exploratory factor analysis to identify latent variables. Although natural farming is thought to entail more financial risks than conventional farming, natural farmers are considered to be more enthusiastic in their pursuit of this particular approach to farming and are dedicated to larger social and environmental goals as well. This study is therefore limited to an analysis of natural farming and natural farmers. There are, moreover, implications for further sampling and time-series research, which could be of value when conducting trend analyses of management practices. The originality of this study lies in its having developed a performance evaluation metric using exploratory factor analysis based on direct inputs from farmers as well as performance evaluation indicators obtained through the observation and interaction with these farmers. Moreover, there has been no research which directly grasps the behavior of farmers who devise measures to improve competitiveness. Finally, since survey data of farmers are generally used narratively rather than quantitatively, due to the challenges involved in the latter, this research has methodological significance.

**Keywords:** performance evaluation, natural farming, revenue recognition, factor analysis, text mining

## 1 INTRODUCTION

Recent administrative reviews of Japan's agricultural sector have identified many problems, including budgetary burdens and issues related to the effective utilization of government subsidies. Moreover, although the circumstances of farmers have improved throughout the postwar period due to government efforts to encourage domestic food production, many farmers are faced with diminishing profitability.

Taking the current condition of Japanese agriculture into consideration, the purpose of this paper is to develop performance evaluation indicators for farmers who have turned to natural cultivation methods (hereafter: natural farmers). Whereas conventional farmers use chemical fertilizers, pesticides, herbicides and other agricultural chemicals, natural farmers do not use any of these inputs. Although natural farming involves greater labor inputs, it has been found to have a positive influence on the environment as well as being competitive in the marketplace (Crowder & Reganold, 2015; Meng, Qiao, We, Smith, & Scott, 2017). Moreover, these farmers, by challenging established agricultural practices, have adopted novel business as well as production strategies.

This study has developed performance evaluation indicators by observing the characteristics of farmers who seek to turn their unconventional agricultural practices into profitable businesses. Up to this point there has been no research that directly seeks an understanding of the motivation of farmers like these who are adopting unorthodox measures to improve competitiveness. Finally, through observation and interview surveys, this research approach considers the primary information gotten from the farmers to be of high value.

Natural farmers face problems such as pest and weed control, not to mention maintaining a balance between yield and selling price. They strive to come up with creative practices to overcome these challenges. Due to their concerns about the environment and potential health hazards, they are motivated to eliminate the use of the agricultural chemicals that are commonly used in conventional farming.

Since natural farmers have often come up with non-conventional farming methods on their own or within a small community of like-minded farmers, there are various natural farming schools and genealogies (Rural Culture Association Japan, 2016). Because of these novel approaches, accurate observation of the differences between natural farming approaches can pose challenges.

The Kimura Natural Farming Method developed by Kimura Akinori (hereafter: the AK Method), considered to be the most popular natural farming approach today in Japan, was examined in this study. A December 2006 NHK documentary introduced Kimura's approach to apple production without the use of fertilizers, insecticides or pesticides to a wide audience in Japan. Subsequently, the publication of books and the release of the movie "Miracle Apple" further raised the public's interest in natural farming. Prior to the boom generated by this coverage, however, Kimura had been traveling throughout Japan teaching and promoting AK natural cultivation methods. The AK Method has attracted both advocates and detractors, as it

sometimes employs non-scientific methods or seemingly intuitive approaches, such as Kimura's experiments with different colored molds. At the same time, although there have been studies on the AK Method by chemists (Sekiya & Sugiyama, 2015; Sugiyama & Toshima, 2016), little research has been undertaken from a management point of view. Since observing and theorizing is important, particularly in the field of management, on-site survey interviews were conducted in order to grasp the present circumstances of natural farming in general and natural farmers in particular. The reason natural farmers are the focus of this study is that they are highly motivated and have chosen to undertake this method of farming not only to turn a profit but also out of concern for the environment and other non-economic considerations. For these reasons, these farmers can serve as effective and thought-provoking measurement targets of performance evaluation.

