Research Article

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Farmers' responses to organic rice farming in Indonesia: Findings from central Java and south Sulawesi

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Abstract: Organic rice farming (ORF) is getting more attention from many parties because conventional rice farming (CRF) has environmental issues and because people's awareness of healthy food is increasing. The social, economical, and environmental challenges make ORF a potential path forward. This study aims to understand farmers' responses to ORF. Data were collected through interviews with 37 respondents from Central Java and 67 respondents from South Sulawesi. The respondents, chosen randomly, represented 40.38% CRF farmers and 59.62% ORF farmers. A mean was used to present the difference between CRF and ORF farmers' responses in each variable. Multiple linear regression was used to describe the factors affecting these responses. Results showed that ORF farmers' mean on all response variables was higher than CRF farmers', except market opportunity (MKOP), which showed only a slight difference in means at 4.357 (CRF) and 4.371 (ORF). MKOP is the one area of trust for both CRF and ORF farmers. Both responses from CRF and ORF farmers have value for use by stakeholders to develop Indonesian ORF.

Keywords: organic farming, conventional farming, rice, questionnaire survey

Abbreviations

OF organic farming
CF conventional farming

ORF organic rice farming
CRF conventional rice farming
ICPB income perceived benefits
SCPB social interaction perceived benefits
EXPB extension perceived benefits
ACSC active in social interaction
ACEX active in extension activities
GVSP government supports
MKOP market opportunity

1 Introduction

Modern people are more aware of eating healthy food. Therefore, they may look into organic products (Akerle et al. 2016). This trend is increasing and is no longer limited to food but also includes other agricultural products. Due to the increasing population, the demand for organic products will most likely increase. This condition makes OF increasingly popular among farmers. OF can also contribute to a safer environment, as environments are impacted by CF through the use of chemical material such as pesticides (Costa et al. 2014; He et al. 2018; Panjaitan et al. 2020).

Indonesia is becoming a promising country for producing more organic foods. Market opportunities for organic products are wide open for both local and export goods, it comes up because of the increasing awareness of healthy food, the increasing Indonesian population, and particularly the growth of the middle class (David and Ardiansyah 2017). As the staple food for most Indonesians, rice is the first choice for farmers beginning organic crops (Palash and Bauer 2016). Due to the large volume of rice farming, how rice is produced has important effects on the environment. Chemical material usage in rice farming is particularly hard on the environment. Therefore, shifting to organic rice farming (ORF) is a good option and can bring good effects to the environment (Orlando et al. 2020). Jouzi et al. (2017) stated that

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benefits from OF include less harm for the environment, an increase in farmers' income, and help with food safety. But OF also has demerits. For example, OF production is not as prolific as CF, OF crops need organic certification to be more valuable, and market challenges remain. The risks and benefits of OF are weighed by many stakeholders, and in Indonesia, it was not the government, but a group of farmers who first saw the good future (Schreer and Padmanabhan 2020). Becoming a pioneer of OF is not easy, but a small group started a good example for other farmers (Lähdesmäki *et al.* 2019).

ORF needs to be analyzed from various aspects, including economic, social, and ecological (Sajadian *et al.* 2017; Freyer *et al.* 2019). The social aspect plays an important role because it is related to farmers' motivation to switch to ORF. In the market, organic rice products for consumer levels are well accepted, but it is not to the level of motivating all farmers to do OF. More acceptance of OF is needed among farmers and their own communities, which are heavily composed of CF farmers (Lähdesmäki *et al.* 2019). Various challenges affect farmers' responses toward OF (Jouzi *et al.* 2017). Social interactions, extensions, and government support are also believed to have effects on farmers' responses (Läpple and Kelley 2013). How farmers respond to innovation and new technology, including ORF, is important for the successful application of ORF (Phondani *et al.* 2020). Therefore, this research aims to understand farmers' responses to ORF in Indonesia. The results will hopefully be useful for stakeholders to create suitable regulations or actions to support the development of ORF in Indonesia.