Reganold and Wachter (2016) have divided agricultural production into conventional, organic, and integrated farming systems and have compared them in regard to production, environmental impact, economics, and the well-being of the farmers themselves. Organic farming, as used herein, refers to agricultural production that rejects the use of synthetic fertilizers, pesticides, herbicides and other agricultural chemicals. However, unlike natural farmers, organic farmers use organic inputs that satisfy the criteria spelled out in the organic certification laws and standards found in most developed countries.

Although the organically cultivated area in Japan is gradually increasing (24,000ha: 2016 estimate), it still comprises only 0.5% of the country's arable land area. Organic food sold in Japan must comply with Japan Agricultural Standards (JAS) for organic foods, which is a certification granted by the Japanese Ministry of Agriculture, Forestry and Fisheries. Organic JAS foods must meet the standards at every production stage, from cultivation through packaging and distribution.

Given the many similarities between natural and organic farming methods, and the fact that both natural and organic farming have emerged as antitheses of conventional farming, natural farming would fall within the organic farming system in the Reganold and Wachter analytical scheme. Furthermore, although there is no unified natural farming method, farmers who call themselves natural farmers are expected to not use any chemical *or* organic pesticides, fertilizers, or herbicides.

In addition to the challenges of actual food production, farmers, natural, organic and conventional alike, are facing an increasingly difficult economic environment. In recent years, government subsidies and other public supports for farmers have encountered increasing criticism and many of these programs have been reevaluated, curtailed or discontinued. As a result, many farmers are finding themselves struggling to turn a profit and subsequently the number of farms and farmers is dwindling and fewer and fewer young people are being drawn to farming.

This study therefore turned to the question of what has motivated farmers to take up natural farming. Although the AK Method began with Kimura's natural farming of apples, the natural or organic production of apples and other fruit face significant challenges in Japan's wet and humid climate. On the other hand,

naturally farmed rice, which is easier to grow in Japan without chemical or organic inputs, is becoming increasingly popular. This study therefore focuses on rice.

This study used factor analysis and a questionnaire-based survey. Given the relatively weak theoretical basis, including hypotheses and constraints on the relationship between the factors and observation variables in preceding studies, an exploratory factor analysis (EFA) was executed to identify latent variables. Bandalos and Finney (2018) have stated that EFA is useful for developing new scales. In the field of management accounting, EFA is often used to map business behavior patterns using questionnaires (Yoshida, Senno, & Fukushima, 2011; Yoshida, Senno, & Fukushima, 2015). To explore the background of a given behavior, extracted potential factors related to the intended purpose of product cost calculation are also analyzed. As for EFA, Arai, Kato, Sakaguchi, and Tanaka (2009) have found potential factors of “product costing” at the factory level, where the scale ranges from the industry to the terminal level, such as a factory.

Exploratory analysis reveals the characteristics of performance evaluation, relevance of performance evaluation, and strategy (Chenhall, 2005; Ito, Kobayashi, Hasegawa, & Metoki, 2014). From these previous studies, we have determined that EFA can be used to explore performance evaluation. Shirinashihama (2016), however, who conducted EFA on social welfare corporations based on Pizzini (2006), also utilized confirmatory factor analysis to confirm the validity of the composition of the scale. Since this study was unable to obtain follow-up data of the scale, confirmatory factor analysis was not undertaken. While continuing to reference these previous studies, EFA was used in this study to explore the performance evaluation for natural farmers, the results of which proved effective in developing performance evaluation indicators.

## **2 METHOD**

### **2.1 Participants**

In this study, the cooperation of 81 natural rice farmers from the seven prefectures of Aomori, Iwate, Miyagi, Okayama, Niigata, Fukushima, and Ishikawa was obtained. The survey targeted only rice farmers who have adopted the AK Method. Questionnaires and on-site interviews were conducted at rice farms in these seven prefectures. The survey interview research received support from the Hirosaki University Innovative Regional Research Center. Questionnaires were administered from October 2016 to January 2017. Participation in the survey was voluntary. At the time of the distribution of the survey form, participants were assured of confidentiality and their consent was obtained. A total of 81 farmers, between the ages of 32 and 78 (Av. = 59.8, Me. = 63.0) participated in the survey interviews.

Questionnaires were distributed to and filled out by farmers in the field, taken home to be completed or were mailed to them at a later date. The 31 respondents who did not fill out all the items and/or did not specify their business type were excluded from the data analysis. As a result, the data for 50 farmers were

analyzed, including 22 full-time farmers (9 of whom answered that they were profitable) and 28 part-time farmers (5 of whom answered that they were profitable). According to the data reported by the farmers, most respondents (97.5%) had a history of encountering natural farming challenges and 57% specifically mentioned their struggles with weeds and approximately 24% said they were bothered by insect and other pests. 61% of them had taken over their family business due to their parents' aging or/and death and 28% started natural farming on their own volition.

## 2.2 Measures

Responses to two questions were set on a five-point Likert-type scale ranging from *strongly agree* to *strongly disagree* for (1) your tips for growing rice and (2) the timing of when you feel your rice crop is or will be "profitable." These scales were prepared with reference to preliminary surveys and interviews. In the on-site interviews, farmers used the expressions "*nae-hansaku*" and "*nae-hassaku*", the former meaning that 50% of the seedlings produced viable rice plants, while the latter referred to an 80% success rate. In other words, the starting point for rice production was the procurement of quality seeds. The survey therefore included questions concerning seedling preparations prior to planting.

The average value and standard deviation for each item are shown in Table 1. In addition, we confirmed that there were no items for which 75% or more of the responses coincided. Therefore, factor analysis (maximum likelihood method, promax rotation) was carried out using all 13 items. Since it was assumed that the extracted factors were correlated, promax (oblique) rotation was selected.

Descriptive statistics (i.e., mean, standard deviation) for the 13 tips for better natural farming as well as their inter-correlations appear in Table 1 and Table 2 respectively.

**Table 1 Descriptive statistics for 13 tips for better natural farming**

	Variable	M	SD
1	Increasing acreages for natural farming	3.90	0.91
2	Cooperating with others to market rice	3.66	1.09
3	Informing buyers about natural farming	4.36	0.59
4	Maintaining a balance between natural and conventional farming	3.50	1.12
5	Seeking advice from farmers with extensive natural farming experience	3.98	0.55
6	Interacting with diverse actors, such as processors	3.90	0.70
7	Raising funds to buy agricultural land and machinery	3.16	1.03
8	Growing delicious rice without relying on national subsidies	3.86	0.72
9	Encouraging natural farming in one's neighborhood	3.56	0.75
10	Improving the efficiency of paper work	3.64	0.74
11	Proving the advantages of natural farming through one's experiments	3.60	0.89
12	Switching to an easy to grow cultivar	3.52	0.98
13	Cultivating as before to be inconspicuous	2.26	1.02

**Table 2 Inter-correlations for 13 tips for better natural farming**

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	.37	1.00											
3	.26	.40	1.00										
4	-.12	-.10	-.06	1.00									
5	.19	.09	.45	-.08	1.00								
6	.30	.21	.56	.03	.41	1.00							
7	.34	.22	.53	.19	.50	.38	1.00						
8	.22	.37	.11	.08	-.05	-.06	.16	1.00					
9	.28	.52	.44	-.19	.22	.41	.40	.40	1.00				
10	.06	.17	.20	.26	.37	.16	.65	.13	.25	1.00			
11	.12	.31	.34	.02	.31	.12	.52	.47	.45	.41	1.00		
12	.05	.05	.09	.18	.24	.24	.31	.07	.22	.42	.25	1.00	
13	.09	-.01	-.08	.29	-.20	-.24	-.13	.04	-.01	-.16	-.36	-.13	1.00