2 Methodology

2.1 Study area

This study was conducted in Klaten Regency, Central Java, which represents the west part of Indonesia, and Bulukumba Regency, South Sulawesi, which represents the east part of Indonesia. Java, especially Central Java, is well known for its rice production and is becoming the major supplier for the entire country. With its dense population, modern people and healthy food – aware people are increasing the demand for organic rice. Therefore, the trend toward ORF is growing more in Central Java. Meanwhile, South Sulawesi is starting to catch the opportunities of the organic rice market, even though some farmers often consume the product by themselves. Compared to Central Java,

supporting technologies and facilities in South Sulawesi are quite behind, so they are working to develop more ORF capabilities. However, Java faces significant changes in agriculture land use due to settlements or industries. This problem makes regions other than Java, such as South Sulawesi, potent to become the center of organic rice production.

2.2 Sampling procedure and data collection

The data in this study were collected from 37 farmers in Klaten Regency, Central Java, and 67 farmers in Bulukumba Regency, South Sulawesi. In Klaten Regency, samples were randomly taken among CRF farmers and ORF farmers in Karanganyar Subdistrict, one of the centers of organic rice production in this regency. Meanwhile, in Bulukumba Regency, the samples were randomly taken among CRF farmers and ORF farmers in Bulukumba Subdistrict, an area that is a pioneer of organic rice production in the regency. The farmers were interviewed using a questionnaire.

Farmers' responses in this study consist of five main variables: perceived benefits, social interaction, extension, government supports, and market opportunity (see Figure 1). Each variable was measured using one statement rated on a 5-point scale from "1 – strongly disagree" to "5 – strongly agree." The perceived benefit was measured according to the benefits of income increase (income perceived benefits [ICPB]), getting good information or innovation from social interactions, including farmers' groups and other communities (social interaction perceived benefits [SCPB]), and getting good information or innovations from extension (extension perceived benefits [EXPB]). ICPB measurement using the statement "I'm receiving more income from ORF than CRF," SCPB measurement using the statement "I'm receiving useful information or innovation from social interaction," and EXPB measurement using the statement "I'm receiving useful information or innovation from extension activities." Social interaction (active in social interaction [ACSC]) was measured using the statement "I'm active in social interactions, such as farmers' groups or other communities." The statement for extension (active in extension activities [ACEX]) was "I'm active in extension activities." For government support (GVSP), participants rated the statement "The government supports ORF." Finally, market opportunity (MKOP) was measured with the statement "Organic rice product is easy to sell."

Figure 1: Research framework.

Other questions regarding ORF to support the above variables were asked as well. The questionnaire also included demographic questions about gender, age, education, family members, CRF experience, ORF experience, and farm size.

2.3 Analytical technique

A descriptive method was used in this study to describe the facts and findings. The Lorenz curve was calculated to understand the inequality of farm size distributions in Central Java and South Sulawesi (Lorenz 2016). Frequency, percentage, and mean were calculated to describe the demographics. These techniques were also used to present the different responses between CRF and ORF farmers on each variable. Factors that affect the responses were analyzed with multiple linear regression analyses using independent variables (demographics) and dependent variables (farmers' responses).

3 Results and discussion

3.1 Demographic features of the respondents

Interviewed respondents are 59.62% ORF farmers and 40.38% CRF farmers (Table 1). CRF and ORF farmers were randomly chosen to be respondents. A common feature of farming activities is the dominance of male farmers, and this study found a majority of respondents were male (93.27%). The plurality of respondents was aged 41–50 (34.63%), followed by those 51–60 years old (26%) and those 61–70 years old (20%). In general, the respondents

are older in age. This issue of aging farmers is common in Indonesia and other countries (Saiyut et al. 2017).

The farming experience was divided into two categories: CRF and ORF experience. All respondents had CRF experience, most with more than 20 years' practice (63.46%). This is attributable to aging farmers who started farming during their 20 s. ORF has been experienced by 59.62% of respondents, most of whom have 5 years or less of experience. Although ORF started in Indonesia quite long ago, it was not popular until recently, when it began attracting more farmers. Farming experience helps farmers to develop sharp abilities to make decisions about their farming (Peltonen-Sainio et al. 2020).

The most common level of education for respondents is elementary school (33.65%), followed by high school (32.69%) and primary school (23.08%). Only 7.69% of respondents has completed higher education. These results show that education among respondents is not high, which is a common trend in Indonesian agriculture. The most common number of family members for respondents was three members (36%). With more family members, farmers need to earn more money from their farm work. But an advantage of a larger family is having more people to work on the farm. How farmers respond to farming change is affected by the size of their farm (Lu et al. 2019). Most respondents have a farm larger than 6,000 m² (46.15%). These farmers mostly come from South Sulawesi, as farm size in Java is known to be smaller. Furthermore, farm size analysis will be presented with a Lorenz curve analysis.

3.2 Lorenz curve

Lorenz curve analysis usually presents the inequality of income distribution on a population. But this curve can also be used to present other inequality distributions,

Table 1: Demographics of respondents

	Freq.	Percentage		Freq.	Percentage
Gender			Farming type		
Male	97	93.27	CRF	42	40.38
Female	7	6.73	ORF	62	59.62
	104	100.00		104	100.00
Age			CRF experience (years)		
30–40	18	17.31	0–5	4	3.85
41–50	36	34.61	6 to 10	8	7.69
51–60	26	25.00	11 to 15	8	7.69
61–70	20	19.23	16 to 20	18	17.31
71≤	4	3.85	21≤	66	63.46
	104	100.00		104	100.00
Education			ORF experience (years)		
Uneducated	3	2.88	0–5	40	64.52
Elementary school	35	33.65	6 to 10	22	35.48
Primary school	24	23.08	11 to 15	0	0.00
High school	34	32.69	16 to 20	0	0.00
Higher education	8	7.69	21≤	0	0.00
	104	100.00		62	100.00
Family members			Farm size (m²)		
1	11	10.58	<1,500	11	10.58
2	21	20.19	1,501–3,000	31	29.81
3	36	34.61	3,001–4,500	11	10.58
4	12	11.54	4,501–6,000	3	2.88
5≤	24	23.08	6,001≤	48	46.15
	104	100.00		104	100.00

such as farm size among farmers. As seen in Figure 2, all respondents are included in the curve analysis (black line), which falls below the 45° equality line, meaning there is an inequality in farm size distribution among farmers. This is attributable to the farm sizes outside of Java, as South Sulawesi is geographically bigger than Java. Additionally, Java is facing changes to agricultural

land use due to settlements and industries. Agriculture land-use change is mainly caused by the increase of population that forces people to change agriculture space to fulfill other needs (Alijani et al. 2020).

The result is different when the curve was analyzed separately for Central Java (blue line) and South Sulawesi (green line). Both results are close to the 45° equality line,

Figure 2: Lorenz curve for farm size distributions.

meaning that when the farm size distribution is compared within the same area, the distribution is quite equal.

3.3 Farmers' responses

Farmers' responses are compared between CRF and ORF farmers through the mean and standard error of each variable (Table 2 and Figure 3). Looking to the standard error, ORF farmers have the smallest standard error and CRF farmers have the highest standard error. The different responses between CRF and ORF farmers can be seen through the mean of each variable. As listed in Table 2, the highest response for CRF farmers is for MKOP with 4.257, followed by ACSC with 4.024. Meanwhile, the lowest mean is for ICPB with 2.952. These results show that CRF farmers understand that the market opportunity for organic products is quite good, and the communities to develop ORF are available, but their motivation is low.

Table 2: Farmers' responses (mean and standard error)

Response	All farmers (N: 104)	CRF farmers (N: 42)	ORF farmers (N: 62)
ICPB	3.750 (0.085)	2.952 (0.048)	4.290 (0.087)
SCPB	3.817 (0.086)	3.095 (0.107)	4.306 (0.078)
EXPB	3.894 (0.056)	3.619 (0.076)	4.081 (0.070)
ACSC	4.385 (0.065)	4.024 (0.093)	4.629 (0.074)
ACEX	3.442 (0.127)	2.143 (0.116)	4.323 (0.091)
GVSP	3.904 (0.057)	3.762 (0.075)	4.000 (0.080)
MKOP	4.365 (0.061)	4.357 (0.082)	4.371 (0.087)

This may be due to limited experience or lower perceived benefits of ORF.