**Table 3 Factor loadings for 13 tips for better natural farming**

Variable	Factor 1	Factor 2	Factor 3	Factor 4	h <sup>2</sup>
6	.82	.34	-.22	-.11	.23
3	.07	.12	.05	.05	.43
5	.46	.37	-.17	-.07	.60
1	.36	-.05	.20	.15	.29
10	-.04	.77	.06	-.03	.41
7	.02	.73	.06	.05	.61
4	-.02	.45	-.10	.33	.78
12	.05	.40	.01	-.05	.56
8	-.28	.05	.82	.06	.60
11	-.11	.41	.59	-.28	.61
2	.26	-.09	.52	.05	.67
9	.37	.03	.52	.09	.19
13	-.03	-.03	.02	.98	.99
Variance (%)	0.15	0.14	0.13	0.09	
Cumulative variance (%)	0.15	0.29	0.42	0.52	
Inter-factor correlations					
Factor 2	-.14				
Factor 3	.06	-.22			
Factor 4	.13	-.30	.44		

### 3 RESULTS

#### 3.1 Factor analysis of the agricultural activity tips scale

The determination of how many factors to retain was guided by the use of the scree method (Cattell, 1966) and the Kaiser rule (factors with an eigenvalue greater than 1.0 to be retained). The eigenvalues of the first six factors were in the following descending order: 4.04, 1.74, 1.54, 1.28, 0.83, and 0.76 and these factors accounted for 15, 14, 9, 9, 8, and 8% respectively of the variance between items. Following the Kaiser rule of maintaining all factors with eigenvalues over 1.0, a four-factor alternative was introduced.

Multiple criteria to determine the number of factors to retain were examined, including parallel analysis. Random data and resulting eigenvalues for parallel analysis were produced using R. The analysis results suggest four factors and three components.

The minimum averages of squared partial (MAP) correlation and Bayesian information criterion (BIC) were also taken into consideration for decisions concerning the number of factors to retain. The MAP procedure successively removes factors from raw data and yields the average of squared partial correlations between items for each removal. The minimum average partial statistic values for the first six principal components of the item correlation matrix were 0.045, 0.045, 0.051, 0.061, 0.078, and 0.108, thus indicating a two-factor solution.

The BIC is a criterion for model selection and the lowest BIC value reflects a compatible model. The minimum average partial statistic values for the first six principal components of the item correlation matrix were 64.17, 40.72, 20.94, 10.69, 3.09, and 0.032, thus indicating a six-factor solution.

The Keiser-Meyer-Olkin factor analysis measure of sampling adequacy yielded a less than satisfactory value (0.629), indicating that factor analysis may be useful, confirming that the instrument had a single valid construct (Kaiser, 1974).

According to the parallel analysis, the result of 4 as the factor and 3 as the principal component is presented in Appendix A. Although the null hypothesis is not rejected when the factor score estimation method is applied to a three-factor structure using the Bartlett method, the cumulative contribution rate was 0.448, which is less than 50%. As can be observed from the scree plot, it appears that there was gentle attenuation after the fifth eigenvalue. When the number of factors to be extracted was changed by referring to the scree plot, the results were compared and it was determined that it would be appropriate to extract four factors to enable a clearer interpretation.

The Cronbach alpha was 0.72. The results were consistent with those of the original 50 items with better convergence and relatively high Cronbach's alpha coefficients (all > 0.70), suggesting structural validity and internal consistency of the shorter scale.

### **3.2 Label factors as performance evaluation**

The first factor includes items such as “7 Raising funds to buy agricultural land and machinery” and “10 Improving the efficiency of paper work”. These indicate a high factor load, and are not directly related to farm work. However, it can be stated these are necessary for sustainable farm development. In addition, variables such as “11 Proving the advantages of natural farming through one’s experiments” are high in this factor load. Therefore, we considered this factor to be one that indicates the importance attributed to “operational efficiency.”

The second factor that carries relatively high weight includes items such as “3 Informing buyers about natural farming” and “6 Interacting with diverse actors, such as processors.” These items reflect the importance assigned to relationships with buyers, processors and peers, so as to raise awareness about the nature of natural rice cultivation. This was called the “human relationships” focus factor.