All mean responses for ORF farmers are above 4, showing high responses for all variables. Social interactions affect farmers' responses toward innovation (Asare-Nuamah and Botchway 2019). In this study, the highest response mean for ORF farmers is ACSC with a mean of 4.629. This suggests that ORF farmers are active in social interactions that include farmers' groups and other communities. This research speculates that they participate in these groups to share or obtain knowledge regarding ORF so they can improve ORF practices. ORF farmers feel comfortable to be active in social interactions that accept and support them. Lähdesmäki et al. (2019) and Läpple and Kelley (2013) found that OF farmers often receive negative stigma from CF farmers because they are breaking "tradition." Lähdesmäki et al. (2019) added that OF farmers can contribute to OF development through activity in farmers' groups and cooperating with related parties. Perceived benefits from social interaction (SCPBs), such as good information or learning from communities, are also accounted for with a mean of 4.306. This score suggests that farmers get benefits from being active in social interactions. This is supported by perceived benefits from extension (EXPBs), such as good information or innovation from an extension, with a mean of 4.081. Andrango et al. (2016) stated that extension plays an important role in developing OF. Extension advisors need to improve their knowledge and abilities to make OF more successful.

Meanwhile, the perceived benefits from income increase (ICPBs) have a high response at 4.290. Many researchers have proven that one of the OF benefits is income increase (Mzoughi 2011; Jouzi et al. 2017). Nicolay (2019)

Figure 3: Farmers' responses (mean).

and Qiao *et al.* (2018) stated that OF farmers will get more economic benefits when they have organic certificates because with the certification, their products will be worth a higher value and return more income. Respondents from the Klaten Regency collectively had ORF certificates. They stated that with the certificate, their products sell more easily. With the certification, the market is more open, so they can sell their products to supermarkets. However, the process to obtain an ORF certificate takes time and is difficult for ordinary farmers to complete. The government contributes to the challenges of this process. The lowest mean response came from GVSP, with a mean of 4.000. This may be because farmers feel they do not get much government support for ORF. Government incentives are not considered enough to raise farmers' motivations to do OF (Läpple and Kelley 2013), because their motivations also come from their selves such as self-satisfaction in OF (Jambo *et al.* 2019).

ORF farmers had a higher mean than CRF farmers regarding ORF (can be seen in Figure 3). ORF farmers realize that ORF has perceived benefits and potency to be developed in the future. CRF farmers also showed

quite high responses regarding ORF, perhaps because they realize that CRF has long-term negative impacts on their soil, health, and farming (Costa *et al.* 2014); therefore, they understand that ORF is better for sustainable farming, but they are not ready to apply OF to their farms. ACSC also has quite a high response (Figure 3), as both CRF and ORF farmers have good awareness in engaging with social communities, especially such as farmers' groups. Both CRF and ORF farmers show similar means for MKOP response, showing that ORF is perceived to have a good market opportunity. The market share grows gradually as more people become aware of healthy foods and organic products (Akerlele *et al.* 2016).

3.4 Factors affecting responses

Adzawla *et al.* (2019) and Akter *et al.* (2017) found that gender can indicate different perspectives and adaptation of skills for innovations. Therefore, the correlation

Table 4: Correlation of variables (multiple regression, sig)

Variables	ICPB	SCPB	EXPB	ACSC	ACEX	GVSP	MKOP
Gender							
CRF farmers (N: 42)	0.171	0.542	0.468	0.665	0.426	0.240	0.308
ORF farmers (N: 62)	0.876	0.083	0.890	0.241	0.291	0.874	0.080
All farmers (N: 104)	0.708	0.049*	0.781	0.124	0.958	0.481	0.421
Age							
CRF farmers (N: 42)	0.725	0.261	0.598	0.580	0.403	0.116	0.973
ORF farmers (N: 62)	0.654	0.230	0.756	0.803	0.320	0.671	0.001**
All farmers (N: 104)	0.023*	0.006**	0.761	0.630	0.019*	0.854	0.002**
Education							
CRF farmers (N: 42)	0.619	0.447	0.017*	0.323	0.053	0.008**	0.762
ORF farmers (N: 62)	0.714	0.046*	0.967	0.003**	0.776	0.705	0.141
All farmers (N: 104)	0.694	0.153	0.370	0.016*	0.771	0.443	0.111
Family members							
CRF farmers (N: 42)	0.376	0.247	0.952	0.993	0.020*	0.584	0.709
ORF farmers (N: 62)	0.694	0.712	0.385	0.292	0.532	0.179	0.773
All farmers (N: 104)	0.531	0.433	0.309	0.192	0.033*	0.453	0.668
CRF Experience							
CRF Farmers (N: 42)	0.816	0.440	0.934	0.283	0.356	0.261	0.261
ORF Farmers (N: 62)	0.413	0.186	0.937	0.604	0.256	0.084	0.318
All Farmers (N: 104)	0.282	0.669	0.915	0.830	0.978	0.319	0.993
ORF experience							
CRF farmers (N: 42)	—	—	—	—	—	—	—
ORF farmers (N: 62)	0.757	0.528	0.522	0.415	0.116	0.336	0.318
All farmers (N: 104)	0.000	0.000**	0.009**	0.011*	0.000**	0.095	0.647
Farm size							
CRF farmers (N: 42)	0.139	0.107	0.331	0.871	0.315	0.002**	0.443
ORF farmers (N: 62)	0.000**	0.148	0.302	0.307	0.543	0.284	0.990
All farmers (N: 104)	0.083	0.175	0.053	0.057	0.114	0.610	0.968