The third factor includes “8 Growing delicious rice without relying on national subsidies,” “9 Encouraging natural farming in one’s neighborhood,” and “2 Cooperating with others to market rice,” all of which were heavily loaded. This factor is similar to the second factor, but the coefficient of variable 9 is relatively low in the second factor, while variable 11 is relatively low in the third factor. This factor was named “ingenuity.”

The fourth factor is characterized by a very high factor loading for variable “13 Cultivating as before to be inconspicuous.” Conversely, variable 11 is negative. This fourth factor was called “open-mindedness.” This involves the sense that one must engage in agricultural practices that do not create conflicts or disturb relationships with one’s neighbors or within one’s community. There is a saying in Japanese “*deru kui ha utareru*”, which when literally translated means “the nail that sticks out gets hammered”; in other words, “keep your head down.” Kimura Akinori, himself, has not always heeded this saying and has sometimes drawn the ire of neighbors and other farmers due to his farming methods, his experiments, and his criticism of the conventional farming methods of others.

Based on the above factor analysis results, it was determined that farmers who have switched to natural farming are concerned not merely with turning a profit, but also do so out of concern for the environment and the health hazards they see in conventionally farmed food. However, they are also concerned about their standing in the community and tend to try to be as inconspicuous as possible and to maintain their relationships with neighbors or other farmers who farm conventionally.

### **3.3 Profitability**

Revenue recognition was measured with the following question: “How much time does it take before rice cultivation seems ‘profitable’? Please circle the option you believe is appropriate.” Narikawa (2015) has stated that production standards and harvesting standards could not be applied to agricultural activities that



are not subject to contract cultivation because of the difficulty and high uncertainty it involves. However, in most cases, naturally farmed products are sold under contract before harvest. In other words, it can be said that natural farming is a contract-based agricultural activity. However, this survey found that natural farmers did not feel that natural rice farming was profitable, even at the early seedling stage. Table 4, Table 5, and Fig. 1 show the revenue recognition of farmers at each stage of rice cultivation. These stages range from stage 1 (when good seeds are obtained) to stage 10 (when payments from customers are received). This is summarized for the farmers who were targeted in the factor analysis. Table 4 summarizes the descriptive statistics.

Business types and profitability breakdown is shown in Table 5. Factor analysis was carried out for 50 farmers. A line graph showing revenue recognition by business type appears in Fig. 1.

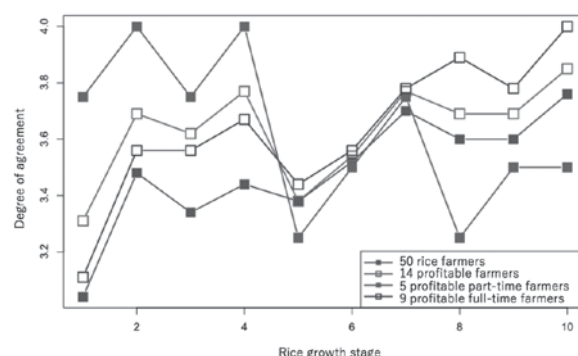
Profitable farmers in general are conservative when it comes to revenue recognition. Profitable full-time natural farmers were even more restrained. In other words, these farmers do not feel they are turning a profit until a very late stage in the growing cycle, even if they already know at the seedling stage, owing to the contract, the revenues they will eventually obtain.

**Table 4 Descriptive statistics for raising process of rice and revenue recognition**

	Variable	M	SD
1	When we obtain good seeds	3.04	0.85
2	When planting healthy seedlings	3.48	0.92
3	When rice heads appear	3.34	0.86
4	When soil is dry, ridding of weeds and insects are accomplished	3.44	0.90
5	When rice leaves turn yellow	3.38	0.85
6	When harvesting, drying, and threshing are accomplished	3.52	0.81
7	When we pack the brown rice in bags	3.70	0.81
8	When an order comes in from a customer	3.60	0.87
9	When delivering rice to customers	3.60	0.87
10	When payments from customers arrive	3.76	0.95

**Table 5 Business types and profitability**

	Full-time farmers	Part-time farmers	Total
Profitable	9	5	14
No answer	13	23	36
Total	22	28	50



**Figure 1 Profitable rice farmers, their farming situation, and revenue recognition**

## 4 DISCUSSION

### 4.1 Characteristics of farmers

In this survey, data of respondents who did not answer the mandatory items, even one of them, were excluded from all data analyses. Although this survey obtained the cooperation of 81 farmers, 31 responses were missing values. However, the general background information from all 81 farmers was examined and reasons as to why certain questions could not be answered were considered.

#### 4.1.1 Aging respondents

The average age of all the 81 respondents was 59.8 years, with a median age of 63. Among the 81 farmers, 72 respondents responded to the question of what got them into farming.

28 farmers answered that they inherited their farm as a result of the aging or death of their parents. 17 farmers started farming on their own after mandatory retirement or otherwise leaving other employment. 51% answered that they were part-time and 32% answered that they were full-time farmers. Seven of those who replied that they were part-time farmers were pensioners. From these answers, it appears that a relatively large number of the respondents started natural farming at a relatively advanced age. As evidence, one of the farmers, in his sixties, answered that “I can’t write anything beyond this,” suggesting that answering this question in writing was too demanding. It turned out that there were other respondents who also felt it was difficult to answer this question.

#### 4.1.2 Respondents’ descriptions

The respondents’ descriptions could not be used as data in quantitative analysis such as parallel analysis. Nonetheless, since it was considered important to grasp the actual circumstances of farmers who cooperated by offering general background information, issues raised therein were also taken up.

Regarding a question concerning revenue recognition, one respondent provided a written description but did not circle the corresponding question about the timing. For example, one respondent wrote “I never felt that my business was profitable,” while another noted, “I hope to make money next year, though I have not yet done so.” Another commented, “My neighbors are also very interested in natural farming, but as I have not yet gotten results, the motivation to do so has not spread to a wider circle of my friends.” These responses suggest that since profits were not yet forthcoming there could be no real confirmation about the timing of revenue recognition.

Simultaneously, some respondents appeared to show little interest in profits or money. For example, “I feel pleasure when I receive high evaluations from people who eat my rice. Furthermore, because the scale of my business is so small, it does not matter whether I make money or not,” Another farmer stated, “I don’t want to be fussy about profits, but I want to grow rice plants with vitality. I want to make delicious rice with vitality. I wish I could live with nature forever.” Another response was, “Because I am thinking that it is ‘gentle’ on the environment, I do not have to think about it being profitable. That said, it costs less to grow, so it may be said that it is profitable.”

There were a few who responded that their main motive was profits. There were instances where economically sustainable natural farming was carried on within a cooperative framework where there was a high consciousness of natural farming and the sale of naturally farmed commodities as a business project.

Survey results showed that many of the natural farmers surveyed found intrinsic value in what they were doing and used such words as “pleasure” and “aspirations” to describe their efforts. We found that there were a certain number of respondents who never felt that their farming practice was profitable or respondents whose aim was not to seek profits. In order to design questions for such respondents, it was important to search for appropriate alternative words for “profitable” in the survey.

## **4.2 Farmers’ hardships**

We asked farmers about the hardships they encountered after turning to natural farming. Preliminary survey results show that weeding and soil enrichment were considered key to a successful natural farm. Open-ended descriptive questions were asked about weeding and fertilization in order to learn about the specific difficulties encountered by each individual. Since the original data was in Japanese, the farmers’ responses were manually entered into a computer in Japanese. These entries were converted in dendrogram from Japanese to English for this paper (Fig. 2). The data in English are highly similar to those in Japanese and are not reproduced here; however, complete figures in Japanese are available upon request.