* Significant at 0.05 level. ** Significant at 0.01 level.

between gender responses was accounted for in this analysis. Gender was not found to be significant with SCPB, meaning that all farmers, male and female, felt the importance of SCPB. In this study, gender only has a significant correlation with ACEX for CRF farmers and all farmers. Age also generally affects farmers' decisions regarding their farming (Leite et al. 2019).

The age of ORF farmers has a significant correlation with MKOP. Younger farmers are more likely to understand that ORF has a good business future; they see OF as an opportunity from the trend that people tend to eat healthy and seek out organic food. This study found no significant correlation for the age of CRF farmers, but age has a significant correlation with ICPB, SCPB, SCEX, and MKOP for all farmers.

Higher levels of education make farmers more advanced and sustainable in their decision-making (Fielke and Bardsley 2014). Education has a significant correlation for CRF farmers with EXPB and GVSP. Even though CRF farmers are not practicing ORF, they are still joining in extension activities to improve their farming skills or to get information, and they may be receiving support from government programs. In other words, they are motivated to learn more. This is common for people with more education; therefore, the correlation is significant. For ORF farmers, education has a significant correlation with SCPB and ACPB. This suggests that more education results in higher chances that a farmer will engage in social interactions with communities. This may be explained by the good benefits, such as sharing information regarding ORF, that they acquire from social engagements. In developing countries, family members are an important part of farming activities, because their labor can save farming costs.

CRF experience does not show any significant correlation with CRF farmers, ORF farmers, or all farmers. This experience is common for farmers; therefore, it does not have any significant correlation with OF. Meanwhile, ORF experience itself does not show any significant correlation with all response variables of ORF farmers. Respondents' ORF experiences are quite short; therefore, the correlation is not significant. However, ORF experience has a significant correlation with SCPB, EXPB, ACSC, and ACEX for all farmers.

Farm size affects farming production or income. Bigger farms will produce more income; therefore, farm size can affect farmers' responses toward innovation or technology (Lu et al. 2019). This is supported by the results of this study, which show that farm size has a significant correlation with ICPB for ORF farmers. Farm size also has a significant correlation with GVSP for CRF farmers.

4 Conclusions

The increasing population and the awareness of healthy food choices make ORF a promising business for the future in Indonesia. Social acceptance, government support, and other challenges are still faced by ORF farmers. These challenges can affect farmers' responses toward OF, and these responses can help to create suitable regulations for developing OF in Indonesia. This study shows that ORF farmers' mean responses are higher than CRF farmers' in all variables except MKOP, where the mean is quite similar (4.357 [CRF] and 4.371 [ORF]). This demonstrates that OF has a good market opportunity, and this opportunity can support OF development. The results of multiple linear regression showed that CRF experience does not have any significant correlation with any variables for CRF farmers, ORF farmers, or all farmers. Meanwhile, other demographic variables have a significant correlation between some response variables and CRF farmers. ORF farmers' responses show a significant correlation, such as MKOP by age, SCPB and ACSC by education, and ICPB by farm size. Both responses for CRF farmers and ORF farmers have their own value to be used for creating suitable regulations for developing OF in Indonesia. The regulations should consider that incentives or other material supports are not enough to build farmers' motivations to practice ORF. The government and other stakeholders need to educate and motivate CRF farmers and other communities to accept ORF farmers. Also, helping ORF farmers to achieve organic certification is important to increase ORF farmers' income and make more farmers willing to practice ORF. CRF farmers who intend to change to ORF can start with their community or farmers' groups to achieve good support such as experiences from the other ORF farmers regarding technical issues in ORF planting and easier access to GVSP and MKOP.

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