### **4.2.1 Clustering approach**

Agglomerative hierarchical clustering is an effective method for understanding the structure of a dataset.

This paper utilized a clustering approach to bundle farmers' responses. This approach is a method for examining the inner structure of qualitative data based on simultaneous co-occurrence patterns. Subsequent to grouping variables together that have similar characteristics, variables are delineated by dendrograms. The perceived distance between individuals (i.e., their degree of similarity) and cluster dendrograms is pictured in a summary called a principal component analysis. The distance measurement is based on Ward's method.

Computer-assisted textual analysis software R with TinyTextMiner (TTM) was used to conduct the analysis. The software was selected based on its verifiability and for its being freeware, and thus more readily available and testable than other software. With TTM, the software generates seven output files named ttm0 through ttm6. The last one, ttm6, which is available as a cross table formed in text and words (appearance frequency) expresses frequency counts derived from a text through morphological analysis.

High-frequency words (top 50) were extracted. Selecting words as variables obviously involves some subjectivity, even when they are selected based on frequency, parts of speech or contextual importance. Nevertheless, this study made every effort to prudently choose the main words and phrases found in the farmers' descriptions of their struggles to grow rice using the AK Method.

#### 4.2.2 "*Pomacea canaliculata*"

The word *gyanbo tanishi* (*Pomacea canaliculata* or freshwater lizard conch) occurred frequently in the farmers list of hardships and difficulties. *Gyanbo tanishi* inhabit paddies and eat rice plants. They are included in the list of Japan's worst 100 invasive species. At the same time, this alien creature is considered by some to be useful for weeding. In natural farming, pesticides cannot be used to combat pests like *gyanbo tanishi* and herbicides cannot be used to eliminate weeds. In the survey, responses fell on both sides of the question. Some farmers said they regarded *gyanbo tanishi* as something that should be eradicated, whereas others thought of it as a useful means of weeding their paddy fields.

The combination of forms of the words *gyanbo tanishi* and "feeding damage", "eat", and "serious" fall into the same cluster. This combination of words clustered with *gyanbo tanishi* confirms the informational trend. By using dendrogram, we found that natural farmers do not tend to welcome the appearance of *gyanbo tanishi* in their paddy fields. It became clear that natural farmers were troubled by the damage incurred and considered *gyanbo tanishi* to be one of their greatest challenges. It was found that the farmers' weed problem was considered to be greater than the importance of building up and maintaining the fertility of their soil and became obvious that there are many words related to weeding and weeds. Without the option of pesticides and herbicides, natural farmers find themselves struggling with pests and weeds while at the same time having to manage the fertility of and water levels in their paddy fields.

Incidentally, the severity of the 2016 *gyanbo tanishi* outbreak was unusual, as reported in the newspapers (*Sanyō Shimbun*, September 5 2016). This outbreak was not foreseen in the preliminary survey. Again, it

turned out that there are many uncertainties inherent to natural farming. These uncertainties may explain natural farmers' conservative or restrained sense of profitability timing.

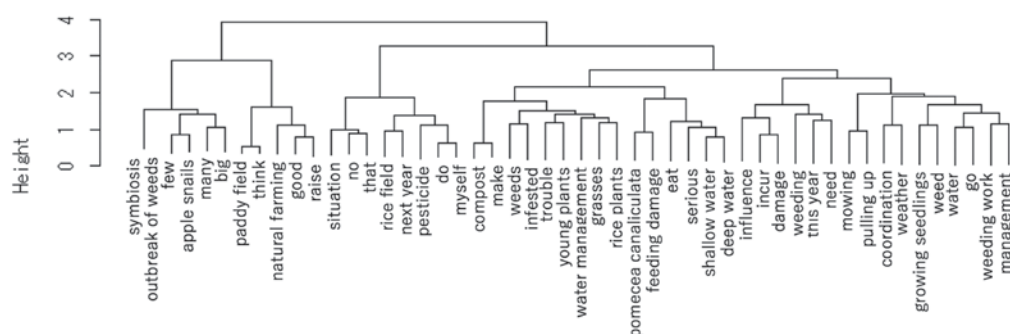


Figure 2 Cluster dendrogram regarding farmers' hardships

## 5 CONCLUSION AND FUTURE DIRECTIONS

### 5.1 Expanding and refining the research design

As the number of factors and the factor structure were not known beforehand, an EFA was conducted to obtain results. The findings revealed that four factors, operational efficiency, human relationships, ingenuity, and open-mindedness could be considered possible factors of performance evaluation. In the future, we hope to evaluate the conformity of the model and the factor number by confirmatory factor analysis.

Although the maximum likelihood estimation method was applied, this method has asymptotic consistency and asymptotic normality. We expect that increasing the sample size would improve estimation accuracy.

As pointed out earlier, the word *jianbo tanishi* occurred many times in farmers' accounts of hardships encountered, mostly to emphasize the importance of the damage incurred by their feeding on rice plants. This study confirmed that natural farming, even when done under contract, was a risky undertaking. This was understood most by profitable full-time farmers.

Future studies could explore some of the issues identified here by using a larger and more representative sample. Time-series research would also be a valuable tool in conducting trend analyses.

### 5.2 Marketing

Many rice farmers sell their product under contract or through the small number of retail outlets that specialize in organic and/or naturally grown foods. For example, one farm visited in northern Miyagi

Prefecture contracts to provide naturally grown rice every fall to a rice cracker (*senbei*) company in Tokyo. Others employ internet sales or other direct marketing approaches. Otherwise, they must market through regular channels, the Japan Agriculture Association (JA) in particular, which often means that their rice is sold as conventionally grown. As indicated earlier, even with contracts and other pre-determined outlets for their rice, natural farmers remain uncertain as to whether the sale of their natural rice will bring in expected or needed returns.

A topic that arose throughout the fieldwork interviews was the ongoing debate over whether or not natural farmers should push for a certification system such as that which exists for organic products. Adopting official standards and an auditing system would assure consumers of the standardized nature of the product, but would also require oversight and intervention, which runs against independent grain of many natural farmers.

### **5.3 *The Kurashiki Model: Linking Natural Farmers to Consumers***

In Kurashiki (Okayama Prefecture), a non-profit organization (*NPO Hōjin Okayama-Ken Kimura-Hōshiki Shizen-Saibai Jikkō-Inkai*) links AK Method growers in and around Kurashiki and the Kimura organization (Kimura World) with the local JA and its Pearl Rice brand as well as with consumers. Both growers and consumers belong and pay dues to the NPO and consumers are assured that they will receive rice at the end of the year. This provides a framework within which natural rice farmers are guaranteed a fair price, are connected to consumers, and are a part of the JA distribution system. It also enables the consumers who belong to become active stakeholders in the natural farming movement and the AK Method.

Although the Kurashiki model has been held up as a template for other areas where naturally farmed rice is produced, it remains to be seen whether or not this organizational model will be replicated elsewhere. As is the case with social movements in general, the question of how to develop the institutions and structure necessary to perpetuate, expand and unify the natural farming movement continues to pose challenges for all of those involved.

### **5.4 *Leadership***

That the name of Kimura Akinori appears on the Kimura Natural Farming Method is indicative of his central role in the natural farming “movement”. He gives numerous lectures and speeches, makes regular trips to production areas to offer guidance, and has been instrumental in organizing natural farming schools (*shizen-saibai jissen juku*) throughout Japan. His high profile attracts media coverage and according to our interviews, Kimura’s charismatic presence has been instrumental in attracting and sustaining interest amongst both farmers and consumers. The question remains as to whether or not this “movement” can be sustained if and when his presence fades.

The leadership and succession issue is closely connected to the discussions taking place within the natural farming movement as to whether or not a more formal institutional structure should be put into place. These discussions bear further study as the natural farming movement in Japan looks to determine its role within a larger agricultural sector that faces looming issues of global competition, environmental sustainability and finding ways to attract young people to farming.

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